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WALNUT (*JUGLANS REGIA* L.) TRADE: COMPETITION POWER OF TURKEY WITH BALKAN COUNTRIES

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Abstract

Turkey is one of the most important walnut producers in the world. Turkey is 4th in the world's walnut production in 2018. In this study, Turkey and the Balkan countries' which have a significant share in the world production of walnut, production, foreign trade, and competitiveness have been studied. The data set for the years 2005-2018 was used in the research. The data of this study was provided from International Trade Centre (ITC) database. Revealed Comparative Advantage Index (RCA) and Trade Balance Index (TBI) indices were used in this study. Although the walnut production of Turkey was more than the total production of Balkan countries, it was determined that Turkey has not foreign trade competitive advantage. It shows that the most competitive country is Moldavia according to the RCA and TBI scores. These findings demonstrated that Turkey is importer country in with walnut trade. In a conclusion, it can be clearly said that Balkan countries except for Bulgaria, Hungary, Moldova, and Romania are net importers of shelled walnuts in foreign trade.

Key words**:** *walnut export, Revealed Comparative Advantage Index, Trade Balance Index, Balkan countries, Turkey*

INTRODUCTION

Walnut (*Juglans regia* L.) is one of the hard-shelled and temperate-climate fruit species within the Juglandaceae family. There are approximately 60 different species in the world and 21 of them are in the *Juglans* genus [2]. Walnut (*J. regia*) is native to central Asia. In addition, it grows as a wild, semi-cultivated, or cultivated tree in a wide area including from southeastern Europe and the Caucasus to Turkey and Iran, through southern portions of the former Soviet Union into China and the eastern Himalayas [11]. Walnut has been evaluated for both human health and nutrition purposes since B.C. 1000 [19]. Walnut (*J. regia* L.) has been used since ancient times to treat various ailments such as diarrhea, hyperglycemia, cancer, infectious diseases, anorexia, eczema, asthma, antihypertensive, neuroprotective, helminthiasis, arthritis, sinusitis, stomach pain and skin disorders [15]. Besides, walnut is rich in protein, fat and minerals and concentrated energy source [2]. Additionally, walnut is also a good source of a wide variety of flavonoids, phenolic acids, and related polyphenols [7], and contain a significant amount of B group vitamins and are the richest in vitamin B-6 among all other nuts [2].

Turkey is one of the major walnut producing countries both in Balkan countries and in the world. Indeed, China, the US, Iran, Turkey, Mexico, Ukraine, and Chile are major walnut producing countries in the world. While the People's Republic of China makes about 44% of the world walnut production, these seven countries realize 87% of the total production. When comparing the Balkan countries with each other, Romania, Greece, and Serbia are the most important walnut producer countries with a total of 97,685 tons of annual production. Thus, there is a serious competition between the Balkan countries and Turkey in walnut production and trade. In Turkey, 126 thousand tons/year walnut production in the early 2000s has reached 225 thousand tons, an increase of nearly 79% according to data from 2019, and meets 5.9% of world production of walnut. Although commercial production areas of walnut are Hakkari, Kahramanmaraş, Mersin, Bursa, Denizli, Sakarya, Bursa, Manisa, Izmir and

Balıkesir, wild walnut trees and modern walnut orchards have been across throughout Turkey. Although there are a total of 21 million pieces of walnut trees in Turkey, 50% of these walnut trees are productive age. Walnut production is made in approximately 1,246 ha areas in Turkey and the average yield per tree is 20 kg [14; 35].

However, due to the widespread use of walnut in desserts, bread, etc. in Turkey, the walnut production of Turkey does not even meet the domestic demand. Domestic demand is mostly met by importing from neighboring countries, especially the Balkan countries. Therefore, walnut production sector of Turkey in order to be competitive and efficient, it is necessary to determine the current status of the modernization situation, competitiveness, and increasing the export potential between Turkey and its neighbors such as Balkan countries. Nevertheless, there is limited data on the competitiveness of Turkey's walnut production sector both in the global market and Balkan countries. Specifically, there are no studies of the competitiveness of international walnut trade that was found between Turkey and important walnut producing countries of the Balkans such as Romania, Greece, and Serbia in the literature.

Therefore, the present investigation was undertaken to determine not only the competitiveness power of the walnut sector with Turkey and Balkan countries but also identify the problems in foreign trade.

MATERIALS AND METHODS

The main dataset (2005-2018) obtained from the International Trade Center (INTRACEN) database were used in this work. Since the most complete and consistent dataset was obtained from 2005 to the end of 2018 and due to missing data in 2019, the data set between 2005 and 2018 was used. In addition to the dataset, references from Turkey and international sources, and related reports were additionally used. There are various techniques to determine strong and weak sectors of countries. In the determination of competitiveness, the Revealed Comparative Advantages (RCA) index, first introduced by Balassa [30; 9, 23, 1], was used. Revealed Comparative Advantages Index is an index used to measure specialization in international trade and is widely accepted in the literature [3; 13; 20; 28; 34]. RCA index is used in studies to determine the strong and weak exporting sectors of a country [4; 10; 33]. The main purpose of using this index is to determine whether the country has a comparative advantage, rather than determining the sources underlying comparative advantage [12]. Balassa's RCA index is formulated as follows: $RCA_{ij} = \left[\left(\frac{X_{ij}}{X_i}\right) / \left(\frac{X_{wj}}{X_w}\right)\right]$ ..... (1)

In Balassa's formula, it is defined RCAij, as the Revealed Comparative Advantage Index of sector 'j' of 'i' country, Xij as export, Xi as total export, Xwj as total World export of sector 'j' and Xw as total World export. Since the RCA index is a value varying between 0 and ∞, the index score is being greater than or equal to 1 means that the subjected country has a comparative advantage over the sector evaluated. This situation shows that the share of the mentioned sector in total exports is higher than the share of that sector in World trade. As a matter of fact, as reported in some studies, if the index score of a sector is less than 1, that sector has no comparative advantage [25; 26]. Balassa's RCA coefficient classification that detailed below is utilized in the evaluation or comparison of these and similar situations [17]:

*Class 1: $0 < RCA \leq 1$: No comparative advantage

*Class 2: $1 < RCA \leq 2$: Weak comparative advantage

*Class 3: $2 < RCA \leq 4$: Medium comparative advantage

*Class 4: $4 < RCA$: Strong comparative advantage

There are different studies in which the competitiveness of different sectors is determined using the RCA index. There are different studies in which the competitiveness of different countries is determined by using the RCA index of different sectors such as textile, ready-made clothing, furniture, walnut, wine, honey, and grain industry [5, 6, 9, 16, 21, 24, 27, 29, 31, 32, 37]. Another

index used in determining competitiveness levels in this study research is the Trade Balance Index (TBI). This index is used in studies to determine the strong and weak exporting sectors of a country [22; 38]. This index is formulated as follows:

$$TBI_{ij} = \frac{X_{ij}-M_{ij}}{X_{ij}+M_{ij}} \quad \text{.....(2)}$$

The TBIij used in the formula is used as the trade balance indicator of j goods in-country 'i', while Xij and Mij indicate the export and import of product "j" of the country "i", respectively. Since the value of this index varies between -1 and +1, if TBIij> 0, it can be clearly said that the country under consideration is a net exporter. On the contrary, if TBIij < 0, the country considered is the net importer [36; 6; 33].

RESULTS AND DISCUSSIONS

While walnut production in Turkey was 150 thousand tons in 2005, it raised to 215 thousand tons in 2018 by 43% increase (Table 1). When the research period is examined, it is noteworthy that there was no significant change in yield between 2005-2018. It was determined that the average yield in the period examined was 0.22 ton/da. Moreover, as shown in Table1, we could conclude that Turkey was an important in shell walnut importer. At the same time, the increase in import spending of Turkey can be shown as evidence for this situation. Indeed, Turkey's import expenditures variability in 2018 compared to 2005 increased by 3,241%.

Table 1. Walnut production, walnut yield and trade statistics in Turkey

Years	Walnut production (1,000 ton)	Walnut Yield (ton/da)	Walnut shelled export value ($)	Walnut shelled import value ($)	Shelled Trade balance ($)	Walnut with shell export value (1,000$)	Walnut with shell import value ($)	With shell Trade balance (1,000$)
2005	150	0.20	1,205	24,401	-23,196	20	3,192	-3,172
2006	130	0.17	1,401	30,999	-29,598	12	9,051	-9,039
2007	173	0.21	4,316	43,325	-39,009	0	15,405	-15,405
2008	171	0.20	13,294	46,749	-33,455	6	28,245	-28,239
2009	177	0.20	10,460	45,322	-34,862	42	42,225	-42,183
2010	178	0.20	23,496	19,081	4,415	24	50,519	-50,495
2011	183	0.20	36,404	7,064	29,340	134	79,881	-79,747
2012	203	0.20	59,757	42,226	17,531	343	99,730	-99,387
2013	212	0.33	46,753	15,439	31,314	38	90,635	-90,597
2014	181	0.26	64,104	10,097	54,007	24	102,777	-102,753
2015	190	0.26	58,491	15,198	43,293	13	115,439	-115,426
2016	195	0.22	21,346	33,423	-12,077	31	139,396	-139,365
2017	210	0.23	32,513	40,254	-7,741	84	115,958	-115,874
2018	215	0.19	26,197	23,027	3,170	42	106,009	-105,967
Variability (%)	43	-3	2,074	-6	-114	110	3,221	3,241

Source: [14; 35; 18].

Producer prices of walnut in Turkey and Balkan countries between 2005-2018 years are given in Figure 1. In the 14-year period of the review, the upward trend, albeit a little, with the fluctuation in walnut producer prices is remarkable. Bulgaria has the least walnut price, while Turkey and Greece have highest prices among Balkan countries in 2018.

Revealed Comparative Advantage (RCA) index scores of Turkey and Balkan countries are given on Table 2 and Table 3. According to the RCA result with shell, Turkey can be thought to have non-comparative advantage at with shell walnut trade.

Balkan countries, while Bulgaria and Moldavia had a competitive advantage of with walnut trade. But other Balkan countries were non-competitive ones. The results of RCA revealed that while Moldavia (16.46) had high competitive power of with shell walnut trade, Albania (0.00), Bosnia (0.19), Croatia (0.03), Greece (0.15), Hungary (0.92), Macedonia

(0.01), Romania (0.51), Serbia (0.02) and Slovenia (0.02) hadn't competitive advantage. When the RCA index score between the years 2005-2018 was taken into consideration, it is clearly seen that Turkey is less competitive than the Balkan countries. However, Turkey has a more competitive position than Albania in the walnut sector between 2005 and 2018 (Table 2).

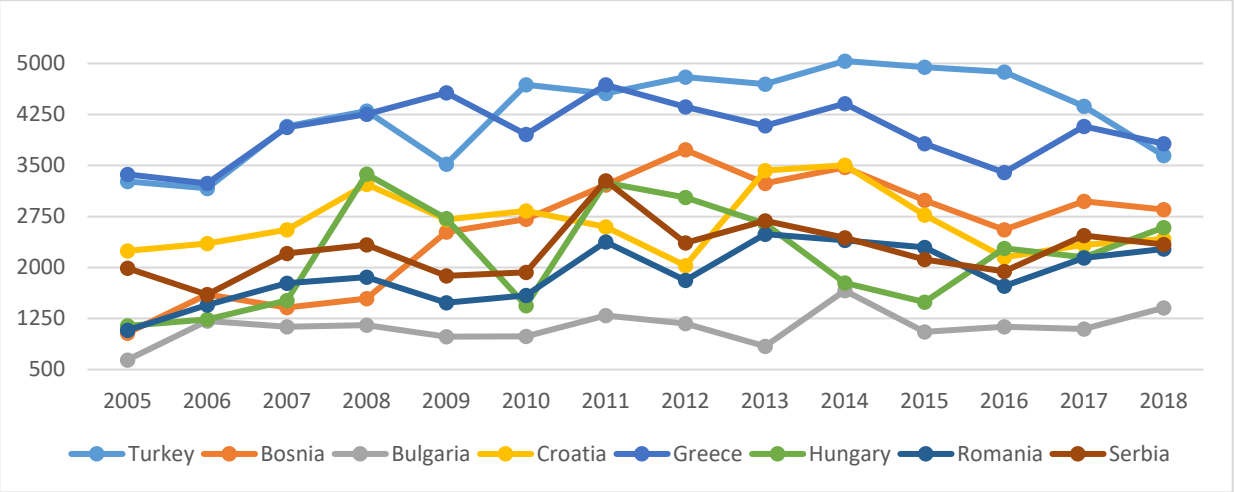

Fig. 1. Producer price walnut in Turkey and Balkan countries
Source: [14].

Table 2. Revealed comparative advantage index score for Turkey and Balkan Countries (with shell) *

Years	Turkey	Albania	Bosnia	Bulgaria	Croatia	Greece	Hungary	Macedonia	Moldavia	Romania	Serbia	Slovenia
2005	0.01	0.00	0.00	4.25	0.00	0.19	0.67	0.02	14.10	0.69		0.00
2006	0.01	0.00	0.00	6.19	0.00	0.10	1.03	0.00	8.57	0.63	0.00	0.00
2007	0.00	0.00	0.00	6.18	0.01	0.30	1.01	0.04	36.28	0.76	0.12	0.00
2008	0.00	0.00	1.44	2.30	0.00	0.41	1.51	-	26.92	0.54	0.01	0.00
2009	0.01	0.00	1.12	1.14	0.00	0.07	0.81	0.00	20.03	0.38	0.04	0.00
2010	0.00	0.00	0.00	0.87	0.00	0.12	0.66	0.00	7.64	0.34	0.01	0.00
2011	0.02	0.00	0.00	1.37	0.00	0.10	0.83	0.00	18.43	0.53	0.00	0.00
2012	0.05	0.00	0.00	0.78	0.00	0.06	0.91	0.01	19.79	0.22	0.01	0.00
2013	0.00	0.00	0.01	4.01	0.00	0.07	1.22	0.00	12.48	0.68	0.04	0.00
2014	0.00	0.00	0.00	2.53	0.37	0.03	1.45	0.00	16.43	1.11	0.01	0.28
2015	0.00	0.00	0.08	4.86	0.01	0.04	1.19	0.01	13.47	1.23	0.00	0.04
2016	0.00	0.00	0.00	0.95	0.00	0.07	0.59	0.00	13.22	0.34	0.00	0.02
2017	0.01	0.00	0.00	2.23	0.11	0.12	0.92	0.06	12.70	0.14	0.01	0.00
2018	0.00	0.00	0.14	0.65	0.00	0.28	0.47	0.01	10.33	0.07	0.00	0.00
2019	0.00		0.00	0.57	0.00	0.32	0.47	0.04	-	0.03	0.00	0.00
Mean	0.01	0.00	0.19	2.59	0.03	0.15	0.92	0.01	16.46	0.51	0.02	0.02

Source: *Calculated by author.

According to the RCA result walnut, Turkey (2.12) can be thought to have medium comparative advantage at with shelled walnut trade (Table 3).

Balkan countries, while Moldavia and Romania had a strong competitive advantage of shelled walnut trade. Bosnia and Bulgaria had a medium comparative advantage at with shelled walnut trade. But Albania, Croatia, Macedonia, Serbia and Slovenia were non-competitive ones. The comparative of RCA index score of shelled walnut trade of Turkey with Balkan countries during 2005-2018 period indicated that while Turkey was less competitive than that of Bosnia, Bulgaria, Moldavia and Romania. But it was more competitive than that of other Balkan countries (Table 3). As for RCA index score calculation, low share of walnut export in total export leads country to become less competitive. Turkey's walnut export competitive position in relation to the Balkan countries. Due to the absence of walnut exports in the period between the years of 2005-2018 Albania's RCA index score was found to be zero.

Another index used to determine the competition level of walnut trade between Turkey and Balkan countries was Trade Balance Index (TBI). TBI score is given separately for the with shell walnut and shelled walnut in Table 4 and Table 5.

Table 3. Revealed comparative advantage index score for Turkey and Balkan Countries (shelled)*

Years	Turkey	Albania	Bosnia	Bulgaria	Croatia	Greece	Hungary	Macedonia	Moldavia	Romania	Serbia	Slovenia
2005	0.30	0.00	0.48	8.53	0.61	6.61	1.09	0.02	510.16	20.56		0.01
2006	0.36	0.00	0.57	8.15	0.08	2.87	1.08	0.10	616.76	12.41	0.09	0.10
2007	0.93	0.00	2.75	6.31	0.11	3.07	1.03	0.14	576.30	9.18	0.21	0.00
2008	1.73	0.00	7.41	4.40	0.22	1.86	0.77	-	436.97	4.67	0.38	0.06
2009	1.50	0.00	25.06	3.77	0.17	1.40	0.72	0.11	508.10	7.64	0.52	0.05
2010	2.82	0.00	5.42	2.18	0.05	0.57	1.05	0.02	526.36	8.99	0.56	0.05
2011	3.42	0.00	0.10	2.36	0.24	0.36	1.74	0.01	393.82	6.63	0.34	0.03
2012	4.52	0.00	0.08	3.08	0.02	0.35	1.69	0.08	528.14	7.86	0.49	0.00
2013	3.54	0.00	0.07	3.89	0.02	0.29	1.53	0.14	452.58	8.51	0.66	0.11
2014	3.77	0.00	0.38	2.54	0.12	0.28	1.71	0.09	428.42	9.69	1.11	0.02
2015	3.10	0.00	0.28	1.30	0.23	0.25	1.32	0.09	382.66	6.09	0.59	0.34
2016	1.36	0.00	0.06	1.16	0.46	0.43	1.01	0.24	367.37	3.20	0.69	0.31
2017	1.62	0.00	0.21	1.58	0.73	0.55	0.82	0.07	308.95	3.65	0.35	0.39
2018	1.46	0.00	0.17	0.93	0.76	0.32	0.31	0.03	287.94	3.04	0.06	0.49
2019	1.31	-	0.33	0.75	0.65	0.35	0.15	0.01	-	2.84	0.14	0.51
Mean	2.12	0.00	2.89	3.40	0.30	1.31	1.07	0.08	451.75	7.66	0.44	0.17

Source: *Calculated by author.

TBI index of Turkey has been -1for all years of examined period (2005-2018 years). It can be said that Turkey is net importer country in with shelled walnut foreign trade during the period examined. With shelled walnut TBI index of Bulgaria and Hungary have been positive score examined period. It can be said that Bulgaria, and Hungary are net exporter countries during the period (2005-2018) examined. While Albania, Croatia, Greece, Makedonia, Moldovia and Slovenia had negative values of with shelled walnut TBI scores.

The TBI scores of Romania and Serbia showed constant variation in the period studied. According to these data, it is not called net importer or exporter for two countries.

Table 4. Trade balance index score for Turkey and Balkan Countries (with shell) *

Years	Turkey	Albania	Bosnia	Bulgaria	Croatia	Greece	Hungary	Macedonia	Moldavia	Romania	Serbia	Slovenia
2005	-0.99	-1.00	-1.00	0.83	-1.00	-0.85	1.00	-0.86	-0.82	0.74		-1.00
2006	-1.00	-1.00	-1.00	0.93	-1.00	-0.89	0.93	-1.00	-0.92	0.87		-1.00
2007	-1.00	-1.00	-1.00	0.80	-0.76	-0.82	0.92	-0.90	-0.67	0.89	1.00	-1.00
2008	-1.00	-1.00	0.10	0.65	-0.95	-0.81	1.00		-0.61	0.82	-0.60	-1.00
2009	-1.00	-1.00	0.31	0.91	-0.87	-0.95	1.00	-1.00	-0.52	0.95	1.00	-1.00
2010	-1.00	-1.00	-0.75	1.00	-1.00	-0.90	0.51		-0.82	0.31	0.33	-1.00
2011	-1.00	-1.00	-1.00	0.76	-1.00	-0.87	0.82	-0.98	-0.38	0.29	-1.00	-1.00
2012	-0.99	-1.00	-1.00	0.62	-1.00	-0.91	0.96	-0.93	-0.39	-0.11	-0.33	-0.99
2013	-1.00	-1.00	-0.20	0.93	-1.00	-0.82	0.98	-1.00	-0.44	0.05	0.85	-0.97
2014	-1.00	-1.00	-1.00	0.84	-0.03	-0.91	1.00	-1.00	-0.49	-0.33	-0.63	0.20
2015	-1.00	-1.00	-0.04	0.89	-0.33	-0.86	0.97	-0.83	-0.61	0.01	1.00	-0.42
2016	-1.00	-1.00	-1.00	0.69	-1.00	-0.78	0.99	-1.00	-0.57	-0.06	1.00	-0.61
2017	-1.00	-1.00	-1.00	0.82	0.40	-0.73	0.99	-0.87	-0.63	-0.85	-0.67	-1.00
2018	-1.00	-1.00	-0.22	0.69	-0.78	-0.46	0.98	-0.96	-0.75	-0.89		-0.99
2019	-1.00		0.00	0.08	-1.00	-0.45	0.99	-0.81		-0.91	1.00	-0.98
Mean	-1.00	-1.00	-0.59	0.76	-0.75	-0.80	0.94	-0.93	-0.62	0.12	0.25	-0.85

Source: *Calculated by author.

When the shelled walnut TBI score was examined (Table 5), it was determined that the scores of Bulgaria, Moldavia, and Romania were positive. According to this result, it can be said that these countries are net exporters. The TBI scores of Albania, Bosnia, Croatia, Greece, Makedonia, and Slovenia were negative in the examined period. In other words, this result shows that the mentioned countries are net importers. Hungary is

exporter during the period examined excluding the year of 2005 and 2018. Turkey is a net exporter in the examined period of 8 years, it is an importer in other years.

Table 5. Trade balance index score for Turkey and Balkan Countries (shelled)*

Years	Turkey	Albania	Bosnia	Bulgaria	Croatia	Greece	Hungary	Macedonia	Moldavia	Romania	Serbia	Slovenia
2005	-0.91	-1.00	-0.95	0.99	-0.85	-0.56	-0.15	-0.98	0.97	0.96		-0.99
2006	-0.89	-1.00	-0.88	1.00	-0.96	-0.73	0.01	-0.76	0.94	0.97	-0.35	-0.94
2007	-0.76	-1.00	-0.52	0.88	-0.95	-0.70	-0.01	-0.72	0.93	0.96	0.35	-1.00
2008	-0.56	-1.00	-0.24	0.78	-0.89	-0.73	0.54		0.94	0.99	-0.43	-0.95
2009	-0.62	-1.00	0.09	0.82	-0.94	-0.77	0.31	-0.89	0.93	0.97	-0.24	-0.97
2010	0.10	-1.00	-0.17	0.97	-0.98	-0.89	0.08	-0.94	0.97	0.91	-0.06	-0.96
2011	0.67	-1.00	-0.97	0.37	-0.91	-0.92	0.11	-0.98	0.91	0.78	-0.57	-0.98
2012	0.17	-1.00	-0.98	0.67	-0.99	-0.88	0.16	-0.87	0.98	0.86	-0.37	-1.00
2013	0.50	-1.00	-0.98	0.85	-0.99	-0.91	0.18	-0.85	0.93	0.66	-0.23	-0.93
2014	0.73	-1.00	-0.89	0.92	-0.93	-0.90	0.18	-0.90	0.92	0.63	0.32	-0.98
2015	0.59	-1.00	-0.91	0.84	-0.86	-0.91	0.15	-0.91	0.88	0.56	0.51	-0.71
2016	-0.22	-1.00	-0.98	0.64	-0.74	-0.86	0.57	-0.76	0.93	0.71	0.85	-0.72
2017	-0.11	-1.00	-0.93	0.59	-0.59	-0.82	0.31	-0.95	0.92	0.65	0.55	-0.71
2018	0.05	-1.00	-0.94	0.26	-0.49	-0.87	0.06	-0.98	0.84	0.50	-0.73	-0.67
2019	0.06		-0.91	0.06	-0.68	-0.88	-0.29	-0.99		0.40	-0.56	-0.56
Mean	-0.08	-1.00	-0.74	0.71	-0.85	-0.82	0.15	-0.89	0.93	0.77	-0.07	-0.87

Source: *Calculated by author.

CONCLUSIONS

The results of the study that Turkey is a major walnut producer country. While Turkey hasn't a comparative advantage at with walnut trade, It has a medium comparative advantage at shelled walnut trade. Turkey in shelled walnut is more competitive than the Albania, Croatia, Greece, Hungary, Makedonia, Serbia and Slovenia. Moldova and Romania from Balkan countries have strong comparative advantage at walnut trade.

Turkey is net with walnut importer country and has not comparative advantage at walnut trade. Again, Turkey is net shelled walnut importer country and has a medium comparative advantage at shelled walnut trade. Producer price of walnut high than Balkan countries due to high deficit walnut trade balance of Turkey. Walnut producer price in Greece is close to in Turkey. Other Balkan countries producer price is less than Turkey. Bulgarian producer price is lowest in the all countries.

While the competitive power of a country in foreign trade has a positive correlation with productivity and production, it has a negative correlation with domestic price. In the Balkan countries, Bulgaria, Moldova and Romania are competitive in walnut trade. Balkan countries except for Bulgaria, Hungary, Moldova and Romania are also net importers in shelled walnut.

Despite of Turkey has a great advantage in walnut production potential, high domestic demand it has to import. Turkey has been supplying the largest part of walnut imports from Balkan countries due to low transportation cost.

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THE IMPACT OF COUPLED SUPPORT ON VEGETABLES GROWN IN GREENHOUSES AND PLASTIC TUNNELS IN ROMANIA

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Abstract

The paper presents the impact of the coupled support on vegetables cultivated in green houses and plastic tunnels in Romania. In this study, a detailed analysis is carried out on the coupled support received by farmers for vegetables grown in greenhouses and plastic tunnels in the period 2015-2018. The main indicators used refer to the evolution of cultivated areas, both in field and in greenhouses and plastic tunnels, the evolution of productions and yields, and trade balance. The paper also presents an analysis of the evolution of the number of farmers who received coupled support, of the areas entitled to payment and of the coupled support calculated per hectare in territorial profile. The analysis is based on data provided by the Agency for Payments and Intervention in Agriculture and the National Institute of Statistics. The results reveal a low impact of the coupled support on the main analyzed indicators, as well as the lack of consistency in the support provided in the investigated period.

***Key words*:** *coupled support, vegetable cultivated in green houses and plastic tunnels, impact*

INTRODUCTION

This paper studies the impact of coupled support on vegetables cultivated in plastic tunnels and greenhouses in the period 2015-2018 and carries out a detailed analysis in territorial profile. The coupled support is conditioned by the production, but also by certain documents that the farmer must submit to APIA (Agency for Payments and Interventions in Agriculture). The purpose of this support is to avoid overproduction of certain products and to ensure that farmers respond to the real market demand. But sometimes a struggling agricultural sector or subsector may receive dedicated aid. The optional coupled support scheme aims to prevent the increasing of difficulties, which could lead to the abandonment of production and could affect other parts of the supply chain or associated markets. Therefore, EU countries can maintain a link (coupling) between income support payments (with a limited amount) and certain sectors or products (European Commission 2019) [6].

However, the process is subject to strict conditions and limits, to reduce the risk of market distortion. This support scheme is known as optional coupled support (OCS). Optional coupled support is a system of production limitation, designed to restrict distortions of competition in the market. Potentially eligible sectors are cereals, oilseeds, protein crops, grain legumes, flax, hemp, rice, nuts, starch potatoes, milk and dairy products, seeds, sheep and goat meat, meat beef and veal, olive oil, silkworms, dried fodder, hops, sugar beet, sugar cane and chicory, fruits and vegetables and short-lived forest species. To fund optional coupled support, the EU countries can:

• use up to 8% of the total budget allocated to income support

• raise this ceiling to 13%, if certain preconditions are met

• raise the ceiling beyond 13% if the support meets very strict criteria and the Commission approves this measure (European Commission, 2019) [6].

EU countries may review their decisions on optional coupled support by 1 August of any year, with effect from the following year. All EU countries, except Germany, have decided to apply the scheme in the period 2015-2020. The amounts awarded and the range of sectors

targeted varies greatly from one country to another (European Commission, 2018) [4].
Almost all Member States apply this payment scheme (coupled support), although the amount of funding and the sectors covered differ significantly from country to country. In the "initial support decisions", 19 Member States have decided to provide such coupled support to the fruit and vegetables sector since 2015. This has remained unchanged to date [7]. At EU 28 level, the number of support measures compared to previous support decisions has remained unchanged at 54 measures since 2015 (Eurostat, 2019) [8].

MATERIALS AND METHODS

The approach used in this paper is based on quantitative analyses, which include both a descriptive part of the vegetables grown under plastic tunnels and greenhouses, in evolution after accession, and a comprehensive analysis of the impact of the application of the payment scheme (coupled support) on the above-mentioned sector, in territorial profile, in the period 2015-2018.
The aim of the paper is to analyse the impact of coupled support on field tomatoes and cucumbers for processing cultivated in the field in 2015-2018, both territorially and nationally, on important indicators such as: cultivated area, yields, total production, prices, trade balance. For this analysis, data provided by APIA and the National Institute of Statistics were used, and the research was conducted for the period 2007-2018, using the calculation of the growth rates of the above-mentioned indicators in dynamics over four-time intervals, namely: 2007-2010, 2011-2014, 2015-2018 and 2007-2018.

RESULTS AND DISCUSSIONS

Impact of coupled support for vegetables grown in greenhouses and plastic tunnels

The coupled support for vegetables grown in greenhouses is granted to farmers who prove the selling of the following minimum yearly quantities per cultivated hectare, based on a tax invoice or the sheets in the marketing book of agricultural products, in the case of individuals: 85 tons for tomatoes for fresh consumption; 50 tons for cucumbers for fresh consumption; 50 tons for cucumbers intended for processing for which a contract must be concluded with a registered processing unit for food safety, 29 tons for peppers for fresh consumption; 46 tons of cabbage for fresh consumption. The percentage of certified native seed used must be at least 5% of the sowing rate per hectare for each species.
Farmers must present to APIA the tabs from the marketing book, the contract concluded with a processing factory and the fiscal invoice, as well as the official certification document of the seed lot or the official analysis bulletin.
Coupled support for crops cultivated in plastic tunnels shall be granted to farmers who demonstrate the selling of the following minimum annual quantities per cultivated hectare: 32 tons for fresh and/or processed tomatoes, 30 tons for cucumbers for fresh and/or processed consumption, 16 tons for peppers for fresh consumption, 22 tons of cabbage for fresh consumption, 20 tons of eggplants for fresh consumption. In the case of cucumbers intended for processing, farmers must have a contract with a registered agro-processing unit for food safety.
According to the representatives of the sector, "granting this support was a good decision, money that Romania would otherwise have lost" [11]. The minimum eligible area for coupled support granted for vegetables cultivated in greenhouses and plastic tunnels is 1,000 square meters, and for tomatoes for processing, minimum 3,000 square meters. These conditions are not difficult to meet, and farmers who have already received subsidies have only to check this additional support when submitting applications to APIA [2].
In the year 2015, 70 farmers received coupled support for vegetables grown in greenhouses and solariums, the area entitled to payment representing 196 hectares. As the number of farmers who knew about this support was very small, the value of this support was extremely high, i.e. 12,675 euros/hectare. Regarding the payment applications submitted in the 2018 campaign, the largest amount, respectively 7,510 euros/hectare was allocated

for vegetables grown in greenhouses and plastic tunnels (Fig. 1).

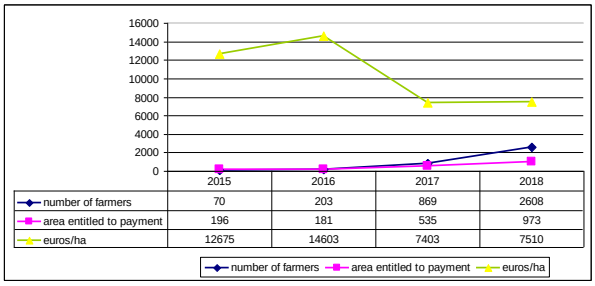

Fig. 1. Coupled support per hectare for vegetables grown in greenhouses and plastic tunnels, 2015-2018.
Source: author's calculations based on APIA data [1].

By counties, in the year 2015, the largest number of farmers who benefited from coupled support came from the counties Buzău (9), Constanța (8 farmers), Olt (6 farmers), but the area entitled to payment had the highest values in the counties Ilfov (75 hectares), Dolj (41 hectares), Constanța (33 hectares). In 2018, the hierarchy slightly changed, the main beneficiaries coming from Olt and Galați counties (about 16% of the vegetable farmers from Galați who grow vegetables in greenhouses and plastic tunnels received coupled support). Practically, the county Galați has one third of the total area cultivated in greenhouses and plastic tunnels in Romania.

Table 1. Number of farmers, authorized amount and area entitled to payment for vegetables grown in greenhouses and plastic tunnels, by counties %

County	2015		2016			2017			2018		
	No. farmers authorized for payment	Amount authorized for payment	Area entitled to payment	No. farmers authorized for payment	Amount authorized for payment	Area entitled to payment	No. farmers authorized for payment	Amount authorized for payment	Area entitled to payment	No. farmers authorized for payment	Amount authorized for payment
	1	2	3	4	5	6	7	8	9	10	11
Bz	13*	5	5	9	8	8	8	8	9	9	7
Ct	11	17	17	3	17	18	3	3	1	1	1
Dj	3	21	21	2	24	24	10	10	11	11	11
Gl	0	0	0	48	18	18	16	16	28	28	24
Gi	3	1	1	3	1	1	2	2	2	2	2
Hd	11	2	2	2	1	1	1	1	0	0	0
If	4	39	39	1	0	0	21	21	1	1	10
Is	3	2	2	3	2	2	1	1	1	1	1
Ms	7	1	1	1	2	2	2	2	2	2	2
Ot	9	1	1	7	4	4	21	21	33	33	30
Vl	4	1	1	0	0	0	1	1	1	1	1

*(1), (4), (7), (10) Number of farmers authorized for payment, in % ; (2), (5), (8), (11) Amount authorized for payment in % ; (3), (6), (9), (12) Area entitled to payment, in %
Source: author's calculations based on APIA data, 2019 [1].

The coupled support for vegetables grown in greenhouses and plastic tunnels, namely tomatoes for fresh consumption, cucumbers for fresh consumption and / or for processing, peppers, cabbages and eggplants for fresh consumption is 7,600 euros/ha, field tomatoes for processing 1,715 euros/ha, field cucumbers for processing 530.03 euros/ha.
In the period 1990-2018, the total area cultivated with vegetables remained relatively constant, with an average of 239 thousand ha, but since 2007 the areas cultivated with field vegetables has decreased by 16%. From 2007 to the present, the areas cultivated in greenhouses and plastic tunnels doubled in size, which could lead to the increase of average yields by a better application of technologies and the correct use of agricultural inputs, yet the share of these areas in total area under vegetables represented only 1.9% in 2018.
In order to see the impact of this support on the areas cultivated with vegetables in the field, greenhouses and plastic tunnels and in total, it was calculated the dynamics of the cultivated areas over several time intervals covering the period 2007-2018.

Table 2. Impact on areas cultivated with vegetables in the field, in greenhouses and plastic tunnels and on total areas under vegetables, 2007-2018, dynamics by time intervals %

	2007-2010	2011-2014	2015-2018	2007-2014	2007-2018
Area cultivated with vegetables – total	4%	-9%	-6%	-6%	-11%
Area cultivated with field vegetables	2%	-15%	-7%	-14%	-17%
Area cultivated with vegetables grown in plastic tunnels and greenhouses	17%	14%	10%	45%	106%

Source: author's calculations based on NIS data, 2019 [9].

In 2018, the areas cultivated in greenhouses and plastic tunnels reached 4,461 hectares, which is double compared to 2007 (areas increased by 106%). The share of areas cultivated with vegetables in greenhouses and plastic tunnels, entitled for coupled support payment in 2018, in total area cultivated in greenhouses and plastic tunnels is 22%, a relatively important share that should have contributed to the increase of average yields

and total productions. However, Tables 4 and 5 show that the impact on areas cultivated with vegetables grown in the field is relatively modest, and in the case of areas cultivated in greenhouses and plastic tunnels for the period 2015-2018 (10%) it is even lower compared to other compared intervals 2007-2010 (17%) and 2011-2014 (14%). Therefore, the real impact of this support in terms of a possible increase of areas cultivated in greenhouses and plastic tunnels due to this support is out of discussion.

In order to see the impact of this support on total vegetable productions obtained in the field and in greenhouses and plastic tunnels, their dynamics was calculated by several intervals covering the period 2007-2018 (Table 3).

Table 3. The impact of coupled support on the total production of vegetables grown in the field and in greenhouses and plastic tunnels; the dynamics by time periods in %

	2007-2010	2011-2014	2015-2018	2007-2014	2007-2018
Vegetable production – total	24%	-9%	**3%**	22%	22%
Production of vegetables grown in the field	15%	-10%	**4%**	19%	17%
Production of vegetables grown in plastic tunnels	33%	22%	**16%**	124%	190%

Source: author's calculations based on NIS data, 2019 [9].

Analyzing the data from Table 3 it can be noticed that the impact of the coupled support on the total productions obtained in the field as well as on those obtained in greenhouses and plastic tunnels in the period 2015-2018 is lower compared to the period 2007-2010, yet slightly higher compared to the period 2011-2014 (affected by drought since 2013). For field-grown vegetable production, however, the increase is rather due to the slight rebalancing of the market after the shock of EU accession, especially in 2007-2009. The dynamics of vegetable production obtained in greenhouses and plastic tunnels was higher both in the period 2007-2010 (33%) and in the period 2011-2014 (22%), compared to the dynamics of the period 2015-2018 (16%), the period for which coupled support was granted.

The impact of coupled support on the evolution of the total area under vegetables, of total production and trade balance

It can be noticed that the impact of coupled support on the evolution of total cultivated area and of total vegetable production is non-significant (Figure 2), the total vegetable production still failing to reach the level of 2011, which represented a historical highest production (4.1 million tons) in the period 2007-2018.

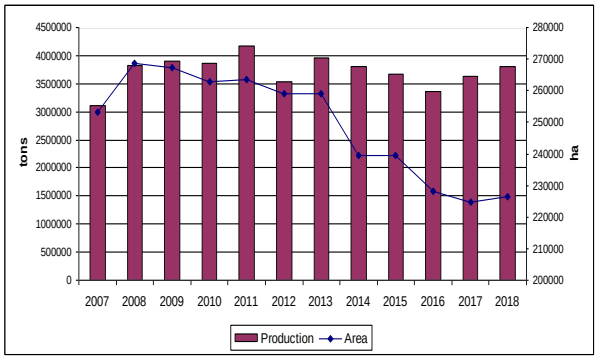

Fig. 2. Evolution of cultivated areas and total production
Source: NIS, tempo online, 2019 [9].

A similar conclusion can be drawn in the case of the impact on imports, which continues to increase significantly even in the period 2015-2018, contributing to the accentuation of the negative balance of trade in vegetables that reached over 450 million euros in 2019: tomatoes 20%, followed by other fresh vegetables (22%) are the main imported species. Nevertheless, the exports of tomatoes for processing at the EU level increased in 2019 by about 33%, following an increase of production of tomatoes for processing by 6% [5], which shows a good perspective for this product at the EU level and perhaps a positive impact of support scheme in other EU countries.

With an increasing trade balance for vegetables and with tomatoes being the most imported species Romania poses an important risk on its food security in terms of vegetable consumption. Increasing trade balance draws back also the opportunities for transforming this sector into a competitive one [10].

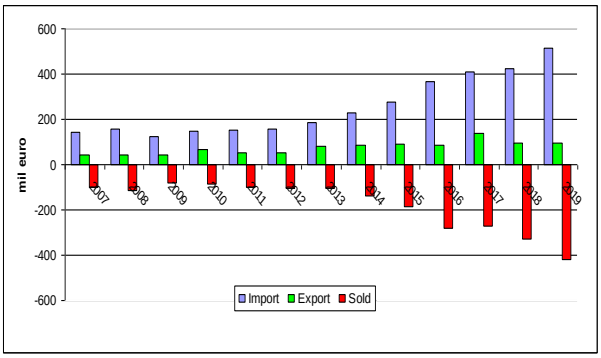

Fig. 3. Total trade balance in vegetables
Source: NIS, Tempo online, 2020 [9].

CONCLUSIONS

In the vegetable sector, the share of areas under vegetables grown in greenhouses and plastic tunnels that benefited from coupled support represents 22% of the total area cultivated in greenhouses and plastic tunnels, and only 1% in total area cultivated with vegetables, the impact being very low/ insignificant on the vegetable area dynamics, yields and total productions both for vegetables grown in the field and for vegetables grown in greenhouses and plastic tunnels. This low impact on these indicators is also reflected in the evolution of imports, which continued to increase, in the period 2015-2019 inclusively, contributing to maintaining a negative trade balance.

The impact of coupled support in Romania's vegetable sector was relatively modest and did not lead to an improvement of the situation, as there was no consistency in its provision although the number of those applying for support increased significantly from 2015 to 2018.

The higher yields are primarily due to the increase of areas cultivated in greenhouses and plastic tunnels that allow for the use of more productive varieties and a correct application of technologies, a trend that was also noticed in the period 2007-2015, prior to granting the support. This conclusion is also reinforced by the calculation of the dynamics of the evolution of cultivated areas, of average yields and total productions over four types of time intervals covering the period 2007-2018.

Regarding the coupled support for vegetables grown in greenhouses and plastic tunnels, farmers in Dolj, Galați and Olt benefited the most with about 30% of the amounts granted. The same proportion is maintained for the areas entitled to payment. About 16% of vegetable farmers in Galati county who grow vegetables in plastic tunnels received support.

This support was primarily an aid to cover production costs, which was appreciated by the farmers who received it. However, as it was shown, the impact of this support was modest in terms of the analyzed indicators. For a major impact on the sector, investments in productive varieties, technologies and new equipment/machinery are needed primarily to increase yields, [12] correlated with the improvement of the supply chain operation (through the organization of the sector, namely the increase of the number of producer groups and organizations).

At the same time the, this would help a better integration of supply chain and adaptation of framers to retailer's requirements [3].

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DETERMINANTS OF CAPITALIZATION AMONG RICE PROCESSING ENTERPRISE IN EBONYI STATE, NIGERIA

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Abstract

The study investigated the determinants of capitalization among rice processing enterprise in Ebonyi State, Nigeria. It specifically analysed the level of capitalization in the rice processing enterprise and estimated the determinants of capitalization among the processors. Data were collected using well-structured questionnaire, administered to one hundred and twenty respondents that constitute the sample size for the study. Data analysis involved descriptive statistics such as frequency concept and ordinary least square model. It was observed that that processors are medium-sized since none of them were able to invest more than ₦1,000,000. The double-log form was chosen as the lead equation. The F-ratio was statistically significant at 1% probability level indicating high goodness of fit of the regression line. The R^2 of 0.788 shows that about 78.8% changes in the investment of the rice processors were accounted for by changes in the explanatory variables included in the model while the remaining 21.2% was accounted for by error. The result shows that age, education, experience and off-firm income were positively related to the amount of capital invested by rice processors and negatively related to nature of ownership and capital input. The study therefore recommended that government and non-governmental organization should provide necessary incentives for rice processors such as loans and other credit facilities so as to improve the efficient and productivity of the processors.

Key words**:** *determinants, capitalization, rice, enterprise, processing*

INTRODUCTION

One of the cardinal objectives of the government of Nigeria is attainment of self-sufficiency in food production. The government view agricultural production as the main hope for the country's survival, growth and development. Over 70% of people in Nigeria live in the rural areas relying on agriculture for their income. This inform the desperation with which various government in Nigeria has enunciated agricultural development programs and projects focused at the sub-sector of the economy to improve their livelihood, yet the per capita of food production has remained low in Nigeria, [1]. This situation has been compounded by grave scarcity and high cost of agricultural production inputs.

There seems to be a consensus that the productivity is discouragingly low due partially to lack of adequate (working) farming capital to optimize production and effectively drive agricultural growth. For example, a study on sources of total factor production growth in 83 industrial and developing countries for the period of 1960-1990 showed that finance formation was three to four times more vital than raw materials in explaining output growth of those enterprises [5]. This study reflects the precarious situation of most rice processors in Nigeria in particular and developing countries in general. The demand for capital in agriculture to address both infrastructural and other facilities cannot be overemphasized. Accordingly, absence of capital base compromise the financial ability of agribusiness enterprises and expose them to risk of solvency [6]. Some of these risk involved inability to make investment in modern technological inputs and other equipments that improves productivity of processors in most rural part of Nigeria. Example, the large 15 integrated rice processing plants in Nigeria birthed through agricultural transformation agenda in 2015, many rice processor in Ebonyi State, are small scale processors with little

technological capabilities arising from low capital base. This has implication on their ability to compete effectively with the large commercialized and capitalized businesses. The study was driven by the following objectives, to:
(i)estimate the determinants of capitalization among the processors;
(ii)analyze the level of capitalization in the rice processing enterprise.

MATERIALS AND METHODS

The study was conducted in Ebonyi State of Nigeria. Ebonyi State has three agricultural zones namely: Ebonyi Central, Ebonyi North and Ebonyi South. Each of these zones is made up of four Local Government Area except Ebonyi South that has five LGAs. It has a population of 2.9 million [4]. The sampling technique that was adopted is multi-stage sampling techniques. In the first stage two LGAs were selected randomly from each of the three agricultural zones, making it a total of six LGAs. In the second stage, twenty rice processors were selected from each of the already selected LGAs making it a total of one hundred and twenty rice processors for detailed study. The primary source of data was used in this stage, where personal interview and questionnaire serves as instruments.
To analyze the data obtained, various analytical techniques were used, descriptive statistics such as frequency concept was used to analyze objective (ii) while objective (i) was analyzed using ordinary least square method.
The OLS method was employed to analyse the determinants of the volume of capital invested and it's implicitly modelled as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10})$$

and explicitly modelled as:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+e \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where:

Y = Capitalization (total capital injected into the business) (₦)
X_1 = Age of processors (years)
X_2 = Years of education
X_3 = Loan size (₦)
X_4 = Plant capacity (kg)
X_5 = Processing experience (years)
X_6 = Off-firm income (₦)
X_7 = Interest rate (%)
X_8 = Source of investment capital (1=equity; 0=debt)
X_9 = Firm ownership (1 = self, 0 = otherwise)
X_{10} = Capital inputs (₦)

RESULTS AND DISCUSSIONS

Level of Capitalization (Investment) of Rice Processors

The level of capitalization was measured by the actual amount of money invested in rice processing business. The result is presented in Table 1.

Table 1. Level of capitalization of rice processors in Ebonyi state

Investment level (₦)	Risk-neutral Frequency (F)	Percentage (%)
<100,000	15	12
101,000 – 250,000	60	64
251,000 – 500,000	30	16
501,000 – 750,000	10	4
751,000 – 1,000,000	5	4
Total	**120**	**100**
Mean	**220,610**	

Source: Field survey, 2018.

The investment result shows generally that the rice processors are medium-sized as none of them invested above ₦1,000,000. The mean value of ₦220, 610 implies that the processors may be using local processing methods which could have been responsible for their poor and inefficient allocation of resources.

Determinants of Capitalization of Rice Processors

The result of the OLS regression analysis on the determinants of capitalization of rice processors is as presented in Table 2.

Table 2. Determinants of capitalization rice processors in Ebonyi state

Variables	Linear (+)	Exponential	Semi-log	Double-log
(Constant)	28773.699 (2.854)***	.954 (3.223)***	10.279 (40.578)***	9.762 (13.367)***
Processors' age (Years)	.954 (2.105)**	6535.030 (.801)	.016 (4.000)***	.159 (2.789)***
Years of education	.750 (2.907)***	.450 (1.792)*	.001 (.197)	.022 (.312)
Loan size (₦)	547.054 (.902)	.553 (.752)	.015 (.976)	.074 (1.682)*
Plant size (Ha)	-275.335 (-.565)	-2158.165 (-.492)	-.006 (-3.000)***	-.041 (-.370)
Processing experience (Yrs)	.757 (2.322)**	2523.573 (.975)	.005 (1.471)	.061 (.935)
Off-firm income	.631 (2.035)**	.734 (1.526)*	-.228 (-2.505)**	-.131 (-1.926)*
Interest rate (%)	.633 (1.555)*	231.435 (.081)	.021 (.299)	.009 (.129)
Source of investment capital (1=equity, 0=debt)	-2,103.231 (-.590)	-2,283.098 (-.637)	-.049 (-1.634)*	-.053 (-.592)
Ownership (1=self, 0=otherwise)	-.554 (-1.753)*	-993.635 (-.075)	-.040 (-.454)	-.018 (-.206)
Capital input (Naira)	-.765 (-2.620)**	-0.108 (1.321)	-.231 (2.112)**	-.390 (4.211)***
F-Ratio	5.092***	1.845*	3.665***	2.897***
Adj. R^2	.231	-.047	.376	-.031
R^2	.788	.257	.446	.268

Source: Field survey, 2018.
***, ** & * = significant at 1, 5 and 10% level respectively.

The determinants of the rice processors' capitalization (ie capital investment into the business) was analyzed using the Ordinary Least Square (OLS) model. Four functional forms of the model (linear, exponential, semi-log and double-log) were tried for the two farmer categories. The lead equation was chosen based on a number of criteria such as value of R^2, F-ratio, signs and coefficients of the variables as they conform to *a priori* expectations. The linear and also the double-log forms were chosen for the risk-seeking and risk-averse farmers severally. The F-ratio was statistically significant at 1% indicating a high goodness of work of the regression line for the two farmer classes equations. The R^2 of 0.788 implies that 78.8% changes in the investment of the rice processors were accounted for by changes in the explanatory variables included in the model while 21.2% was accounted for by error. The result shows that age, education, experience and off-firm income were positively related to the amount of capital invested by rice processors and negatively related to ownership and capital input.

The coefficient of age was positively related to investment capital of the respondents implying that advancement in age encourages higher investment by rice processors. According to [8], the age of the entrepreneur was found to be positively related to their level of investment meaning that older processors tend to accumulate more capital and could invest more in both farms and off-farm activities. [7] shared a similar thought and asserted that the age of an investor was expected to have an effect on the investment behaviour because as the age of an individual increases, thus do his quest to go into investment increase intrinsically investment can later function as a monetary defend on retirement. [9] also stated that age has direct influence on investment as increase in age of investor increases the amount invested in farming. While these results may not conform

to *a prior* expectation, it is obvious that experience gathered over the years could play a critical role in determining investment. Youthfulness does not discourage investment except in the event of inexperience and low interest in agriculture; thus, investment is not altogether expected to be significantly lower compared to older adults.

Education was positive to rice processor's investment. This entails that with more education, processors have incentive to increase their investment. This finding agrees with economic theory that education is a strong asset that influences behaviour to risk. [7] asserted that an informed individual has higher potential to choose the area to invest as he is aware of the nitty-gritty of investment. Formal education provides entrepreneurs with a better capacity to learn about new production processes and product designs, offer specific technical knowledge conducive to firm growth, and increase owners' flexibility. In justification to this finding, it's been reported that well educated folks perceive higher risks and uncertainties that are found in business and are scientifically equipped to grasp the complexities of those eventualities. Hence, it might be inferred that educated investors might see varied problems and issues would like completely different angles as compared to uneducated investors. This finding refutes that of [2] who inferred that the level of education of household head had an inverse relationship to the investment in agriculture.

The coefficient of processing experience was positively related to the investment of rice processors implying that with more experience, investment will increase in line with *a priori* expectation that the more experience the farmer gathers, the more he will be able to manage his firm and accumulate more resources for investment [8]. According to [9]**,** small holder entrepreneurs who are highly experienced are usually not very active economically to invest on non-farm enterprise opportunities.

The coefficient of off-firm income was positively related to the investment of rice processors. This signifies that off-firm income increased investment. According to [8], income is one of the major determinants of investment such that an additional earning of ₦1.00 from farm and off-farm incomes tends to increase investment by ₦0.34 and ₦0.31 respectively. [6] thus implied that increase in investor's annual income will increase his/her quest to invest. [9] also reported that an increase in farm income of the entrepreneurs will increase the amount invested in farming. Investors with higher levels of income have a higher tolerance for risk. Hence, they are most likely to invest more funds in farming. Interest rate had an expected negative relationship with the investment of risk-seeking farmers implying that as interest rate increased, investment decreased. This agrees with economic theory and as well as the findings of [8] where it was confirmed that high interest rate tends to decrease investment. Ownership nature of the agricultural business had a negative sign for rice investors. According to [7], the decision on who owns an enterprise is a vital variable in determining investment decision thereby supporting [10] who reported that only a very small proportion of investors (2%) can invest in ventures owned by entrepreneurs with which they are not personally acquainted.

Capital input was negatively related to the level of investment by the rice processors implying that as the value of capital inputs increased, investment reduced. This is expected since capital inputs constitute costs which are leakages from entrepreneurs' stock of resources. Thus, for every 1% increase in capital inputs, amount invested in rice processing reduces by 0.765% thus implying that capital inputs variable is a strong predictor of investment. This agrees with the findings of Echebiri and Nwaogu (2017).

CONCLUSIONS

Based on the findings, the following conclusions were made:

A mean investment value of ₦220, 610 indicates a low level of capital investment which makes processors to be involved with local processing methods and this is responsible for their poor and inefficient allocation of resources. The result shows that

age, education, processing experience and off-firm income were positively related to the amount of capital invested by rice processors and negatively related to nature of ownership and capital input. Therefore, based on the findings, the researchers recommend that:

(i)Deliberate policies should be put in place by stakeholders in rural development to encourage small-scale rice processors in non-agricultural wage and self-employment categories to invest off-farm income into rice production and processing. This is because when more funds are invested, it would lead to expansion in farm size and output so that they could operate in larger markets and go into full agribusiness processing;

(ii)Similarly, the Federal Government, in conjunction with other government and non-governmental agencies should organize training for rice processors on the management of additional income from off-farm work activities. This would enable them to commercialize their business and take advantage of enabling agribusiness environment in the country.

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DEFINING INDICATORS FOR INVESTIGATING TRADITIONAL HOME-GARDENS IN ROMANIA

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Abstract

Home-gardens are at grounding the definition of the cultural rural universe all over the world and are paving for centuries our entire existence as human civilizations. They are directly connecting people to nature and are securing our rapid access to genetic resources for food and agriculture in a close connectivity to all them believes and achievements. The natural landscape was sculptured towards the human needs and for centuries they represent the borders between human settlements and wild biodiversity. In Romania traditional home-gardens are not recognized yet as heritage values of our ancestors even certain papers are describing home-gardens but they are not considering that traditional home-gardens can still be found or investigated. Sibiu county has unique villages with peculiar attributes related to the organization pattern of households, the use of specific genetic resources into their home-gardens including landraces, the access of wild biodiversity for food as well as the connectivity maintenance with the main events of the Christian calendar. The scope of this paper is to scientifically ground a set of indicators to be discussed in order to define traditional home-gardens models for Sibiu county. Furthermore, they may become important milestones for ensuring food security in the region also considering climate-change dramatic effects.

Key words**:** *home-gardens, landraces, food security, biodiversity conservation*

INTRODUCTION

In the last years, many researchers and conservationists asked themselves about the right definition of traditional home-gardens and gardening and their role in connecting the today rural communities to the demands of society [1]. How can we define a framework of basic principles to start developing appropriate indicators and how can we monitor them? In this regard we are emphasizing that certain types of home-gardens, very well described by following these principles, are already part of our cultural heritage at the global level [12]. That means the monitoring system of the chosen set of indicators was already adopted in different countries all over the world, in a broader context and closely connected to the cultural heritage, as a core subject. Generally it is accepted that home-gardens are also essential for food chain suppliers, ensuring food security and are described in scientific papers of the past 10 years for New Zeeland [40], Japan [30], Central America [7], India [8]. Conclusions remarks of the above-mentioned authors are relevant subjects of reflections and analysis also regarding the landscape management in close conjunction with specific gardening activities. The way a home-garden is integrated into the household, its proportion towards the total arable land and so on.

As a follow-up, landscape development strategies have been proposed in direct connectivity with gardening activities and cultural heritage protection.

A specific example from Indonesia exists in the island of Borneo and defined as *Kaleka* a traditional garden settled in the proximity of forests, and proofing over centuries to applying the best measures of sustainable land management [25]. The integration of cultural heritage into traditional communities' protection as well as for biodiversity conservation in this case is more than obvious. At the roots of defining these traditional landscapes resides the complex

analysis of communities' benefits on *long term* also as a tribute to society. Among these relevant are ensuring the access to food and feed resources for all year-round by taking into account new developing factors. In this regard the authors are looking to momentum life cycle when it is taken into consideration the integration of a new project [13; 17].

The theory of *resources dependence* also supported by the last authors is placing this subject at the core of any community analysis when a new project should be integrated as it was defined by Pfeffer & Salancik since 1978, some 40 years before. According to these authors the economic and non-economic environments cannot be separated to each other in any analysis as all of them are based on a balanced access to required resources. This argument is very strong if it is taken into consideration the need for ensuring food security for the future and it should be consistent with resource-*dependent communities*. Following this approach, all traditional communities can be defined as *resource dependent* [19; 33].

Taking together all above mentioned concepts and ideas the best approach, to continue development into traditional communities is the life-cycle analysis *ad integrum* when a new project is implemented that should not interfere with already existing resource dependence. Why? Because these traditional communities can be quickly disrupted by any out-side factor if it is not well understood before acting and such negative examples have been already signalled [18].

Usually, these traditional lifestyles, rich in biodiversity, may be defined also as the best settlements into which it is most suitable to integrate the best food security policies with the support of local authorities [15; 27]. Moreover, the implementation of a monitoring system may be supported based on existing political commitments taken under the provisions of the Art. 5 of the International Treaty on Plant Genetic Resources for Food and Agriculture or Plant Treaty (i.e. ITPGRFA) [4; 5].

Summarising, different theories and models regarding traditional communities' maintenance, home-gardens definitions and traditional gardening have been proposed during more than 40 years. However, lot of them are connecting non-economic and economic environments by considering specific financial mechanisms.

A case study from Cameroon was focused on traditional agroforestry [38]. In this case, the analysis is going down to the richness of biodiversity as a platform for further analysis in the most complete manner of the management of resources. The researchers discussed the term "home garden" in close connectivity to annual field crops and traditional forests gardens. The final conclusions set the connectivity between species richness and landscape sustainable management [34]. Furthermore, challenged by current policies and climate change effects the analysis of traditional gardens brought into the frontpage food security for the future [22]. The interconnectivity between old and new, was in all cases identified. However, it is essential to grounding the development of new local strategies for food security maintenance as an asset for society. The main feature of *home gardens* is that they provide direct access to food, that being their major attribute grounding any food security strategy development for a region or a country.

How may be possible to fully ensure the direct access to PEGFRA to a country population? This concept also is not new, and it was very well underline by Brownrigg since 1985 [10]. Considering that gardens are evolved landscapes into human settlements and very deep integrated into their daily existence with a history of more than 10,000 years, may be a good start into taking into consideration more historical factors acting on the analysed communities.

Currently for European countries lot of scientific articles described different traditional gardens [6; 20; 24; 37]. For each of them resource dependence and management measures have been described. At the core of their analysis stood the principle of describing these traditional gardens as being integrated into specific traditional landscapes [32].

In case of our country the current interest in defining home-garden was the developing of circular economy that can open the door for

analysing them in specific rural areas for the first time [23].

The scope of this article is to define a *framework of indicators* to be used in the process of describing traditional home-gardens for food security in the historical region of South-East Transylvania, mainly located in Sibiu county, Romania. Even indicators connecting home-gardens to nature conservation have been defined it is relevant to underline some peculiarities of the Eastern former communist countries that should be taken into consideration as well as the richness in terms of biodiversity compared to Western European countries [9].

MATERIALS AND METHODS

Study area. During the last 10 years of around 60 missions in Sibiu's county villages it was obviously that people still use local seeds such as landraces and apply traditional mixed with modern agricultural practices. All 53 main localities of Sibiu county have been surveyed, at different extents, for landraces' presence and traditional agricultural practices. 80% of these localities have also been also surveyed for genetic resources for food and agriculture such as: Alma Vii, Alțâna, Apoldu de Jos, Arpașu de Jos, Ațel, Axente Sever, Bârghiș, Biertan, Boița, Chirpăr, Cârțișoara, Cristian, Gura Râului, Hoghilag, Iacobeni, Jina, Loamnes, Ludoș, Marpod, Merghindeal, Micăsasa, Mihăileni, Moșna, Nocrich, Orlat, Păuca, Poiana Sibiului, Racovița, Rășinari, Râu Sadului, Roșia, Sadu, Slimnic, Șeica Mare, Șeica Mică, Șelimbăr, Șura Mare, Șura Mică, Tilișca, Târnava, Turnu Roșu, Valea Viilor and Vurpăr.

Questionnaire applied In all these cases a common questionnaire was applied that was recently published (Antofie et al., 2019). The questionnaire includes relevant information related to the landscape, geology, climate, but also to agricultural practices (i.e. from traditional to modern), applied equipment and machinery, irrigation. A relevant part of the questionnaire was oriented to the covering of the family' needs for an annual consuming. The access to the wild flora and fauna as genetic resources for food and feed were also investigated. Another subject of relevance is the religious calendar use for planning agricultural practices and without any exception in all villages the traditional knowledge (TK) related to agricultural practices is connected with the major religious fests of Christianity due to over 2000 year of constant coverage of this religious over pre - Christianity knowledge.

Our investigations covering the entire Sibiu county were made with the support of 86 students of the two specializations of Montanology and Environmental Protection belonging to the Faculty of Agricultural Sciences, Food Industry and Environmental Protection of the University "Lucian Blaga" of Sibiu and took place between 2010 and 2019. The main scope to involve students was to raise awareness among them regarding the presence of TK related to agricultural practices and use of landraces as the major step before starting to implement any new agricultural practices or to introduce a new crop. By applying an adaptive strategy should further be more beneficial to villages in terms of sustainable development.

RESULTS AND DISCUSSIONS

The first reason to define traditional home-gardens is the presence of TK related to traditional plant genetic resources for food and agriculture (PGRFA) cultivation for more than 100 years in the same agro-ecosystem. The lack of official recognition in Romania of traditional home-gardens triggered us to start this study in our attempt to further support the development of reliable food security strategies for rural communities.

However, certain authors are not describing any historical backgrounds and are not citing any historical resources in this regard [16]. The scarcity in historical evidences became obvious and this should be taken into consideration. This case is similar to former communist countries and can provide an interest due to peculiarities of the countries. However, compared to the Western European countries, having no interruption into their historical democracy, Romania has a gap of 45 years of democracy disruption when

traditional home gardens were removed from countryside with small exceptions (i.e. local communities into hilly-mountain areas). What really happened? How people faced this new situation? Do they continue to cultivate home gardens? Do they change the former traditional landscape? The TK related to home gardens is diminishing gradually into the heart of rural communities up to 1989 when the arable land was again retuned to the former owners without any resources considering the sequestration of all agricultural tools and equipment after 1945 [14; 26]. It was a dramatic transformation of TK among people of different generations and accessing a completely new landscape governed by the principle: *the good of the people*! The land was not anymore part of their culture and civilization but rather an exchange coin.

However, after 1989 the old generation from rural communities quickly accessed their traditional memory and reintegrated again their home gardens into the existing landscape. A former public market network disappeared, and new small markets emerged without political support for networking. During the past 30 years, most of the landowners loosed from economic point of view their capacity to continue working their arable land [39]. However, less and less of them continued to develop and disseminate the knowledge connected to crops cultivation, nature connection and religious calendars and contributed further to safeguard food security for their own communities. Seeds considered as lost before 1989 have been collected during certain missions into rural communities having home gardens [31; 35; 41].

Another group of researchers from Romania already published and considered that home gardens of the 18th century where mainly dedicated to edible and aromatic plants [36] in the historical province of Transylvania, specifically focused on a closed rural community. However, the description of species planted into the home gardens at least one century before is not yet published up to 1953 [21]. Traditional knowledge related to wildness is already described as existing in Romanian rural communities not encapsulated into the public goods after 1945 [16].

However, home gardens are not described yet for Romania even it is highly recognized that we have one of the richest countries in terms of biodiversity in Europe, namely in rural areas [11].

Home-gardens are constant parts of all investigated villages in Sibiu county. What is relevant to be define and to be discussed further in future articles.

1. The historical topography of home-gardens inside a household. This subject becomes relevant when the proportion of home-gardens inside the village (i.e. urban planning) is discussed against that of the outside village (non-urban planning) due to urban planning and households needs; Such an indicator was already described as 0.54% as general proportion at the country level related to all arable land [29]. In fig. no 1 is the oldest house in Moșna commune dated 1794 and which respect the ancient topography of the households: 1:10 constructed area towards green area (home-garden, orchard and vineyard).

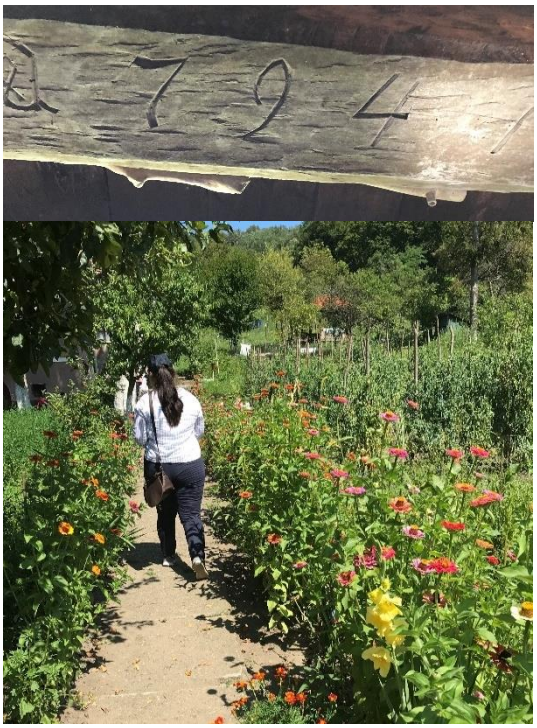

Fig. 1. The oldest household: no. 204, Moșna Commune has one of the representative ancient home-garden of the region. The first image is the original basement's beam of the house. The second is the entrance into the home-garden, paved by ornamental species.
Source: Original photo, 18 August, 2019, Antofie MM.

2. Genetic resources for food and agriculture present in home-gardens. This is associated with a survey of potential local landraces and also with their proportion in use that were already investigated in our country [28]. The famous landrace at the county level Moșna cabbage was recorded in several home-gardens (Fig.2).

Fig. 2. 'Moșna cabbage' is a landrace famous for very thin, elastic, and compacted leaves and very flattened heads, excellent for pickling over the winter. It is also cultivated in home-gardens positioned outside urban area, in direct connectivity to the beach forest. It belongs to the householders at the no 254 of the commune of Moșna.
Source: Original photo, taken on 20 August 2019, Antofie MM.

3.The integration of wild genetic resources into the household needs. This subject is relevant for integrating biodiversity as a whole with agricultural biodiversity in order to create an appropriate balance for the preservation of wild fauna and flora [2; 3]. The direct connectivity to natural forest habitats can be seen in fig no. 3.

4.Vulnerabilities and risks regarding traditional knowledge erosion due to existing national policy for agriculture. Usually national policies are supporting farming systems based on large agricultural surface use. However, in this case arable land is highly fragmented and the major benefit is that due to this fragmentation the resilience [2; 3].

Fig. 3. Home-gardens in the outside urban area, in direct connectivity to the beach forest. It belongs to the householders at the no 254 of the commune of Moșna. Source: Original photo, taken on 20 August 2019, Antofie MM.

5. *Capacity building at the local level* related to the recognition of TK and PGRFA as heritage values for local communities.

CONCLUSIONS

Traditional home-gardens still exists in Romania and they are already described in Sibiu county. The cultural value of crops cultivation are well integrated into the seminatural and natural landscapes further supporting the idea that this should be the main characteristics of our traditional home-hardens. Moreover, their continuing existence into the same agro-ecosystems and substantiation by historical evidences may further support the idea of a full analysis for these communities. The main subjects should be: a full inventory of genetic resources domesticated or wild for food and agriculture. Their connectivity to their culture or TK. The way of using urban and outside urban areas may also support the definition of the traditional home-garden and further to define different evolved garden types, slightly different compared to ancestral models. As complex a community is in integrating and preserving genetic resources for food and

agriculture they are more prepared to become relevant resilient communities for the future.

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INDICATORS FOR INVESTIGATING TRADITIONAL HOME-GARDENS IN ROMANIA - CROPS DIVERSITY IN MOȘNA COMMUNE, SIBIU COUNTY

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Abstract

Traditional home-gardens surveyed in villages of the historical province of Transylvania of Romania are dedicated for cultivating crops, fruit trees, shrubs and ornamental plants as well as inside and outside urban planning areas. They are connected to the semi-natural and natural landscapes and as a consequence their role in the biodiversity conservation is high. However, this concept in Romania is not yet defined. The scope of this article is to reveal the high diversity of plant genetic resources for food and agriculture in Moșna commune from Sibiu county of Romania. Our results revealed that the commune is dominated for crops cultivation by maize, potatoes, and cabbage but not only. A series of crop species and landraces are unique for the region such as the 'Moșna cabbage', the maize landraces 'Red of Moșna' and 'Lăpușneag'. There are landowners experimenting new varieties or new introduced species improving their skills for implementing different agricultural practices and saving seeds. Moreover, a series of other species are not officially recorded due to the constraints of the official forms in place. In this case they may become neglected crops species for the country at the official level. This situation can create the scene for vulnerabilities supporting their disappearance or crops erosion. It is the case of local carrots that disappeared due to the loosing of their capacity to save seeds as the species is cross pollinated. All these results support us to define the gastronomic footprint of the village as a major component in the agricultural policy to support food security.

Key words**:** *home-gardens, landraces, food security, crops conservation*

INTRODUCTION

Traditional home-gardens are considered at the global level that are important hot-spots of biodiversity due to the high diversity of cultivated crop species and varieties and their complex connectivity with other species into seminatural and natural ecosystems [12]. These small surface areas, as open systems, are ideal habitats for different other organisms setting the scene for resilient complex agro-ecosystems towards implementing climate changes' adaptation and mitigation measures [10]. In Romania traditional home-gardens are not yet defined even at least in the European Union it has the highest rate of rural population living inside these peculiar cultural traditional landscapes [14].

The fast changing of life in rural area may have dramatic effects on the preservation of rural traditional values and afterwards negatively impacting their resilience under climate change effects [19]. In this case, at the global level and in other European countries this process started years ago [6; 23].

To define traditional-home garden we need to understand and furthermore substantiate the way how can we better assess the diversity of crops in relationship to landscape peculiarities, householders believes and associated traditional knowledge. In this regard, we propose as a very first step the *on farm* survey of crops diversity residing in these ecosystems. The original pattern of the diversity of species and varieties recorded in the field may further support us to define the gastronomic footprint concept for an area closely connected to cultural heritage. This should be a relevant indicator in developing the definition of rural cultural heritage related to cultivated crops as genetic resources for food and agriculture and traditional knowledge.

In terms of crops inventory at the national level, in line with the European Union policy, Romania decided in 2001 through the Governmental Decision no 540/ 2001 to set the major indicators for agriculture namely to survey on a yearly basis crop species diversity relevant for trade [20]. These indicators are feeding the National Statistics Register in line to the European Union regulatory framework. Thus, the forms AGR 2A and AGR 2B, officially entered into force in 2001 with the scope to collect the major data related to field crop species, sparsely trees and orchards, regarding cultivated surface area (AGR 2A – for spring) and productivity (AGR 2B – for autumn). In terms of capacity building the main authorities involved, according the current regulatory system, are the City Halls and the County Directorate for Agriculture and Rural Development. The last is in charge to first data validation, followed by data feeding into the national statistics designated offices at the county level. The National Institute for Statistics and their county offices are in charge with final data validation at the national level and processing and furthermore of data transfer to their homologues at the European level. Finally, at the European level, a general image of crops production is created and refined into the annual statistical reports.

There is a clear missing link in terms of capacity building at the local level between authorities working on one hand under agriculture and on the other hand on biodiversity. If authorities for biodiversity conservation are in charge under the Convention on biological diversity (CBD) and all related treaties in case of Romania the Plant Treaty that originates from the scope of the CBD as a complementary treaty to cover all biodiversity, it is only working under authorities of agriculture namely the Gene Bank of Suceava. Under these circumstances there is a great need to rising awareness of the importance of ensuring conservation measure for all genetic resources for food and agriculture to officials in the City Halls of communes in our country as well as in other European Union countries. This gap is not covered yet in terms of regulatory framework or recommendations at the European level or national level.

Any resource and, in this case any plant genetic resource for food and agriculture (PGRFA) may be at the heart of developing new innovative economic activities for easy supplying the food and feed economic needs in our contest to ensuring food security for the future. Thus, one principle may be defined: *the more diverse the genetic resources are on which a village depends, the more its inhabitants are protected from the effects of climate change and implicitly from food insecurity*. Such ideas have been already published with different connotations already [5; 16; 18]. The cultural values of villages go behind food security and all rural cultural values. However, in terms of PGRFA, relevant for climate change are all of them including ornamentals and wild species residing inside the rural cultural landscapes. Why? There are long-term ecological connections between all these species. Furthermore, to define traditional home-gardens we need to also address climate change challenges such as drought, heavy rain falls or unusual meteorological conditions as well as the need to address food security for the future and furthermore the need for continuation of traditional culture so seldom mentioned or studied under social connotations [8]. In Romania, the direct connectivity between City Halls and landowners or householders is not officially defined for protecting landraces or PGRFA older than 100 years in the same agro-ecosystem [24]. It is still possible based on local decisions of the City Hall Council to further support the recognition of knowledge related to the continuous cultivation and dedication for cultivation of PGRFA.

The scope of this article is to survey the diversity of crops species in a village recognized to preserve traditions and to analyse the results against the official forms AGR 01 and AGR 02 that filled in by the City Hall officials to reveal the extraordinary crops heritage residing in their home-gardens. The results of this study are relevant to substantiate the gastronomic footprint of the cultivated crops species that may be accepted

as an indicator in the procedures for recognizing traditional home-gardens in certain rural areas of Romania. All data are analysed to reveal new opportunities for villages' development considering all genetic resources that are presently cultivated and their potential for new economic activities.

MATERIALS AND METHODS

Study area. Moșna is a commune positioned in Sibiu county, Romania (46°5′32″N 24°23′44″E), comprising other two villages Alma Vii (46°2′53.8″N 24°25′51.73″E) and Nemșa (46°5′9″N 24°26′43″E), a well-documented rural area relevant for agriculture in the historical province named *Transylvania* of the Middle Ages, based on the Fiscal Transcription of Transylvania from 1750 [13].
Methods of investigations. The complete survey of 12 households and officials regarding the current situation of crops cultivation as well as the connectivity with the historical arable land-use and land-use change (Fig. 1).

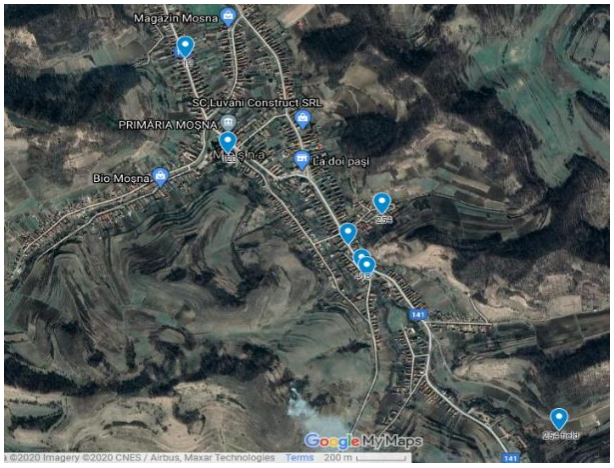

Fig. 1. A general view of the Moșna commune and the 12 locations of investigated home-gardens. Map realized by Antofie M.M. with the support of Google My Map on 14 August, 2020.
Source: https://www.google.com/maps/d/viewer?mid=1NWQtu_Rcsvj8On1Q_osCAAMWEQ7X0kbn&ll=46.088106006013795%2C24.40285550000003&z=15

The 12 householders were selected mainly based on their continuous activity of cultivating the arable land and on their openness to allow a direct investigation inside their home-gardens and their own field for crops. For this purpose, a questionnaire was applied that was recently published for the 12 landowners and officials from the City Hall [3]. The questionnaire includes among others a complete information related to the cultivated crops as well as the crops' management system at the local level. 12 missions took place during August and October, 2019.
Official records In order to evaluate the consistency of the current official recording with the commitments taken under the provisions of art. 5 of the Plant Treaty the City Hall Officials supplied us with their official transcripts to find official solutions to encourage the official recognition of their home-gardens as traditional hot-spot of biodiversity in Romania at the European Union level [4].

RESULTS AND DISCUSSIONS

Moșna is a famous commune for the last two centuries in Sibiu county, mainly due to the professor Stephan Ludwig Roth, of Saxon origin fighting for the protection of Romanian population and therefore considered as the main emancipator of the Romanians in the region of Mediaș during XIX century [9]. The commune is also famous for selling excellent quality legumes and wine on the agri-market of Mediaș (46°9′50″N 24°21′3″E), the main city of the region located at 5 km distance, and for more than 300 years documentary attested [13].
The connection with the landowners was mediated by the City Hall officials due to the complexity of the interview, duration of survey, including the visiting on spot of all home-gardens and fields, and privacy of the households' families.
The results of survey will be discussed below and grouped on cereals, potatoes and legumes.
Cereals. For more than 300 years the village was famous for cereal cultivation (spring and winter wheat, rye, oat, einkorn, millet) [13]. After 1750 maize entered the home-gardens together with other crops such as potatoes, tomatoes and peppers. The situation continues to be unchanged up to 1960 when commercial varieties of wheat dominated the agricultural

landscape and eliminating einkorn and millet. However, after 1960 maize entered into the field outside the village and shared a 10% average of the cultivated land up to late 1990 [4]. A complex situation was recorded after 1990 when maize started to dominate the agricultural landscape up to 90% of the cultivated field area. According to officials and landowners this change was generated by the arable land restitution without taking into account the need for any agricultural machinery (i.e. all rudimentary agricultural machinery was confiscated from all citizens before 1950) and the continuation of impoverishment of the population up today. Under such constraints, the local inhabitants continued to cultivate the agricultural fields as well as their home-gardens according to their fair possibilities. Thus, maize become slowly but continuously, the major cultivated crop due to its simple technology of cultivation compared to cereals. However, compared to cereals, maize will very soon spoil the soil [21]. The official claimed that due to this concern during 2018 the wheat and other common cereals were cultivated at higher costs on a larger surface compared to maize.
Based on data provided by authorities during 2019 only 2% of the cereals were represented by traditional crops such as *Triticale* hybrids and *Avena sativa* L (i.e. oat) and the rest of them by *Zea mays* L. (fig. 2, table no. 1).

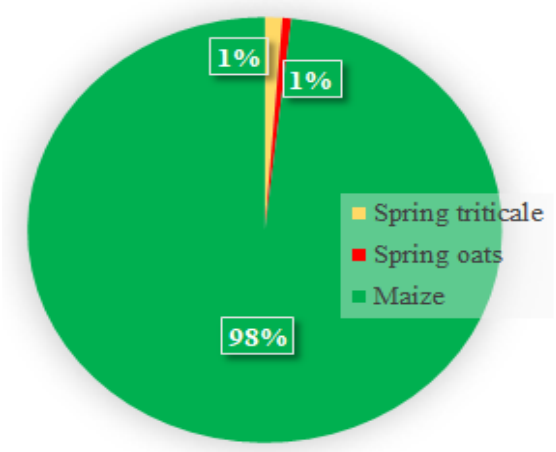

Fig. 2. The current share situation between the major cereals cultivated in Moșna, a commune with a long history of wheat cultivation.
Source: Original image based on collected data from the field.

This situation was confirmed by all respondents. However, what was not possible to officially record, was the variety or hybrids for any species. Unfortunately, at the local level only the species is officially recorded into the forms AGR 2A and AGR 2B. We underline that for more than 20 years it is recognized the relevance of the diversity of varieties for agro-ecosystems [2] and therefore a change can be realized at the local level – at the level of local authorities.
In this case we were able to identify one householder cultivating outside the urban area (i.e. inside the arable land) a large surface of maize local variety or landrace: 'Lăpușneag' (i.e. 10 yellow rows on the cobs) on 5.3 ha and another cultivating another landrace: 'Red of Moșna' (i.e. 12 purple rows on the cobs) on 4 ha. These two different landraces are cultivated for more than 100 years in the same agro-ecosystems of the county [4].

Table 1. The major crops species cultivated during 2018-2019 in the crops' fields of Moșna commune.

Crt. No.	Crop species in the field in close connectivity to home-gardens	Old varieties	New varieties
1.	*Avena sativa* L.		x
2.	*Brassica oleracea* var. capitata L. 'Moșna', local variety	x	
3.	*Medicago sativa* L.		x
4.	*Solanum tuberosum* L.	x	x
5.	× *Triticosecale* Wittm. ex A. Camus.		x
6.	*Triticum aestivum* L.	x	
7.	*Zea mays* 'Lăpușneag', 'Red of Moșna'	x	
8.	*Z. mays* L. hybrids of import		x
9.	*Z. mays* L. 'Tuda 200' national hybrid	x	

Source: all data are based on original investigations by corelating the official data to the field data collected from home-gardens during 2020 in Moșna commune, Sibiu county, Romania.

Both landowners declared that they are content with a production that is varying between 3,000 up and 4,000 kg/ha because this is constant even for very dry weather conditions. Moreover, they are using for food the 'Lăpușneag' maize variety because *the polenta is much sweeter and 'velvet-like'*

when eating based on the local opinion. The 'Red of Moșna' is used for improving the milk quality providing *a full taste of sweetness to the cheese* they are producing (Table 1).

Among the old Romanian hybrids 'Turda 200' is well established in these agro-ecosystems covering more than 90% of the arable land area. The officials claimed that also there are landowners cultivating new hybrids but there is no official record to establish their identity. In this regard, related to cereals as PGRFA it can be considered that in Moșna it is possible to preserve old and new cereals, the landowners are open to the new but they are also cultivating old varieties. Their traditional knowledge is strong, and they can easily adopt new crops in the region.

The change from classic cereals to maize production was catalysed by landowners' financial difficulties, to borrow common agricultural machinery that are needed for cereal technology based on the declaration of all respondents as well as of that of officials. However, during 2018, only 4.4 t/ha of winter wheat were produced on 327 ha due to dramatic weather conditions (i.e. high temperature and humidity were perfect for supporting the occurrence and spreading of wheat rust). All these factors were decisive to the locals to renounce to furthermore cultivate wheat in 2019. We mention that the region may be considered as a hot spot area for *wheat rust* also considering historical data provided by the Fiscal Conscription of Transylvania for 1750.

It can be concluded that in 2019 a large part of the arable land was cultivated with maize against traditional cereals (i.e. wheat, rye, barley, oat) that proves the excellent integration of maize as a crop into the agricultural landscape of this rural area (Fig. 2). The total grain production for 2019 was 832 t with a productivity of 16 t/ha that was similar to that of 2018 (15.5 t/ha).

In the last 30 years in the case of cereals it is a clear shift between classic cereals such as wheat against maize. If cereals dominated these agroecosystems for more than 5,000 years, after less than 30 years maize dominates the entire arable land area. It is obviously that this shift is due to a regression in terms of *access to technology* related to the present life needs.

This shift is not unique in Romania and similar situations have been recorded in Poland [17], Hungary [7] also countries that follow the communism breakdown and completely changing their political regime. However, at least in case of cereals, local authorities should be aware of the negative impact of maize cultivation under such an extensive way on long term over the quality of soils, decreasing food security for the future.

Potatoes entered as a garden species in this village area in the beginning of the XVIII century, in the same manner like in other parts of the country, and since then, it becomes one of the most important crops of the region [13]. During 2019, 52 ha of arable land were cultivated with autumn potatoes a comparable surface to 2018 when 48 ha were cultivated. There are at least two families declaring that they are using saved seed potatoes each year for many years. They weren't able to provide for sure the exact information of how many years they are saving seed's potatoes or the source. However, their productivity is not so high (bellow 5,000 kg/ha) they considered that the need to use pesticides decreased and both of them were content with a moderate production. The rest of eight investigated families are using commercial seed potatoes and associated pesticides due to the need to respond their needs. They were not able to provide the exact name of new introduced varieties. The major pests and diseases recorded based on this survey are as following: potato cysts nematodes (i.e. *Globodera rostochiensis* or *G. pallida*) in the region as well as wart disease (*Synchytrium endobioticum*) and late blight disease (Phytophthora infestans) mainly expressed during rainy summers.

There are no boundaries related to the way of choosing potatoes varieties, each of the locals respect the other neighbour's decision related to the management of their own arable land. In case of local seed potatoes these families may be of interest considering the programme of mountain potato seed collection from

Romania that started recently at the global level [11; 15].

Table 2. The major legumes species cultivated during 2018-2019 inside home-gardens of Moșna positioned half inside the urban area and half outside urban area – in the field of crops.

Crt. No.	Crop species as legumes cultivated in home-gardens	Old varieties	New varieties
	Allium cepa L. 'red' and 'white'	x	x
	Allium sativum L.	x	
	Anethum graveolens L. 'local variety'	x	
	Apium graveolens L. 'local variety'	x	
	Armoracia rusticana G.Gaertn., B.Mey. & Scherb. 'local variety'	x	
	Artemisia dracunculus L. 'local variety'	x	
	Beta vulgaris L. ssp. *vulgaris* var. rubra L.	x	
	Brassica oleracea var. botrytis L.		x
	Brassica oleracea var. capitata L. 'Moșna', local variety	x	
	Brassica oleracea var. gongylodes L.		x
	Capsicum annum var. grossum Sendt.		x
	C. annuum L. var. 'Kapia' and 'Alma Paprika'		x
	C. annuum var. microcarpum (Cav.) Voss in Vilm.		x
	Cucumis sativus L. 'local variety'	x	
	Cucurbita maxima Duchesne	x	x
	Daucus carota L.		x
	Helianthus annuus L.	x	
	Lactuca sativa subspec. *capitata* (L.) Schübl. & G.Martens 'local variety'	x	
	Lycopersicon esculentum Mill. 'local variety'	x	
	Mentha piperita L.	x	
	Ocimum basilicum L.	x	
	Petroselinum crispum f. vulgare (Nois.) Danert	x	x
	Phaseolus vulgaris L. dwarf and climbing local beans	x	x
	Pisum sativum L.		x
	Rheum rhabarbarum L.	x	
	Satureja hortensis L.	x	
	Solanum melongena L.		x
	Spinacia oleracea L.		x

Source: original data based on original investigations by corelating the official data to the field data collected from home-gardens during 2020 in Moșna commune, Sibiu county, Romania.

Another risk is associated to the lack of control for using pesticides as their application need a specific knowledge and to respect some strict protocols even for the use eco-friendly pesticides. This should be another vulnerability of the official system identified at the local level.

Legumes The commune and its two villages were and still are famous for legumes cultivation [13].

The cultivated surface was 48 ha for both years 2018 and 2019 with a total production of 740 t for 2018 and 710 t for 2019. The slight increase for 2018 was due to the weather conditions: warm and humid that are positively influencing vegetable cultivation.

The surface is comparable with that of potatoes cultivation. Among these species we describe the cultivation of tomatoes, onion, garlic, cabbage, pepper, cucumber, carrots, beans, eggplants, cauliflower and other not mentioned by the official forms (i.e. AGR 2A and AGR 2B) and they were cultivated in similar proportions during both investigated years. It can be considered that 25% of the arable land is covered with legumes and to a certain extent it follows the history of the village for legumes cultivation (Fig. 4).

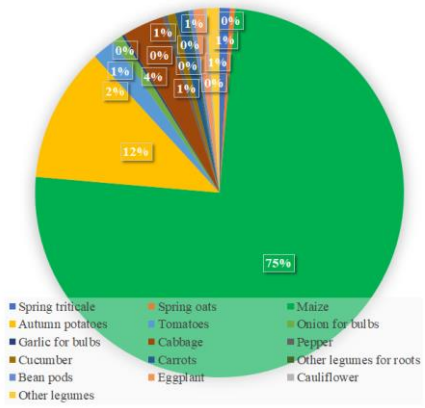

Fig. 3. A diagram presenting the proportions of the land use for cereals and home-gardens shows that for Moșna village one quarter of the arable land is covered by home-gardens that can be in the urban area as well as out-side urban area.

Source: original data based on original investigations by corelating the official data to the field data collected from home-gardens during 2020 in Moșna commune, Sibiu county, Romania.

By analysing the species listed into the Table 2, and by comparing with the species listed into the forms AGR 2A and AGR 2B, it appears that they are cultivating more species, that today are not recorded officially. It can create a false impression that other species than those officially recorded are not important and here is not the case.

In case of onion both red and white varieties local as well as commercial, are cultivated on a surface of 5 ha on a yearly basis in the last two years: 2018 and 2019. Only local garlic landraces are cultivated here due to its taste and gastronomic qualities as well as for its traditional preservation over winter (i.e. cool and well air drained basement rooms) and officially recorded for 1 ha on a yearly basis. However, the local needs are not addressed when we are talking of very small parcels and all together can easily extent the surface with at least 2 ha for onion and 0.5 ha for garlic according to officials.

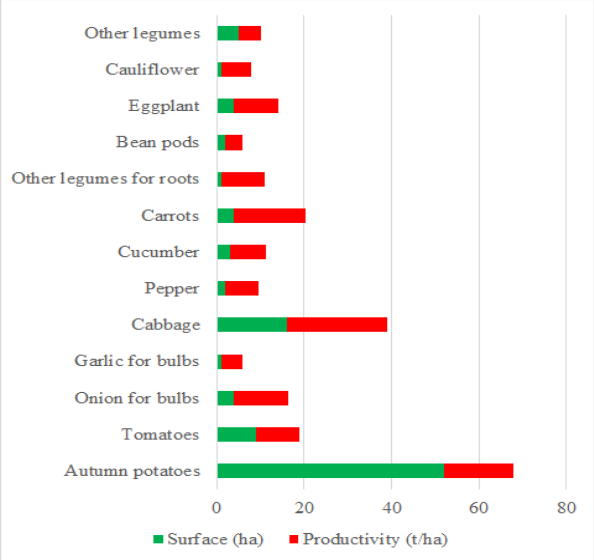

Fig. 4. A diagram presenting the connection between the cultivated area of the species and their productivity supports further the idea that the region is suitable for legumes, potatoes and cereal cultivation as well.
Source: original data based on original investigations by corelating the official data to the field data collected from home-gardens during 2020 in Moșna commune, Sibiu county, Romania.

Vegetables such as red beet, lettuce, different local varieties of dwarf and climbing French beans, cucumber are claimed to be all local varieties. The householders officially declared a total arable land area of 5 ha as being cultivated with cucumbers but appears also that the surface is probably higher with 1-2 ha due to very small, cultivated parcels also inside the urban area. A similar situation is for French beans, officially recorded for 2 ha which in reality, it easily can increase at 3 ha as it is a basic food vegetable.

Due to different difficulties it was a common issue to preserve carrot seeds and this is not only in this region [22].

All householders are using seeds of commercial origin, that was not a common use in the past. The great infusion at low costs seeds into the commercial network fuelled the loss of local seeds of carrots that claims a specific knowledge and certain barriers in order to avoid cross-pollination [1].

A similar situation is for peas, spinach and different subspecies and varieties of pepper. In case of pepper we mention the introduction of the new variety 'Alma Paprika' of Hungarian origin, very much appreciated by locals, extensively cultivated and used as a pickle.

Into the official records we may found only 3 ha of pepper subspecies as a total. However, based on the opinion of the officials the surface is doubled for the village considering more than 500 small parcels from the gardens.

The pea surface may be around 0.5 ha for the entire village but there are no official records.

An interesting situation is for cabbage for some of the householders.

Even there are householders that are claiming that they are cultivating the original local variety 'Moșna cabbage', with a history of centuries (i.e. the leaves are very thin and elastic and the best for pickling) still some of them renounced to the local seeds for commercialized seeds or seedlings, very easy to be found.

Regarding the famous 'Moșna cabbage' we need to underline that it is a cross pollinated species and therefore it should be very hard to consider that still the old variety survived, and local carrots doesn't. A molecular analysis is compulsory to officially recognize this variety as a local landrace. A close analysis of official data shows that the highest productivity was recorded for potatoes followed by the traditional cabbage and carrots.

CONCLUSIONS

An integrative screening of crops diversity in Moșna commune (i.e. cereals, potatoes and legumes) reveals an impressive diversity in terms of varieties and species compared to the official forms that are supporting the monitoring of PGRFA at national and European's levels.

The householders are equally oriented to preserve old varieties and to import or test new crop species or varieties, proving real skills for adopting new technologies and being interested in the commercialization of their products.

It can be considered that the gastronomic footprint of Moșna locality is dominated by maize, cabbage and potatoes and these local varieties should be at the core of further molecular investigations to prove if they really are landraces.

Traditional home-gardens of Moșna are dominated by legumes propagated by saved seeds and are open for new varieties too to their strong traditional knowledge related to crops cultivation.

In the village are also problems in saving seeds for cross-pollinated species such as the case carrots and therefore concerns should be raised to improve this capacity for locals.

All home-gardens for legumes includes ornamental plants for all village and further investigations will be realized.

Traditional home-gardens are split into two areas: inside and outside urban area, depending on the surface of the households. A strong connectivity between these urban areas exists and the landowners are dedicating to improve their cultivation skills and productivity.

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INDICATORS FOR INVESTIGATING TRADITIONAL HOME-GARDENS IN ROMANIA - VINEYRADS, FRUIT TREES AND CULTIVATED SHRUBS DIVERSITY IN MOȘNA COMMUNE, SIBIU COUNTY

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Abstract

Home-gardens survived in many villages in Romania especially in the historical province of Transylvania and the rich diversity of species and their varieties recorded for vineyards, fruit trees and shrubs may further contribute to define the concept of traditional home-gardens. More than other cultivated species, vineyards and fruit trees that are positioned inside, or outside urban areas, are connecting these agro-ecosystems to the wild ecosystems in a very specific landscape, making possible the preservation of an impressive number of wild species diversity for the region. The scope of this article is to record and discuss the diversity of domesticated species and their varieties related to three groups of plant species such as following: vineyards, fruit trees and shrubs in Moșna commune, Sibiu county, Romania. Our results revealed that even the vineyards decreased 23 times compared to 1750, local community continued to cultivate the first hybrids that have been introduced after the first attack of Phylloxera during the 19th century. Fruit tree species were also recorded in fossils excavated from human settlements in South Eastern Transylvania, the fruit diet being almost unchanged for so many centuries. This is the case also for bushes species that are towering all traditional home-gardens inside urban areas. However, the population expressed an obvious openness for testing and integrating new varieties, new species as well to preserve all old inherited plant genetic resources for centuries supporting us to further define a new type of gastronomic footprint in the support of food security for the future.

Key words**:** *traditional home-gardens, vineyards, fruit trees, shrubs, food security*

INTRODUCTION

The diversity of plant genetic resources for food and agriculture (PGRFA) is not only related to crops but also to species that are contributing to completing the human diet [3]. Food security for the future became more and more acutely discussed on higher political agenda due to the overconsuming rate and climate change effects [9]. As a consequence, the pressure to ensure food security for the future rests nowadays on developing PGRFA based on the full free access of Gene banks such as that of Svaldberg from Norway as real gene collections [17]. However, the major impediment is that gene banks are only capturing features of species' genomes for a specific time frame and are losing the connectivity to the evolution of environmental factors [12]. Therefore, for improving our access to genetic resources *on farm* conservation should also support the global care for PGRFA and the incredible work done in gene banks for the long-term preservation of crops germplasma [16]. At the global level, the World Food Programme (WFP) was recently awarded with the Nobel Price mainly due to *its efforts to* combat hunger, and fight for food security for more than 30 years [10]. However, efforts should be done at the global level and by every country to ensure the full and free access to PGRFA as well as the continuation of taking care of the traditional knowledge (TK) evolution in every single indigenous or local community for ensuring all attributes development in the fight for ensuring food security for long-term [14]. After the Second World War, the extraordinary evolution of human civilization left behind the rural civilization in many places at the global level compared to a sharp evolution into the urban civilization. No matter of governmental policies or natural

disasters a major negative impact was recorded on rural communities: either their transformation in peri-urban areas by transferring urban attributes to rural communities either their continuous impoverishment [13]. Lessons can be learned from both when local communities' resilience is facing climate change or natural disasters [15]. Where to start our quest? It should start from the ground or directly from the field. And, it is compulsory that we need to understand all values of rural civilizations and moreover to further support their TK process as a continuous generation and evolution that is essential for their existence by adding concepts such as food security and resilience to the evolution of our civilization as it is accepted today [18]. In our efforts to continue our saga related to the survey of traditional home-gardens of Sibiu in Romania, aside crops we need to add also other integrated species. Thus, by taking into consideration the complete diet of the XVIII century we need to add also fruits producing species such as vineyards, fruit trees and bushes. These are well documented by the archaeologist finding in archaic human settlements fossilized seeds of fruits or remains of them [4; 6; 7]. The mentioned researchers found fruits remains of domesticated as well as wild species to be used in the archaic diet for more than 6.000 years BC. All these archaic PGRFA will be relevant for the integration of the new entered especially during the Roman Empire [5] as well as after the migratory waves starting with the IV century A.C. [8]. Alongside crops there is a huge history of including different other PGRFA such as fruit trees, shrubs as well as wild species for more than 7.000 years BC.

The scope of our article is to investigate PGRFA such as vineyards, fruit trees and shrubs used today in Moșna, a remote traditional village in Sibiu county of Romania. We consider therefore that the study's results may fuel at the European Union level the need to increase our capacity to take into considerations for official surveys also the today neglected species in terms of official inventories. These neglected PGRFA and their specific use are generating the unicity of rural populations today in terms of culture residing in small villages from the Easter to the Western counties as well as from the Mediterranean to the arctic areas.

MATERIALS AND METHODS

Study area. Traditional home-gardens belonging to 12 householders from Moșna commune, Sibiu county, Romania (46°5′32″N 24°23′44″E), with two villages Alma Vii (46°2′53.8″N 24°25′51.73″E) and Nemșa (46°5′9″N 24°26′43″E) were investigated.

Methods of investigations. A complete survey for households and officials regarding the current situation of vineyards, fruit trees and shrubs as well as the connectivity with the historical use of them was applied (Fig. 1).

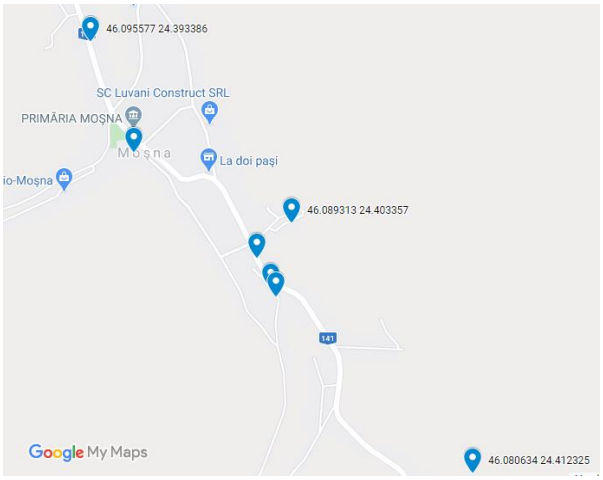

Fig. 5. The 12 locations generated for Moșna commune, Sibiu county, Romania by Antofie M.M. with the support of Google My Map on 14 August, 2020.
Source:https://www.google.com/maps/d/viewer?mid=1NWQtu_Rcsvj8On1Q_osCAAMWEQ7X0kbn&ll=46.088106006013795%2C24.40285550000003&z=15, Accessed on Sept 2020.

A unique questionnaire was applied for householders and officials from the City Hall [2]. The questionnaire includes among others a complete information related to householders, TK, the cultivation of vineyards, fruit trees and shrubs, collected during the 12 missions that took place between August and October 2019. This information will be used to further substantiate the official recognition at the local level, based on a bottom up approach, of traditional home-gardens as hot-spots of

biodiversity in Romania as well as in the European Union [1].

Official records The City Halls Officials supplied us all public data regarding the Forms A and B required on an annual basis by the National Institute for Statistics in agriculture chapter.

RESULTS AND DISCUSSIONS

Moșna as a commune, located into the Hârtibaciu Plateau in middle of Romania, a hilly area with specific climate characteristics, allowed during many centuries, the development of complex agricultural ecosystems: crops cultivation, vineyards, fruit trees and shrubs cultivation as well as animal breeding and beekeeping as well.

The commune was famous for trading agricultural products including wines and fruits on the agri-market of Mediaș (46°9′50″N 24°21′3″E), the main city of the region, located at 5 km distance, and for more than 300 years documentary attested [11].

The survey was conducted with the support of City Hall officials and covered for a single day and a single household all potential aspects of a comprehensive questionnaire [2].

The results of this survey, focused this time on vineyards, fruit trees and shrubs diversity and uses will be discussed below and grouped on the three subjects as well.

Vineyards. Once known as a famous area for the best wine in the region, this local community is cultivating nowadays vineyards only on 7 ha, that is 23 times less compared to 200 years ago when 170 ha where documented covered with vineyards [11]. Historical documents emphasized the economic importance of cultivating vineyards that took place on the top of the hills surrounding the village. The specific climate conditions of the area rested almost the same for centuries allowing the sun to ensure the best conditions for ripening the grapes only on the top of the hilly area. We need to mention that at the foot of the hills, especially during the ripening time due to seasonal conditions the fog stay for long time from the morning t the noon time creating the best conditions for pathogens development. However, by cultivating vineyards on the top of the hills it is overcome this barrier. For many centuries the wine was considered of good quality for Moșna and mediocre for Nemșa. For both of them the wine was an important asset for the local economy of the 18th century.

A unique landscape was shaped, a village surrounded by medium heigh hills, terraced for vineyard cultivation, that remained unaltered during a long period of time up to the years 1970 (Fig. 2). After this period the vineyards were abandoned and the terrain was cultivated with crops and preserving the terrace shaping of the hills.

Fig. 6. Hilly terraced areas for the cultivation of vineyards in Moșna, Sibiu county, Romania. Household of no. 256.
Source: Original photo, taken on 18 August 2019, Antofie M.M.

From an economic point of view, we can have some interesting estimates for wine trade. Thus, back to 1750, the must urn of Moșna (2,704 l) cost 20 critters (100 critters = 1 florin or 0.4825 USD at the end of the 19th century), i.e. 0.1 USD (1 dollar in 1860 now costs 30.91 USD) or 3,091 USD in 2019, or about 2.61 Euros today (i.e. 13.20 lei today). Considering that the price today reaches 1.5 Euros pr litre (i.e. 6 lei), it can be considered that was much affordable for people today towards 3 centuries ago. Also, the must urn of

Nemșa (2,704 l) cost 15 pennies and the one of Alma (2,704 l) 12 pennies. Concluding we may have an idea of the functioning of the circular economy some two centuries ago. It is not enough to be! History teaches us that we need to redefine ourselves every time in the context of the manifestation of major social changes.

Fig. 7. Traditional home gardens include vineyards of old hybrids (photo above at no 417) and new varieties such as 'Isabel'(photo bellow at no 254).
Source: Original photo, taken on 18 August 2019, Antofie MM.

Nowadays very popular are local vine hybrids with red grapes, that have been cultivated starting with the end of the 19th century after the *Phylloxera* attack. Even this vineyard is not of high productivity and quality, it can be recorded in almost all home-gardens of Moșna and therefore it can be considered as part of their cultural heritage.

However, new varieties such as 'Isabela', are very popular in the vineyards of the commune together with 'Black Pearl' and 'Riesling'. Usually, the old red hybrid is cultivated inside the home-gardens in the urban area (i.e. vineyards' pergola) and the new varieties are cultivated on the top of the terraced hills (i.e. vineyards' poles), outside urban areas (Fig. 3). The openness of householders towards integrating new and old varieties or hybrids is obvious.

Table 3. The fruit trees and shrub specie recorded in the gardens of householders of Moșna, Sibiu. Original data.

Crt. No.	Fruit's trees species and bushes species	Varieties	
		Old	New
1	*Cornus mas* L.	x	
2	*Cydonia oblonga* Mill.	x	
3	*Juglans regia* L.	x	
4	*Malus domestica* (Suckow) Borkh.	x	x
5	*Prunus armeniaca* L	x	
6	*Prunus avium* L.	x	
7	*Prunus cerasifera* Ehrh.	x	
8	*Prunus cerasus* L.	x	
9	*Prunus domestica* L.	x	x
10	*Prunus persica* (L.) Batsch,	x	
11	*Pyrus communis* L.	x	x
12	*Ribes uva-crispa* L.	x	
13	*Rubus fruticosus* L.	x	x
14	*Rubus idaeus* L.	x	x

Source: all data are based on original investigations by corelating the official data to the field data collected from home-gardens during 2020 in Moșna commune, Sibiu county, Romania.

Fruit trees. According to the current agricultural statistics based on indicators of Form A and B there are cultivated apple trees, pear trees, plum trees, apricots trees, cherries and bitter cherries, walnuts trees with a total production for 2018 of 60,220 t which means 362.77 t/ha. Inside the village we may found all species described in the Fiscal Transcription of Transylvania for more than

two centuries ago (Table no.1). With several exceptions they were found in archaeological human settlements of the region for more than 6,000 years ago [5]. The region can be considered as a habitat for plum tree, cherry, sour cherry trees and walnut tree, and adding other several species of fruit trees and shrubs based on the archaeological evidences mentioned before. Grafting and maintaining activities for orchards are continuously applied by all householders, being well integrated as a TK at the local community.

Pear trees are very popular too. They are not in great number and only old varieties can be found and some of them are very old (more than 80 years). Usually they are positioned in marginal areas of home-gardens due to their high vigour. Exists several newest home-gardens, without pear trees. 3,020 t of pear fruits have been harvested at the official level for the three communes of Moșna in 2018.

Fig. 8. Plum tree orchard, organized in large rows, inside the home-gardens at the household no. 418, Moșna, Sibiu county, Romania.
Source: Original photo, taken on 23 August 2019, Antofie MM.

Plum trees are a very common in all home-gardens. In certain traditional home-gardens they may occupy more than 500 m^2 as small orchards (the household of no. 418 in Moșna Fig 4). They are old varieties as well as some new varieties such as 'Bistrița'. At least two categories of varieties have been identified: early and late and related to the ripening season. Usually they are positioned as small orchards comprising several specimens in the sunny areas of home-gardens. The highest production of the commune in 2018 was recorded for plums: 30,100 t. The use of fruits goes from the cuisine up to plum brandy of households use. The regeneration of plum trees is natural under the canopy of plum trees.

Apricot trees are common presence into all surveyed home-gardens. However, based on officials they are more numerous considering the production of 1,000 t declared for 2018. All recorded specimens belong to old varieties based on the owners' declarations.

Fig. 9. Peaches, the variety 'of vineyard' and peaches seedlings in the second year inside the home-garden of 206 householders positioned outside urban area. Source: Original photos, taken on 17 August 2019, Antofie MM.

Peach trees that have been recorded were all local varieties, named 'de vie' or 'of vineyards'. They are very common and very much appreciated by the locals for taste, acidity, and texture. A production of 5,800 t

for 2018 was officially recorded at the commune level, but the productivity might be higher based on the discussions with officials. Moreover, locals are interested in starting their own seedlings production starting with local seeds for a three years life cycle before the final plantation in their home-gardens or orchards (Fig. 5).

Cherry and sour-cherry trees are also very common fruit trees in all home-gardens inside the urban area. They are not too many in terms of number of specimens, like in case of plum trees, but there are constantly present. The total production for 2018 was 5,400 t without the production not declared that may go for up to 8,000 t according to officials. We need to mention that both species have been found in archaeological settlements for more than 7,000 years ago [5]. Thus, it can be considered that this domesticated species is integrated for many centuries and it can be considered that it is living inside its own natural habitat.

Walnuts trees are also common species for Moșna and the region. However, they are occupying marginal areas in home-gardens inside urban area or in orchards. From cultural point of view, they occupy a central place in the mystic culture of community and therefore each of the traditional home-garden includes at least one vigorous walnut tree. Only 3,700 t of walnuts fruits have been declared as being harvested during 2018 at the commune level. However, the productivity can be tripled but it was not possible to be recorded when only solitary specimens were recorded in almost each home-garden and majority of them are older than 80 years.

Quince tree was recorded in 8 traditional home-gardens of 12 householders. They are of old origin not yet defined as a variety. These species are not recorded in the national inventory. They are part of the traditional culture of the village and have different culinary uses. The species was not recorded during the archaeological excavations and they are not recorded to reside inside all investigated home-gardens.

Raspberry is very common in home-gardens, and the place is famous for the presence of an old variety named ‘Saxon raspberry’ that is similar to the new ‘Ostara’ variety in terms of continuous production during the summer time. However, the productivity is not so heigh but fruits are more perfumed compared to ‘Ostara’. The locals are also interested in new varieties and it was recorded the ‘Gold raspberry’ a yellow fruit variety very sweet and appreciated by the owner.

Fig. 10. Raspberry, the variety ‘Saxon raspberry’, red and highly perfumed is still cultivated for centuries in most of the house-gardens in the Moșna commune (upper image householder no. 418). However, householders are seeking to try the cultivation of new varieties such as the ‘Gold raspberry’(bellow photo householder no. 268).
Source: Original photos, taken on 17 August 2019, Antofie MM.

The cornelian cherry is not so often but still is present in certain home-gardens as old varieties. It is used in the cuisine and for medicinal purposes. The species is also in its own natural habitat as a wild species

considering the results of archaeological investigation that are dating the fossilized seeds for more than 7,000 years inside human settlements.

Fig. 11. Blackberries are also very popular cultivated bushes for Moșna commune in Sibiu county, Romania. In this image it is a thornless new variety (house no 268).
Source: Original photo, taken on 17 August 2019, Antofie MM.

Blackberries are not so popular into the commune. We need to mention that the wild species is next to the village in the wild and the thorns are a barrier towards the desire to cultivate this shrub. However, the householder from the no 268 was interested in cultivating the thornless cultivar of blackberry and declared that they are very satisfied with the quality of this variety.
European gooseberry is very common in all home-gardens as different old varieties. Usually they are towering the legumes areas being exposed to the sun. They also may be considered as traditional for their cultivation in these traditional home-gardens.

CONCLUSIONS

The landscape peculiarity of Moșna commune is highly contributing to the increased diversity of cultivated species inside their home-gardens either positioned in the urban area (the village area) either outside urban area (the arable land area).
Almost all described species are of archaeological importance too for the region and they are contributing nowadays to the gastronomic value of the village for setting a specific fingerprint.
The openness of householders to integrate into the old diversity of cultivated species' and varieties other new varieties is a real fact.
For many centuries a specific traditional knowledge is constantly generated and developed in direct connectivity to agriculture.
It appears that no matters of political regimes this local community continued to be closely connected to the rich diversity of cultivated species that have been inherited from their ancestors for more than 7,000 years followed by the continuously testing and integration of new species and varieties. Grafting fruit trees and conducting apricot's nurseries in traditional way is also part of their traditional knowledge.
It can be considered that the gastronomic fingerprint of Moșna locality is still dominated by vineyards, several fruit trees and domestic shrubs species as well.

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THE IMPORTANCE OF THE MELLIFEROUS FLORA FOR THE BEEKEEPING IN GURA RÂULUI COUNTRYSIDE AREA (SIBIU COUNTY), ROMANIA

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Abstract

The melliferous potential consists in the capacity of a certain areal to provide food (nectar, pollen, manna) for the bee's families to obtain the beekeeping products. The knowledge of this resource is important in the beekeeping practice, being the success key to obtain a rich production of quality. The purpose of the study is the identification of the flora with a melliferous potential in Gura Râului countryside (Sibiu county). To achieve the purpose, it was important to analyze the specialized literature, the direct field research, the examination, taking photos, collecting botanical material and its identification in the laboratory. The study is finalized by drawing up a list with 47 species with a melliferous potential that belong to 22 botanical families.

Key words**:** *plants with melliferous potential, Gura Râului countryside (Sibiu county)*

INTRODUCTION

The honeybee is the creation of the Gods, offered to the mortal mankind in a moment of divine inspiration and maximum generosity.
Diodor of Sicily and Calimax in the "Hymn to Zeus" said that the bees fed Zeus, when he was a baby in Crete, where he was hidden by his mother Rhea to protect him against the canibalous appetite of the Cronos.
Glaucos Minos'son, was lost as a baby, in the catacombs of the labyrinth. He was found by Poliidor, dead in a large pot full of honey [9].
On the Goddess Artemis's skirt, that is a statue found in the archaeological exactions in Pritaneu, Efes, between other symbols are present bees disposed by fours in two lateral rows.
Honey was used also as material to embalm. In the Palace of Cnossos, pots full of honey were found that contained the dead bodies of the Cretan children. The people believed that over these pots, the souls of the embalmed children were flying in form of the bees.
The Olympian Divinities always protected the honeybees. Arister, Apollo's son learned about the beekeeping from the Centaur Chiron. Therefore, beekeeping spread within Elada and beyond its borders.
Herodotus gave us an information in "Histories" that the lands beyond the Ister (Danube) cannot be easily crossed because of the swarm of the bees.
Through here penetrated Darius of Istaspe and then Alexander the Great as well, in his expedition to pacify the turbulent tribes in North, before going into the great Asian adventure. After ten years he returned home in a coffin full of honey [10].
Testimonies about the fact that in the regions beyond the Istru, the beekeeping culture was an economical preoccupation and that honey was a part of the daily menu of the inhabitants, one could also find the information on the metopes of the "Column" in Rome.
In whole Europe, the bee was used as a heraldic symbol, being found on the imperial mantles [2].
Biological science dedicated multiple studies to the bee, crowned even by Nobel Prize.
For centuries people were interested in beekeeping, following to obtain of more and more productions in honey and beeswax.

Nowadays this interest is exceeded by the importance of the bees concerning the pollinating of the plants.
It is a known fact that the pollinating of entomophilous plants could grow the production with 75-80%. The bees evolved with flowers in a symbiosis that assure the reciprocal success of the two groups [1].
Scientific researchers appreciated that a single bee could visit in a minute, several other 24 flowers; that made it to be labeled as "the creature of the world who could not be replaced". This fact stimulated research about the melliferous base in the beekeeping areal. The assurance of a rich habitat in wildflowers comes as a help for this important pollinator, the bee.
Many researches state out the fact that the autochthon plants adapted to soils and local climate, which are the preferable sources for bees [11].
This fact was spotlighted by our researches that took place in different habitats in Sibiu county in the period of 2013- 2020.
The purpose of the present study consists in the identification of the flora with a melliferous potential in the basin of the countryside Gura Râului (Sibiu county).
The magic of beekeeping is deep embedded in the human mental being an explanation for the pensioners' dream to spend their time with this bucolic activity, meaning the return to nature.

MATERIALS AND METHODS

In the South of Transylvania, in an area between the Olt river, Frumoasa valley and the Northern crests of the South Carpathians Mountains, live so called "The marginals" (Mărgineni) a community that stand out by an authentic spiritual and economic feature.
The localities disposed on two rows along the areal, converging their majority towards are called "Mărginimea Sibiului" (Marginal of Sibiu).
One of the villages of "Mărginime", is Gura Râului, a countryside on the Cibin river, where the thrifty man is in connection with the mountain, with a rich vegetation, with a diversified fauna where beekeeping is in a meaningful attention.
The border of the village is from top of the mountains- at the Iezerele Cindrelului – to the valley at the limit of the village Orlat, that was formerly a center of the frontier guard (Fig.1).
Lucian Blaga has a true poetical inspiration in his verses of the poem "Boca del Rio" (Gura Râului): "Do you remember the green, the beehives and the cooing doves on the roofs?"
Indeed, three quarter of the border of the village is covered by deciduous forest (oak tree, hornbeam, beech tree), coniferous forest (fir tree, spruce fir) that cover a surface of 6,217 ha. as well as shrubs, bushes, pasture lands and hay field with a surface of 2,958 ha.
It is important to mention that on the territory of Gura Râului village there are four protected areas: one site of communitarian importance - Frumoasa, an area of avifaunistical protection - Frumoasa and two other natural areas are protected by the national interest - National Park Cindrel, beside the Iezerele Cindrelului.
There are also arable cultivated plots of land with: wheat,rye, two -row barley, oats, maize, potato, vegetables, fodder. The surface of the arable plot is assessed to 924 ha [29].
Beekeeping is at home! The number of bee families increases every year, therefore in 2019 they were more than 700, with a honey production more than 15 tons [30].
To achieve the purpose of this study, the following methods have been applied:
-The analysis of specialized literature about the flora in the studied areal.
-The direct field research, collecting the plants and taking photographs.
-The application in the field was in the period of 2018- 2019.
- In the laboratory it was identified the collected material in the studied area, using numerous bibliographic sources [4, 8, 16-19, 25, 26, 27].
The final of the study consists in drawing up the list of the plants with the melliferous potential in this area [3, 5, 7, 12-15, 20, 28].

Fig.1. The localization of Gura Râului locality in the Sibiu county
Source: http://pe-harta.ro/Sibiu/, Acccesed on 07.10, 2020.

RESULTS AND DISCUSSIONS

The honeybee in her way of life is close connected with her natural medium, being implied in the conservation, restoration and supporting the biodiversity both by pollinating the spontaneous flora and also of the cultivated one, being such a strong link in the trophic chain of all species [21].

The key of success in beekeeping consists of mastership by the farmer of the technology for beekeeping and also its insurance by turning to account as efficient as possible of the melliferous resources from spontaneous, forestry and cultivated flora of every habitat.

The village Gura Râului is, together with other 29 localities, in the category of areals with good botanical investigations and a floristic inventory almost complete [6]. On the basis of the speciality literature [6, 22-27] and our own researches, 177 taxons in the studied areal were identified. Among them, 47 taxons are in the category of plants with a melliferous potential (22.55%) (Table 1).

Table 1. Flora with melliferous potential in the basin of the village Gura Râului (Sibiu county)

Nr. crt	Species	The economical beekeeping weight	Biological data	Observations
1	2	3	4	5
			Pinaceae	
1	*Abies alba* Mill.	high	Coniferous tree, resinous, pollen, manna	Host plant for the manna producers
2	*Picea abies* (L.) H.Karst.	high	Coniferous tree, resinous, nectar, manna, propolis	The spruce fir is the host plant which is the most important for the manna producers
3	*Pinus cembra* L.	medium	Coniferous tree, resinous, pollen, manna	On the branches and offshoots live species of *Lachnidae*, manna producers
			Cupressaceae	
4	*Juniperus communis* L.	low	Coniferous tree, resinous, manna	The juniper tree supplies considerable harvest of manna for the maintenance and development of the bee family
			Ranunculaceae	
5	*Aconitum firmum* Rchb.	medium	herbaceous, nectar	Can be found in meadows, rocky places in the mountain zone
6	*Aconitum tauricum* Wulf.	medium	herbaceous, nectar	Can be found in grassy places around the sheepfolds
7	*Aquilegia vulgaris* L.	low	herbaceous, propolis, nectar, pollen	The flowers are intensely visited by bees
			Fagaceae	
8	*Fagus sylvatica* L.	medium	deciduous tree, nectar, pollen, manna	The tree supplies the harvest of bees in the period May-June
9	*Quercus petraea* (Matt.) Liebl.	medium	deciduous tree, pollen, manna	-
			Betulaceae	
10	*Alnus glutinosa* (L.) Gaertn.	medium	tree, pollen, propolis	Offers high quantities of pollen as early as March
11	*Alnus incana* (L.) Mnch.	medium	deciduous tree, pollen, manna	It offers harvests in springtime months, March, April
			Corylaceae	
12	*Corylus avellana* L.	medium	deciduous tree, pollen, manna	The most early bush that offers pollen to bees.manna is produced by the Homopter Myzocallis coryli (Goeze)
			Caryophyllaceae	
13	*Silene vulgaris* (Mnch.) Garke	high	herbaceous, nectar, pollen	-
			Rosaceae	
14	*Cerasus avium* L.	medium	tree, nectar, pollen	Fruit tree, very often visited by bees
15	*Malus domestica* Borkh.	medium	fruit tree, nectar, pollen	Species very appreciated for the nectar, but mostly for its highly polleniferous value
16	*Prunus spinosa* L.	medium	thorny bush, nectar, pollen	Honey has a yellow-golden colour, intense flavour and a pleasant taste
17	*Prunus domestica* L.	medium	fruit tree, nectar, pollen, manna	a fruit tree with a large spreading
18	*Pyrus communis* L.	medium	fruit tree, nectar, pollen	The flower secrets smaller quantities of nectar
19	*Rosa canina* L.	medium	thorny bush, nectar, pollen	The flowers are intensely visited by bees
20	*Rubus caesius* L.	medium	bush, nectar, pollen	The harvest of nectar and pollen are very important for maintenance and development of the bee families
21	*Rubus idaeus* L.	very high	bush, nectar, pollen	It can be found in the zone of the spruce fir and the beech tree. It blossoms at the end of May. In the best conditions it produces large quantities of nectar
22	*Sorbus aucuparia* L.	medium	tree, nectar, pollen	the limit of the coniferous and mixt forests
			Fabaceae	
23	*Lotus corniculatus* L.	medium	herbaceous, nectar, pollen	-
24	*Trifolium campestre* Schreb.	medium	herbaceous, nectar, pollen	-
25	*Trifolium dubium* Sibth.	medium	herbaceous, nectar, pollen	-
			Celastraceae	
26	*Euonymus europaea* L.	medium	bush, nectar	It grows in forets, groves, bushes.It blossoms in spring and sommertime
			Rhamnaceae	
27	*Frangula alnus* Mill.	medium	bush, nectar, pollen	The monoflower honey has important therapeutical qualities
			Aceraceae	
28	*Acer pseudoplatanus L.*	medium	tree, nectar, pollen, manna	It is widely spread in the mountain zones. It produces nectar also during unfavourable time. It offers a large quantity of pollen.Honey is extremely flavoured

Source: [6].

Table 1. Flora with melliferous potential in the basin of the village Gura Râului (Sibiu county) (continued)

Apiaceae				
29	*Astrantia major* L.	low	herbaceous, pollen, nectar	-
30	*Angelica archangelica* L.	medium	herbaceous, pollen, nectar	-
31	*Pimpinella saxifraga* L.	low	herbaceous	-
32	*Sium latifolium* L.	medium	herbaceous, pollen, nectar	-
Salicaceae				
33	*Populus tremula* L.	medium	deciduous tree, pollen, manna, propolis	-
34	*Salix caprea* L.	high	bush, pollen, nectar	the honey has a silvery colour, pleasant taste, in autumn produces manna
Ericaceae				
35	*Vaccinium myrtillus* L.	medium	bush, nectar, pollen	the flowers are intensely visited by bees
36	*Vaccinium vitis-idaea* L.	medium	bush, nectar, pollen	the bees visit intensely the flowers all period of blossoming, from May to July
Primulaceae				
37	*Primula verris* L. em. Hudus	medium	herbaceous, nectar, pollen	It can be found in grassland; the blossoming is in April- May
Oleaceae				
38	*Fraxinus excelsior* L.	medium	deciduous tree, pollen, manna	-
Lamiaceae				
39	*Mentha arvensis* L.	high	herbaceous, pollen, nectar	The peppermint honey has a yellow colour with a tint of green. The taste is sweet, with a specific flavour
40	*Teucrium chamaedrys* L.	medium	herbaceous, nectar, pollen	-
Dipsacaceae				
41	*Scabiosa ochroleuca* L.	medium	herbaceous, pollen, nectar	-
Asteraceae				
42	*Taraxacum officinale* (L.) Weber ex F.H. Wigg.	medium	herbaceous, nectar, pollen	the flowers offer to bees an intense harvest of nectar and pollen in the hours before lunch
43	*Telekia speciosa* (Schreb.) Baumg.	medium	herbaceous, nectar, pollen	-
44	*Arnica montana* L.	low	herbaceous, pollen, nectar	The harvest takes place only during the period of blossom, on an average of 14 days
Orchidaceae				
45	*Orchis morio* L.	medium	herbaceous, pollen,nectar	-
46	*Neotinea ustulata* (L.) R.M.Bateman, Pridgeon & M.W.Chase	medium	herbaceous, pollen, nectar	-
Poaceae				
47	*Zea mays* L.	medium	herbaceous, under crop, pollen	-

Source: [6].

The flora with honey potential in the basin of Gura Râului locality (Table 1) includes 47 species belonging to a number of 22 botanical families. We note the existence of the following families:

- **with one representative:** *Cupressaceae* (*Juniperus communis* L.), *Corylaceae* (*Corylus avellana* L.), *Caryophyllaceae* (*Silene vulgaris* (Mnch.) Garke), *Celastraceae* (*Euonymus europaea* L.), *Rhamnaceae* (*Frangula alnus* Mill.), *Aceraceae* (*Acer pseudoplatanus* L.), *Primulaceae* (*Primula verris* L. em. Hudus), *Oleaceae* (*Fraxinus excelsior* L.), *Dipsacaceae* (*Scabiosa ochroleuca* L.), *Poaceae* (*Zea mays* L.);
- **with two representatives:** *Fagaceae* (*Fagus sylvatica* L., *Quercus petraea* (Matt.) Liebl), *Betulaceae* (*Alnus glutinosa* (L.) Gaertn, *A. incana* (L.) Mnch.), *Salicaceae* (*Populus tremula* L., *Salix caprea* L.), *Ericaceae* (*Vaccinium myrtillus* L., *V. vitis-idaea* L.), *Lamiaceae* (*Mentha arvensis* L., *Teucrium chamaedrys* L.), *Orchidaceae* (*Orchis morio* L., *Neotinea ustulate* (L.) R.M.Bateman, Pridgeon & M.W.Chase);
- **with three representatives:** *Pinaceae* (*Abies alba* Mill., *Picea abies* (L.) H.Karst., *Pinus cembra* L.), *Ranunculaceae* (*Aconitum firmum* Rchb., *A. tauricum* Wulf, *Aquilegia vulgaris* L.), *Fabaceae* (*Lotus corniculatus* L., *Trifolium campestre* Schreb, *T. dubium* Sibth.), *Asteraceae* (*Taraxacum officinale* (L.) Weber ex F.H. Wigg, *Telekia speciosa* (Schreb) Baumg., *Arnica montana* L.);
- **with four representatives:** *Apiaceae* (*Astrantia major* L., *Angelica archangelica* L., *Pimpinella saxifraga* L., *Sium latifolium* L.);
- **with nine representatives:** *Rosaceae* (*Cerasus avium* L., *Malus domestica* Borkh., *Prunus spinosa* L., *P. domestica* L., *Pyrus communis* L., *Rosa canina* L., *Rubus caesius* L., *R. idaeus* L., *Sorbus aucuparia* L.).

Most species with honey potential in the area are part of the category of forest honey plants and includes 14 tree species and 13 shrub species. Trees and shrubs by their diversity and by occupying most of the studied area represent the most important honey source of the studied area. These categories come with the highest intake of nectar and pollen. The remaining 20 species belong to the category of herbaceous plants.

The 47 species that form the honey resources of Gura Râului basin are divided in terms of importance for beekeeping in the following categories:

Species with a very high beekeeping weight, with one representative (2.12%), which occupies important areas and annually ensures significant production harvests. In this category the species *Rubus idaeus* L. was identified with the average date of onset of flowering between 05.-15.05 [7] and which on days with temperatures above 20^0C produces large amounts of nectar.

Species with a high beekeeping weight cover large areas and ensure periodic or annual harvesting. The five species (10.63%) included in this category are: *Abies alba* Mill., *Picea abies* (L.) H. Karst., *Silene vulgaris* (Mnch.) Garke, *Salix caprea* L., *Mentha arvensis* L.

Species with medium bee weight. Most plants (76.62%) included in this group provide sustained harvests of nectar and pollen annually for the maintenance, development of bee families. Sometimes, in extremely favorable conditions, they can also support production harvests. The category includes 36 species: *Pinus cembra* L., *Aconitum firmum* Rchb., *A. tauricum* Wulf., *Fagus sylvatica* L., *Quercus petraea* (Matt.) Liebl., *Alnus glutinosa* (L.) Gaertn., *A. incana* (L.) Mnch., *Corylus avellana* L., *Cerasus avium* L., *Malus domestica* Borkh., *Prunus spinosa* L., *P. domestica* L., *Pyrus communis* L., *Rosa canina* L., *Rubus caesius* L., *Sorbus aucuparia* L., *Lotus corniculatus* L., *Trifolium campestre* Schreb., *T. dubium* Sibth., *Euonymus europaea* L., *Frangula alnus* Mill., *Acer pseudoplatanus* L., *Angelica archangelica* L., *Sium latifolium* L., *Populus tremula* L., *Vaccinium myrtillus* L., *V. vitis-idaea* L., *Primula verris* L. em. Hudus, *Fraxinus excelsior* L., *Teucrium chamaedrys* L., *Scabiosa ochroleuca* L., *Taraxacum officinale* (L.) Weber ex F.H. Wigg., *Telekia speciosa* (Schreb.) Baumg., *Orchis morio* L., *Neotinea ustulata* (L.), *Zea mays* L.

Species with low bee weight. The five species in the group (10.63%) provide nectar or pollen harvests for the maintenance of bee families, but do not support production harvesting. In this category we find the species: *Juniperus communis* L., *Aquilegia vulgaris* L., *Astrantia major* L., *Pimpinella saxifraga* L., *Arnica montana* L.

We emphasize that out of a total of 47 species with honey potential, 32 species (68.08%) are important sources of both nectar and pollen. The pollen collected by bees is transformed into pasture so indispensable to bees for their food and larvae, especially those of the queen. But what bees look for in plants is nectar, produced by the nectar glands of entomophilous plants, and transformed into floral honey. We mention that if the honey plants are in suitable environmental conditions, the secretion can be continuous.

Also, the honey base of the Gura Râului basin includes 13 species (27.65%) producing manna. Extremely important is the manna of animal origin produced by *Lecanidae* and *Lachnidae* (*Insecta: Homoptera*) that are found on conifers. Manna-producing insects on deciduous species are of little interest.

CONCLUSIONS

The analysis of the flora in the basin Gura Râului certified the fact that the locality and its surroundings are well studied, having the floristic inventory almost complete, with 177 species. Among them, the identified flora with melliferous potential is represented by 47 species (26.55%).

The inventory of the melliferous flora contains 22 botanical families, among them the family Rosaceae is the best represented (9 taxons), followed by *Apiaceae* (4 taxons), *Pinaceae, Ranunculaceae, Fabaceae, Asteraceae* (3 taxons each of them), *Fagaceae, Betulaceae, Salicaceae, Ericaceae, Lamiaceae, Orchidaceae* (2 taxons each of them).

Several 10 families have each of them a single representative: *Cupreeaceae, Corylaceae, Caryophyllaceae, Rhamnaceae, Aceraceae, Primulaceae, Oleaceae, Dipsacaceae, Poaceae.*

From the point of view importance for beekeeping there were 4 categories identified: species with a very high beekeeping weight (2.12%), species with high beekeeping weight (10.63%), species with a medium beekeeping weight (76.62%) and species with a low beekeeping weight (10.63%).

The majority of melliferous species are nectaro-polenipherous. Due to the fact that the first three groups with importance for beekeeping, that assure harvesting of honey yearly or periodically, totalized 89.37% from the total plants with a melliferous potential, demonstrates that the melliferous resources of this zone are satisfying for the beekeeping demands.

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A STUDY OF CONSUMER BEHAVIOUR IN PURCHASING FOODSTUFFS: A CASE STUDY OF SOFIA, BULGARIA

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Abstract

Traditionally, foodstuffs are included in the consumer basket of households. Statistics for recent years reveals an upward trend in the market of fast-moving consumer goods in Bulgaria. The growth in the number of retail outlets and in the number of fast-moving consumer goods in particular poses challenges to retail chains. The entry of foreign chains for consumer goods on the Bulgarian market as well as the variety of their product and brand supply result in intensified competition between them. The desire for increased market share is a prerequisite to providing higher value to end consumers through the elements of a commercial product which ensure competitive advantages. In order to establish the key (motivational) factors in the purchase process related to foodstuffs, a questionnaire was developed and a quantitative survey was conducted based on the method of the structured personal interview. The survey also shows the frequency of purchasing various groups of foodstuffs, the degree of purchase planning, the impact of reference groups on the purchasing process through one-dimensional frequency distributions.

Key words**:** *consumer behaviour, foodstuffs, Bulgaria*

INTRODUCTION

Each purchase is aimed to satisfy a certain set of needs and at the same time is a deeply emotional consumer experience, a reaction to consumer striving for needs and desires satisfaction.

Consumer needs are a dynamic category which reflects the development of society, production and commerce. They are the starting point of any production and commercial activity. With the development of society and technology, needs improve, become more diversified and change. The share of fast-moving goods in the structure of consumption, household spending on such goods, the influence of factors differing in their impact and degree in terms of the purchasing process, naturally lead to the study of consumer attitudes to the elements of a commercial product as well as to establishing the key factors determining consumer behaviour in the purchasing process of fast-moving consumer goods.

Consumer needs are satisfied through the goods and services offered by trade organizations (companies). On the other hand, the realization of sales is impossible without knowledge of consumer purchase behaviour. Consumer behaviour is part of overall human behaviour, but it is focused on the sphere of consumption [22, 2]. It is expressed in the consumer process of searching, buying and using goods [18]. It involves the processes in which the end consumer [2], each household or group chooses, buys and uses goods or services in order to satisfy their needs and desires [23]. A sequence of actions is implemented, divided into three stages: a purchase decision, a purchase, a purchase period of goods use [1] and an answer to the following questions is sought: What do consumers buy?; How much do they buy?; Who makes the purchase?; Why and where is a purchase made? [16].

Therefore, consumer behaviour in purchasing is a mental process related to the conditions under which a purchase is made; a physical process in terms of the place of purchase; a dynamic process of interaction and exchange of information between companies and consumers. Consumer behaviour is not constant. It changes depending on the changes in the market situation, on the opinions consumers exchange, on the novelties in product offering and, respectively, under the

influence of various factors that differ in impact degree and significance. The factors influencing consumer choice are characterized by multiplicity and variety. They form a complex system of interrelated and interdependent elements. They have different significance and degree of impact depending on the particular market situation and the particular consumer need. Demographic factors are a starting point in the process of purchase decision-making [10]. Consumer lifestyle and social status are crucial as well [24]. Alongside are revealed the degree of consumer involvement in the purchase process and the availability of goods supply, situational impact (physical environment, social environment, time perspectives, choice of place for purchase and previous influences) [19], impact of the elements of the marketing mix [3], referent groups impact, family [7].

Goods are divided into two main groups: for personal and investment purposes. Goods for personal purposes are for long-term and for short-term use. Fast-moving consumer goods are used to meet personal and/or collective needs within a household or a family. They mostly satisfy the basic needs in the hierarchy of needs of Maslow's pyramid. Unlike goods for long-term use which are **used** repeatedly within their useful period (determined by the manufacturer based on the warranty period or by the trader through the provided commercial warranty), fast-moving consumer goods are **consumed** once (at once) for food and in parts for non-food. They are characterised by a great frequency of demand and are purchased daily and/or weekly [4]. They have fast turnaround in terms of demand and consumption [25] and a relatively short shelf life [12]. They are intended for individual as well as for collective consumption within a household or a family [8]. They are bought frequently, with minimal effort and low consumer involvement in the purchase process [17]. Fast-moving consumer goods include foodstuffs and part of non-food groceries for short-term use (toiletries, cosmetic products, detergents, pharmaceuticals) [5, 15, 21].

According to the European classification NACE Rev. 2 [26] amended by Regulation 1893/2006 and harmonised in Bulgarian practice, retail trade in specialised shops for food, beverages and tobacco includes the following groups of food products:

-Meat and meat products;
-Fish, fish products, crustaceans and molluscs;
-Bread, baked foods and confectionery;
-Sweets;
-Dairy products;
-Eggs;
-Cooking oils and fats;
-Fresh fruit and vegetable;
-Processed fruits and vegetables;
-Coffee, tea, cocoa and spices;
-Non-alcoholic beverages, mineral and other bottled waters;
-Alcoholic beverages;
-Tobacco products.

The survey did not include purchases of eggs and tobacco products.

MATERIALS AND METHODS

The main objective of the study was to establish the major factors in consumer behaviour in terms of purchasing foodstuffs in Bulgaria. A quantitative survey based on the structured personal interview (face-to-face) was conducted in 2018 in Sofia for it is a capital city and has the largest population in Bulgaria (in 2011 17,7%, and in the beginning of 2018 19% of the Bulgarian population was concentrated in the capital) according to the National Statistical Institute [20]. The survey was conducted on different days of the week and at different times of the day near the outlets of big chains for fast-moving goods chains in order to cover a diverse consumer aggregate. The survey does not include brand differences within commodity groups. To determine the sample volume we use the most conservative possible estimate of the relative share in the overall aggregate π. It is the result of the assumption that p=q=0,5. We assume that the maximum error in such surveys is 0,05 with a guarantee probability of 0.95.

To calculate the sample volume we use the formula [13]:

$$\boldsymbol{n} = \frac{\boldsymbol{z^2\,\pi\,(1-\pi)}}{\boldsymbol{E^2}} = \frac{\boldsymbol{z^2\,p\,(1-p)}}{\boldsymbol{E^2}},$$

where:
n – sample volume;
z – guarantee multiplier (its value is assumed to be 1.96)
π – the most conservative estimate of the relative share in the overall aggregate;
E – the maximum permissible error;
Using the above formula it is established that the sample volume is:

$$n = \frac{z^2\,\pi\,(1-\pi)}{E^2} = \frac{z^2\,p\,(1-p)}{E^2} = \frac{1.96^2\,0.5\,(1-0.5)}{0.05^2} =$$

384 respondents.

In order to achieve sustainability of the survey results, the sample includes 600 respondents.
The statistical data were processed with the SPSS statistical programme. Based on the data processing and to identify the key factors in purchasing we used one-dimensional frequency distributions such as purchase frequency; factors influencing consumer choice; favourite day for shopping; referent groups influence; degree of purchase planning; involvement of other people in the purchase process.
By demographic characteristics the distribution of consumers buying fast-moving foodstuffs for their household is as follows:
According to employment status: 70% employed, 27% retired, 2% students, 1% unemployed;
According to educational degree: 62% graduates, 30% with secondary education, 8% with college education;
According to marital status: 54% married, 29% single; 17% living together in cohabitation;
According to household size: one-person (16%), two-person (28%), three-person (35%), four-person (19%), bigger than four-person (2%);
According to household monthly income: up to 500 lv. (8%), from 501 to 1,000 lv. (22%), from 1,001 to 1,500 lv. (32%), from 1,501 to 2,000 lv. (24%), from 2,001 to 2,500 lv. (8%), from 2,501 to 3,000 lv. (3%), over 3,000 lv. (3%). (1 EUR = 1.95583 BGN);
According to age: up to 25 years old (7%), from 26 to 35 years old (18%), from 36 to 45 years old (27%), from 46 to 55 years old (25%), from 56 to 65 years old (18%), over 65 years old (5%);
According to gender: 49% men, 51% women.

RESULTS AND DISCUSSIONS

The frequency of purchase of foodstuffs is due to their nature as essential goods as well as to the impossibility to store them for a long time because of their relatively short shelf life (Fig. 1).

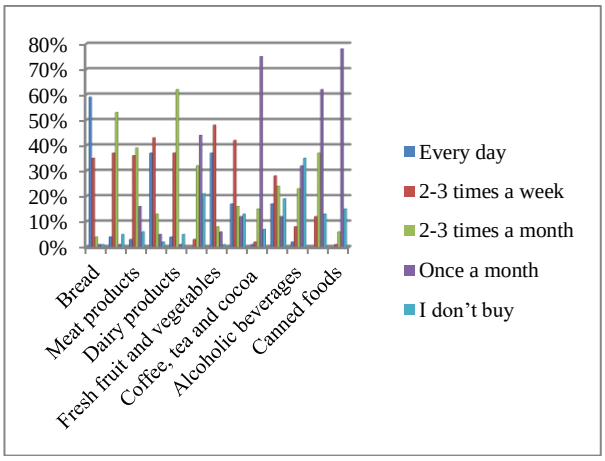

Fig. 1. Frequency of purchase of foodstuffs
Source: Author's own research.

As an essential commodity, bread has a relatively large share in the structure of household consumption. Survey results show that over 60% of the respondents make purchases every day. Milk is also an essential commodity and has a large relative share in the structure of consumption. 33% of the respondents buy milk for their household every day. On average, 47% of the respondents buy milk every other day (two to three times a week). Most often, dairy products are bought two to three times a month (for over 60% of the respondents), followed by two to three times a week (37% of the consumers surveyed). Over 50% of the respondents make purchases of different kinds of fresh and chilled meat two to three times a month, followed by two to three times a week (38%). The different kinds of meat products (sausages and minced meat) have a frequency of purchase mostly two to three times a month (38%) and two to three times a week (35%). Most often, the different kinds of vegetable fats are bought once a month (42%). A similar

frequency of purchase is that of the goods used for the preparation of different kinds of hot drinks (bought once a month by 73%), fish and fish products (bought once a month by 61%) and tinned food (bought once a month by 76% of the respondents). With regard to fresh fruit and vegetables and confectionery, the highest frequency of purchase is two or three times a week and is respectively 48% and 41% of the respondents. Most often, non-alcoholic beverages are bought two to three times a week (28%) and two to three times a month (23%), whereas most often alcoholic beverages are bought once a month (32%), with a large share of the consumers who do not buy alcoholic beverages (34%). It should be noted that the frequency of purchase for the different types of product groups depends on the weight or net content in their packaging, household size, household disposable income and the prices of the goods as well. According to the National Statistical Institute of Bulgaria, compared to 2017 the consumer price index of food and non-alcoholic beverages for 2018 is 2.7, i.e. prices increased by 2.7% [11]. The analysis of the survey results shows that 36% of the households spend up to 300 lv. of their budget on foodstuffs, 39% spend between 301 and 500 lv., and 25% - over 500 lv. Based on the survey results, the key factors determining a purchase are (Fig.2) the quality and shelf life of the goods (20%), price (18%), special offers (13%), assortment variety of products and brands (12%), a possibility to use customer loyalty cards giving the right to price reductions (9%), location (9%).

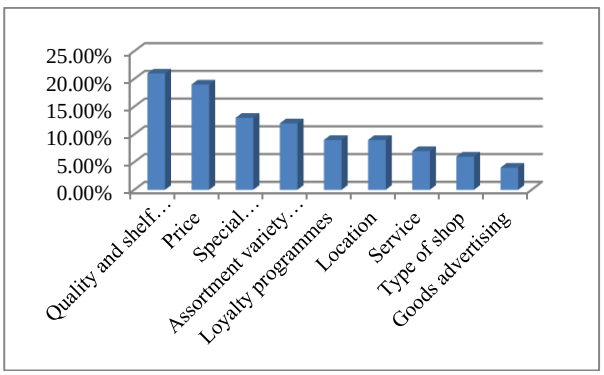

Fig. 2. Key factors for the purchase of foodstuffs
Source: Author's own research.

The days for purchase are in accordance with the identified characteristics of fast-moving foodstuffs (high frequency of demand, bought daily with minimum effort and low consumer involvement in the purchase process, with a relatively short shelf life): over 40% of the consumers surveyed make purchases both on weekdays and weekends, 27% of the respondents make purchases on weekends only and 32% make purchases on weekdays only (Fig. 3).

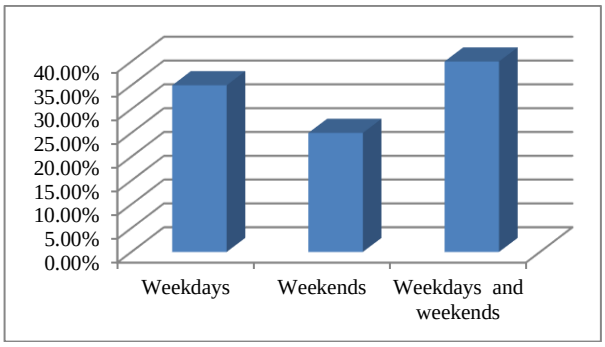

Fig. 3. Favourite days for purchase of foodstuffs
Source: Author's own research.

The degree of planning depends on the degree of consumer involvement in the purchase process. When buying fast-moving goods, we observe low consumer involvement (frequent, recurrent, periodic purchases of goods, for which there are no significant differences between brands) [6]. Based on this, it is possible to distinguish planned, semi-planned and impulsive purchase behaviour and, respectively, impulsive buyers and buyers planning partially [9]. Survey results reveal that 22% of the consumers plan ahead what to buy and which brand to choose.

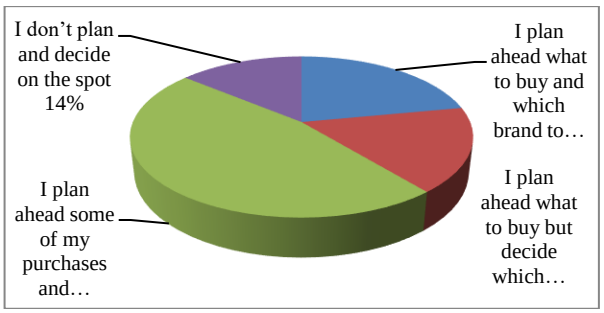

Fig. 4. Planning the purchase of foodstuffs
Source: Author's own research.

17% of the respondents plan ahead what to buy but decide which brand to choose on the

spot. 47% plan ahead some of their purchases and decide about the rest in the shop. Therefore, the partially planned purchases are over 60%. 14% of the respondents do not plan their purchases ahead and make a decision what to buy on the spot. Therefore, impulsive purchases amount to 14% (Fig. 4).

Social influences (the influence of different referent groups, social classes, family, etc.) have impact on consumer behaviour [14]. In the purchase process of foodstuffs, 49% (Fig. 5) of the respondents are influenced by the opinion of their social environment (relatives, friends, colleagues, established consumer style in the family).

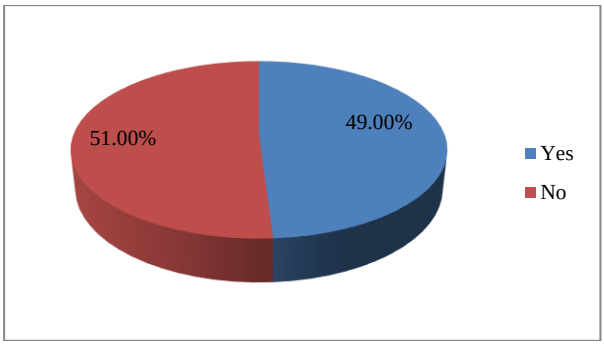

Fig. 5. Influence of referent groups on the purchase process
Source: Author's own research

The influence is related to the opinions expressed regarding the quality characteristics of the goods, trader's image or special offers (Fig. 6). 15% of the respondent consumers get informed about current special offers by their social environment.

Survey results show that consumers get informed about current special offers mostly from shop brochures (39%), by visiting a shop (19%).

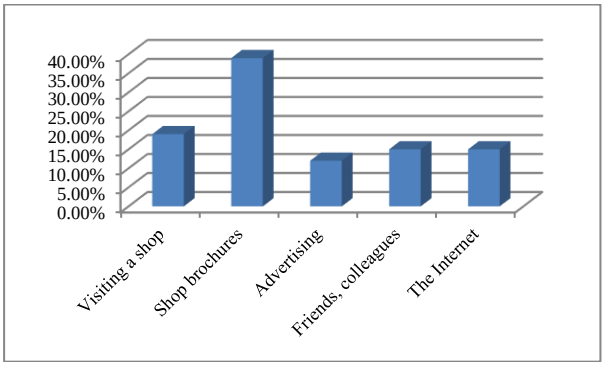

Fig. 6. Sources of information for current special offers
Source: Author's own research.

15% get informed from the trader's website and they are mainly from the age groups up to the age of 45 (over 70%). People over 65 are the least informed from the Internet (2%). The introduction of smart applications that allow consumers to be informed about current sales offers and to prepare a preliminary list of their desired purchases is observed in the practice of retail chains in Bulgaria [27].

The involvement of other people (family members or members of referent groups) in the purchase process can influence final consumer decisions. Fig.5 shows that the influence of the different referent groups is reflected in consumer decisions.

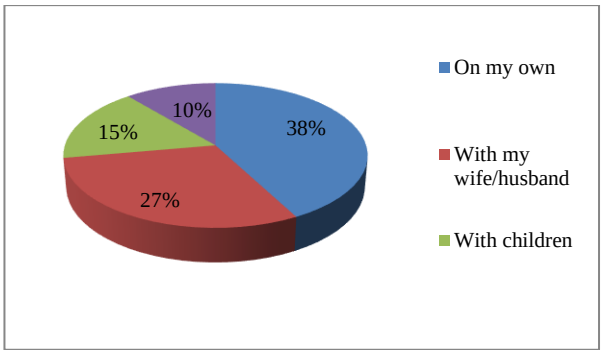

Fig. 7. Involvement of other people in the purchase process
Source: Author's own research.

The analysis of the survey results reveals that 38% of the respondents make purchases on their own, 27% make purchases when they are with their wife/husband, 15% - when they are with their children and 10% when they are with relatives, friends and colleagues (Fig. 7).

CONCLUSIONS

Consumer behaviour in purchasing fast-moving foodstuffs is in accordance with the characteristics of these goods identified in theory. The commodity groups of bread, milk and fresh fruit have the highest frequency of purchase. The commodity groups of tinned food, vegetable fats and the goods used for the preparation of different kinds of hot drinks (tea, coffee and cocoa) have the lowest frequency of purchase. For all studied groups of goods, the key factors in consumer behaviour are quality, price and special offers. In the purchase process, consumers are

motivated to achieve the acceptable price-quality ratio. Entirely planned are the purchases of 22% of the respondents and 14% of the respondents do not plan their purchases. In the purchase process, 49% are influenced by the opinion of different referent groups. The introduction of smart applications leads to digitalisation of the purchase process.

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ADOPTION OF BIOFORTIFIED CASSAVA AMONG FARMERS IN SOUTH WEST NIGERIA: A BINARY LOGIT ANALYSIS OF THE DETERMINANTS

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Abstract

The adoption of agricultural technologies is a vital strategy in addressing food security and improving households' nutrition. This study examined the determinants of adoption of biofortified cassava among farmers in South West Nigeria using a binary logistic regression model. Primary data through administration of structured interview were obtained from 396 respondents which were selected using a multistage sampling technique. Descriptive analysis of the socio-economic characteristics analysis showed the mean of 46.9 years, 1.8ha, 20.0 years and ₦238,693.18 for age, farm size, years of experience and income of the respondents respectively. Most (68.9%) of the respondents were males, 77.0% were primarily farmers, 90.2% were literate, 87.1% were married, 86.1% had group membership while 89.4% had access to extension services. There were low levels of awareness of the benefits of biofortified cassava and cosmopliteness of the respondents. The Binary logistic regression model result revealed that adoption of biofortified cassava was influenced by increase in awareness, perception, income from cassava, marital status and a decrease in age. It is therefore recommended that increase in awareness, income, and positive perception and younger farmers should be targeted when channeling a course for adoption of a new technology.

Key words**:** *adoption, determinants, biofortified cassava, binary logistic, regression*

INTRODUCTION

The prevalence of hunger and malnutrition has continued to be a daunting and haunting challenge around the world. About 805 million people of the 7.3 billion people in the world, or one in nine, were suffering from chronic undernourishment, consuming less than the recommended 2,100 calories a day between 2012 and 2014. Also, there are 11 million people undernourished in developed countries and almost all the hungry people, 791 million, live in developing countries, representing 13.5 percent, or one in eight, of the population of developing counties [4]. Specifically, 11.5% of the Nigerian population is undernourished [6]. It is estimated that about two billion people suffer from hidden hunger in which vitamin A is an integral part [7] Available records show that in Nigeria, Vitamin A Deficiency (VAD) afflicts about 30 per cent of children under five years, almost 20 per cent of pregnant women, and 13 per cent of nursing mothers [12] This shows that, Nigeria is not yet successful in combating malnutrition because of the percentage of its populace that is still malnourished. Though, progress has been made to control micronutrient deficiencies through supplementation and food fortification, new approaches are required, especially to reach the rural poor. There is a new public health approach to control vitamin A, iron, and zinc deficiencies of staple food crops in poor countries known as biofortification [8].

Biofortification is the process of breeding food crops that are rich in micronutrients, such as vitamin A, zinc, and iron. It refers to technologies for enhancing, through biological processes such as breeding and transgenic techniques, the micronutrient content of staple foods. Cassava has been chosen for the biofortification programme in

Nigeria because of its easy accessibility to the resource-poor farmers. Nigeria currently produces about 54 million metric tonnes (MT) per annum [5] making her the highest cassava producer in the world. The nutrient content in cassava can be enhanced by developing new varieties through biofortification affirming that scientific evidence shows this is technically feasible without compromising agronomic productivity [15]. The roots of these varieties are coloured yellow due to the presence of high levels of beta-carotene, the precursor for vitamin A. Biofortification is different from ordinary fortification in that it focuses on making plants more nutritious as the plants are growing, rather than adding nutrients to the foods during processing. When eaten, biofortified crops can provide essential micronutrients to improve nutrition and public health. The crops have the capacity of boosting farmers' income and ensuring food security and agriculture transformation in the country [7]. Technological change has been the major driving force for increasing agricultural productivity and promoting agricultural development in many parts of the world. As a result of increased research and improved methods of communication, a great variety of new materials and ideas have been generated and made available to Nigerian farmers and other rural dwellers. Adoption is defined as a decision to continue full use of an innovation while adoption process is a decision making process [3]. Adoption of innovation by the target beneficiaries is very essential to arriving at a target change and ultimate economic development in any economy. In many developing nations, a huge amount have been devoted to extension services in order to educate farmers on new agricultural practices. The efficiency and overall success of whatever innovation that is being introduced depends on a number of factors that influence its adoption. The understanding of these factors is an essential pre-requisite for such an intervention on biofortification of staple food in order to address malnutrition. The adoption of agricultural technologies is a challenging and dynamic issue for farmers, extension agents, researchers, agri-business and policy makers. However, because of variability in natural resources, culture, political system, traditions, beliefs and socio-economic factors, the factors affecting technology adoption differs across locations.

This research focused on examining the factors that influence the adoption of Vitamin A biofortified cassava variety among farmers among farmers in South West, Nigeria.

Specifically, the study described the socio-economic characteristics of the respondents in the study area identified factors that influenced farmers' adoption of biofortified cassava.

MATERIALS AND METHODS

A multi-stage sampling procedure was used for respondents' selection. At first stage, three states namely; Oyo, Lagos and Ogun were purposively selected for the study because of the volume of cassava produced in the states. The states were also among the locations where the biofortified cassava was first introduced and disseminated in the country. The sampling frame used was based on the agrarian zoning system of the Agricultural Development Project (ADP) which is applicable to all the states in the country. Only registered farmers with the Agricultural Development Project (ADP) were included in the sample frame. At the second stage, proportional purposive selection was used. Half of the zones in each state were selected out of the 4, 4 and 3 zones in Oyo, Ogun and Lagos States respectively. The selected halves were the first two ADP zones where the technology were first disseminated in each state. Namely; Ibadan/Ibarapa and Oyo zones in Oyo State, Abeokuta and Ijebu-Ode zones in Ogun States; and Eastern (Imota) and Far Eastern (Epe) zones in Lagos State: The third stage entails a random selection of half of the blocks in each zones to make a total of 18 ½ blocks. This was followed by an independent simple random selection of 25% of the cells in each block to make a total of 33 cells. In the final stage, 12 cassava farmers were selected from each cell. This resulted to a total number of 396 respondents being selected.

Measurement of Variables

Socioeconomic characteristics: Relevant information were solicited on selected socio-economic characteristics of the respondents such as age, primary occupation and monthly income.

Cosmopoliteness: In order to assess the level of exposure, respondents were asked how often they travel outside of their community using a four-point Likert type scale and labelled as Very often – 3, Often – 2, Rarely – 1 and Never – 0.

Awareness level of benefits of biofortified cassava: Respondents' were asked if they were aware of benefits such as presence of vitamin A and reduction in weight. A 3 point Likert type scale was used and labelled as Much Aware- 2, Just Aware – 1 and Never Aware- 0.

Farmers' Perception of Biofortified Cassava: Five - point Likert scale of Strongly Agree, Disagree, Undecided, Agree and Strongly Disagree was used to determine the respondents' perception towards biofortified cassava on a list of 29 statements. The scores of 5, 4, 3, 2 and 1 were assigned for positive statement respectively and reversed as 1, 2, 3, 4 and 5 for negative statements. The values were added together to arrive at a minimum, maximum and pooled mean for cosmopoliteness, awareness and perception.

The dependent variable of the study is farmers' adoption of biofortified cassava. The dependent variable of adoption of vitamin A biofortified cassava (*Yi*), was used as a dummy variable where an adopter of Vitamin A biofortified cassava varieties was scored 1, and non-adopters scored 0. The data analytical tools used in the study comprises of descriptive and inferential statistical tools. The independent variables were analysed using descriptive statistics such as frequency counts, means, range, percentages, standard deviations and charts. The dependent variable was analysed using binary logistic regression model and factor analysis. Binary logistic regression as an approach is similar to multiple linear regression, but takes into account the fact that the dependent variable is categorical and dichotomous. The outcome variable is binary and leads to a model which can predict the probability of an event happening for an individual [17].

The general form of the model to be adopted is expressed as

$$\text{Logit}(P) = \text{Log}[P/(1-P)] \quad \ldots\ldots\ldots \quad (1).$$

The term within the bracket is the odds of an event occurring. In this case it is the odds of a respondent adopting the technology. Using the logit scale changes the scale to plus and minus infinity and also because logit (P) = (0), when P = 0.5. Transformation back from the logit (log odds) scale to the original probability scale, the predicted values will always be at least 0 and at most 1.

$$Pi/(1-Pi) = \exp(\beta_0 + \beta_1 X_1) \quad \ldots\ldots\ldots \quad (2)$$

$$1 - Pi = 1/(1 + \exp(\beta_0 + \beta_1 X_1)) \quad \ldots\ldots \quad (3)$$

$$Pi = Pi + fi = \exp(\beta_0 + \beta_1 X_1)/1 + \exp(\beta_0 + \beta_1 X_1)) + fi \quad \ldots\ldots\ldots\ldots \quad (4)$$

The regression process finds the coefficients which minimize the squared differences between the observed and expected values of Y (the residuals). As the outcome of the logistic regression is binary, Y needs to be transformed so that the regression process can be used. The logit transformation gives the following:

$$\text{In}\left(\frac{\rho}{1-\rho}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \ldots\ldots\ldots\ldots \beta_n X_n \quad \ldots\ldots \quad (5)$$

where ρ = probability of event occurring, that is a person adopting, and $\frac{\rho}{1-\rho}$ = odds ratio OR

$$\text{In(odds)} = \text{In}\left(\frac{\hat{Y}}{1-\hat{Y}}\right) = a + bX \quad \ldots\ldots\ldots \quad (6)$$

where $\hat{Y}$ is the predicted probability of the event (adoption), 1- $\hat{Y}$ is the predicted probability of the other decision (non-adoption), and X is the predictor variable.

For the probability of adoption, the logistic regression equation is written as:

$$\rho = \frac{\exp(\beta 0+\beta 1X1+\beta 2X2+\beta 3X3+\beta 4X4+\beta 5X5+\beta 6X6+\cdots\ldots\ldots\ldots\ \beta nXn}{1+\exp(\beta 0+\beta 1X1+\beta 2X2+\beta 3X3+\beta 4X4+\beta 5X5+\beta 6X6+\cdots\ldots\ldots\beta 7X7+\beta 8X8+\beta 9X9)}\ 0 \rho < \rho < 1$$

The same model was used by [16] and [1] on a study of determinants of adoption of Vitamin A biofortified cassava. The assumption is that the random variables yi are independently distributed. Equation (1), states that the probability that the ith farmer will adopt a given technology, such as improved cassava varieties *Pi* (*yi* = 1), is a function of

the vector of explanatory variables, Xi, and the unknown parameter vector.

The independent variables are explained for the explanatory variables as follows:

X_1 = Age (continuous), X_2 = Sex (Male = 1, female = 0), X_3 = Primary occupation (farming = 1, others = 0), X_4 = Farm size (continuous), X_5 = Level of education (Formal Education = 1, No formal education = 0), X_6 = Membership of organisation (Yes = 1, No = 0), X_7 = Awareness of Vitamin A in biofortified cassava (continuous- awareness summed score), X_8 = Perception on biofortified crops (continuous- perception summed score), X_9 = Extension services access (Yes = 1, No = 0), X_{10} = Level of cosmopoliteness (continuous - cosmopoliteness summed score), X_{11} = Religion (Christianity = 1, others = 0), X_{12} = Religion (Dummy variable: Islam = 1, others = 0), X_{13} = Marital status (Married with spouse = 1, otherwise = 0), X_{14} = Farming experience (continuous), X_{15} = Income (continuous: from cassava), ei = error term, β_0 = Constant/intercept, $\beta_1 \rightarrow \beta_q$ = Coefficient for explanatory variables $X_1 \rightarrow X_q$

RESULTS AND DISCUSSIONS

Socio-economic characteristics

The results of socio-economic characteristics of the respondents is presented in Table 1. The study showed that $\bar{x}$ = 46.9 years and a standard deviation of ±10.5 reveals that the ages of the respondents spread across 36 to 56 years. This implies that most of the respondents were still in their active and productive age. This is in line with [2] who found out that the mean age of cassava farmers was 43 years. The findings showed a minimum of 0.2 hectares of cassava farm and a maximum of 12 hectares, with $\bar{x}$ = 1.8 and a standard deviation of ±1.6.This indicates that they are mostly small scale farmers and there existed a wide gap in the farm size of the farmers. A minimum of two years was recorded for years of experience and $\bar{x}$ = 20 years. That reveals respondents were well grounded in cassava farming. The mean income was ₦238,693.18 with a standard deviation of ±₦225,723.44. This reveals a wide gap in the earnings of the farmers from cassava. This is traceable to the disparity in the farm size of the farmers. In line with [13], the mean annual income from cassava was ₦234,580.67. The cosmopoliteness which reveals the level of exposure from visit to other place outside their places of residence reveals a minimum of one and $\bar{x}$ = 9.8. The findings also reveals that there was a noticeable difference in the awareness level of the respondents about the benefits of biofortified cassava with a minimum of zero, $\bar{x}$ = 6.58 and a standard deviation of ± 4.15. That shows some of the respondents were not aware of the benefits at all.

Table 1. Socio-economic characteristics of respondents

Variable	Minimum	Maximum	Mean	Std deviation
Age (years)	24	75	46.9	±10.5
Farm size (ha)	0.2	12	1.8	±1.6
Years of experience	2	57	20.0	±10.2
Income from cassava (₦)	30,000.00	1,750,000.00	238,693.18	±225,723.44
Cosmopoliteness	1.0	18.0	9.8	±3.4
Awareness	0	12	6.58	±4.15
Perception	46	125	87.75	±18.88
Percentages				
Sex	Male (68.9)		Female (31.1)	
Religion	Christianity (54.3)		Islam (43.9) Traditional (1.8)	
Primary occupation	Farming (77.0)		Others (23.0)	
Marital status	With a spouse (87.1)		Otherwise (12.9)	
Formal Education	Yes (90.2)		No (9.8)	
Group membership	Yes (86.1)		No (13.9)	
Extension services access	Yes (89.4)		No (10.6)	

Source: Field survey, 2018.

The perception of the respondents about biofortified cassava revealed a minimum score of 46 and a maximum of 125 with $\bar{x}$ = 87.75. There were more males than females cassava farmers with a record of 768.9% males and 31.1% females.

The religions practiced were 54.3% Christianity, 43.9% Islam and 1.8% Traditional worship. Most (68.9%) of the respondents has farming as their primary occupation, about 87% were married and with spouse, while 90.2% had formal education which implies a high literacy level in the study area. About 86% of the respondents were members of one group or the other while 89.4% had access to extension services, group membership and extension access are expected to make them better receptive to adoption.

Determinants of Adoption

The null model, which is a model with no explanatory variables includes a constant so that each respondent has the same chance of adoption. The null model, that is, the intercept-only model is In(odds) = β_0 = 0.674, p = 0.00. The predicted odds (Exp(β)) = 1.962. This implies predicted odds of adoption of biofortified cassava is 1.962. The Omnibus tests of model coefficients gives the result of the Likelihood Ratio (LR) test which indicates whether the inclusion of the block of variables contributes significantly to model fit. A p-value of less than 0.005 for block means that the block 1 model is a significant improvement to the block 0 model [10]. In this case, $\chi 2$ is 408.873, df = 16 and p = 0.000, which implies a significant improvement. Percentage of correctness also increased from 62.2% to 96.4%.

The values for the model summary is: -2Log likelihood statistic (also known as deviance) = 87.341. This measures how well the model predicts adoption (how much is left unexplained by the model). The smaller the statistic the better the model. The Cox & Snell R^2 = 0.651 and Nagelkerke R^2 = 0.903. These values implies that between 65.1% and 90.3% of the variation in adoption of biofortified cassava can be explained by the model. The classification table also showed good prediction performance of 96.4% of overall prediction (96.2% of non-adopters and 96.4% of adopters).

The Wald test is similar to the LR test, it is used to test the hypothesis that each β = 0. In the Significant column, the p-values are all above 0.05 except that of age (0.043), awareness (0.000), perception (0.000), marital status (0.048), and income from cassava (0.014). This means that although the following variables were included in the equation: sex (0.724), educational qualification (0.971), farm size (0.151), cosmopoliteness (0.908), Christianity religion (0.466), Islam religion (0.578), primary occupation (0.626), group membership (0.619) and years of experience (0.477), it can be concluded that the additions of these variables to the model was not statistically significant once the other variables were controlled for. That is, the variables do not explain variations in adoption, the relationship between all of them and adoption is not strong enough to elicit influence. This implies that only, age, marital status, income generated from cassava, awareness of the benefits and perception of respondents about the technology were the determinants strong enough to influence the adoption of biofortified cassava. The differences in the influence is presented on the Exp (B) column which represents the odd ratio for the individual variable. For instance, with sex, male was denoted as 1, while female was the reference sex. This means that a male is 1.271 times likely to adopt than a female having allowed for other variables in the equation. The coefficients for the model are contained in the B column. A negative value means that the odds of adoption decreases. The age coefficient is negative but statistically significantly. Exp(B) for age is 0.946, which means for each year difference of reduction in age, the farmer is 0.945 times more likely to adopt the technology having allowed for other variables in the equation in the model. The model also predicts that the odds of adoption are 2.509 higher for those aware of the benefits of the technology than for those who are not. In addition, the odds of adoption for positive perception is 1.234 higher than for those with negative perception. The income

coefficient is statistically significant, while Exp(B) for income is 1.00 which means that with each unit increase in income, the farmer is 1.00 times more likely to adopt having allowed for other variables in the model.

Similar empirical studies on adoption found out that gender, marital status and membership of farmers' organisations were the major determinants [14]. It was affirmed that access to extension agents and media were the major determinants of adoption of vitamin A biofortified cassava variety [1]. Furthermore, it was discovered that age, farm size, cosmopoliteness, participations in field day and training, distance from house, contact with extension agents, market distance and income were the major determinants of adoption [11]. While using logit and transformed logit regression, it was revealed that location, knowledge on value addition and nutritional benefits awareness, and availability of vines were the key factors for the adoption of orange flesh sweet potatoes varieties [9].

From Table 2 below, the estimated model is:

$\text{Logit(Adoption)} = -15.416 - 0.055X_{age} + 1.980_{\text{marital status}} + 0.920_{\text{awareness}} + 0.210_{\text{perception}} + 0.00_{\text{cassava income}}$

Table 2. Results of Binary Logistic Regression showing the Determinants of Adoption of Biofortified Cassava

Variables in the equation						
Variable	B	S.E	Wald	Df	Sig.	Exp(β)
Age	-0.055	0.027	4.095	1	0.043*	0.946
Sex	0.240	0.678	0.125	1	0.724	1.271
Formal Education	0.036	1.011	0.001	1	0.971	1.037
Farm size	-0.549	0.382	2.067	1	0.151	0.578
Marital status	1.980	1.000	3.921	1	0.048*	7.244
Cosmopoliteness	-0.012	0.105	0.013	1	0.908	0.988
Awareness	0.920	0.196	22.073	1	0.000*	2.509
Perception	0.210	0.040	27.268	1	0.000*	1.234
Income from cassava	0.000	0.000	5.993	1	0.014*	1.000
Religion (Christianity)	-1.873	2.568	0.532	1	0.466	0.154
Religion (Islam)	-1.440	2.586	0.310	1	0.578	0.237
Primary occupation	-0.375	0.768	0.238	1	0.626	0.688
Group membership	-4.33	0.871	0.247	1	0.619	0.648
Years of experience	0.022	0.031	0.505	1	0.477	1.022
Extension visit	1.158	0.864	1.797	1	0.180	3.184
Constant	-15.416	4.204	13.445	1	0.000	0.000

Source: Data Analysis, 2019.

Number of Observations = 396; LR, $\chi 2$ (16) = 408.873; -2Log likelihood = 87.341; Cox & Snell R^2 = 0.651 and Nagelkerke R^2 = 0.903. *Statistically significant at 5%

CONCLUSIONS

This study examined the determinants of adoption of biofortified cassava using a binary logistic regression model. The study revealed that increase in awareness of the benefits of biofortified cassava, positive perception of the respondents about biofortified cassava, increase in income generated from cassava, marital status with increase in the number of people with spouse together, and a decrease in age were the strong determinants of adoption of biofortified cassava in the study area.

It is therefore recommended that increase in awareness, income, and positive perception and younger farmers should be targeted when channeling a course for adoption of a new technology.

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OPTIMIZATION OF SOME PARAMETERS FOR ORNAMENTAL PLANTS PRODUCTION IN OFF-SEASON

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Abstract

The present study evaluated the behaviour of three ornamental species through flowers, in off-season cultivation conditions, in order to optimize production parameters. The total time of flowering (Ttf) was described, for each species, by mathematical models, in relation to the temperature and plants height. The biological material was represented by the species: Lathyrus odoratus L.; Antirrhinum majus L., and Matthiola incana (L.) W.T. Aiton., respectively. The variation of the plant height, in the studied ornamental species, in relation to the temperature (T), was described by polynomial equations of degree 3, in safety statistical conditions (R^2=0.975 for Lathyrus; R^2=0.987 for Antirrhinum, and R^2=0.971 for Matthiola, respectively). In relation to the biological specificity and the behavior in the off-season, the three species had different values for the total time of flowering (Ttf); Ttf = 19 days for Lathyrus; Ttf=166 days for Antirrhinum, and Ttf=210 days for Matthiola. Multiple regression analysis led to the obtaining of Ttf estimation models, depending on the temperature (T, °C) and the height of the plants (H, cm), in statistical safety conditions. The Wolfram Alpha software facilitated the obtaining of 3D and isoquant graphic distribution models of Ttf, according to T (°C) and H (cm), for each species studied. The optimal values for H and T were determined, in order to obtain the best total flowering time, in off-season conditions, values that can be ensured by the cultivation technology of the studied species.

Key words: *Antirrhinum, Lathyrus, Matthiola, models, total time of flowering*

INTRODUCTION

Ornamental flowering plants are very numerous and are represented by various species and genotypes, in relation to taxonomic criteria. They are grown for decorative interest, rather than for other purposes.

They are annual plants, biennial or perennial, herbaceous, in the form of shrubs, or trees, of indoor or outdoor [7]. Ornamental plants have a very varied origin, in different centers and areas around the world, depending on the origin of the framing species [7].

Three ornamental species were analyzed in the present study, in out-season conditions: *Lathyrus odoratus* L., *Antirrhinum majus* L., and *Matthiola incana* (L.) W.T. Aiton, respectively.

Lathyrus odoratus L. is an ornamental plant of the genus Lathyrus, a genus that includes about 160 species. Some species are of economic importance and are grown for food resources, as fodder or for ornamental purposes [38], [39], [45].

Although various species of *Lathyrus* have been cultivated since ancient times, cultivation as an ornamental plant is associated with Sicily, England and the Netherlands, around 1699.

These species quickly became cultivated as ornamental plants for smell and various decorative ornaments [29]. Some studies have evaluated the potential of the *Lathyrus* gene pool [38]. The propagation of *Lathyrus odoratus* L. species has been approached both by classical and *in vitro* methods [27].

Antirrhinum majus L. is an ornamental species, and belongs to the genus *Antirrhinum*, Family *Plantaginaceae* [28], [41]. *Antirrhinum majus* has a flower that expresses beauty through specific shape and colors [16]. It is an annual herbaceous plant that predominates in the Mediterranean region.

Antirrhinum majus is widely used as an ornamental plant, and is a model species, extensively studied in genetics [24].

Antirrhinum majus has been extensively studied in relation to genome structure, genetic diversity and evolution [42], [41], [21]. The behavior of some F1 hybrids was studied in relation to post-harvest flowering attributes [18].

Various studies have analyzed *Antirrhinum majus* in relation to seed germination, plant growth and flowering [2]. The flowering and post-harvest performance of the cut flowers were analyzed, in relation to different growing conditions (e.g. temperature) and ethylene treatments [5]. *Antirrhinum majus* has also been studied in relation to flowering and flower pattern, from the perspective of evolution and development [15].

Matthiola incana (L.) W.T. Aiton. belongs to the Brassicaceae family and is frequently cultivated as an ornamental plant, in large areas, in different parts of the world [11], [46].

In some areas (Bolivia, Ecuador, India, Iran, Italy), it is also used as a medicinal plant in traditional medicine and treatments [43]. *Matthiola incana* L. is also of interest for human nutrition, in some areas being eaten flowers (as vegetables in the form of garnishes, desserts, or for tea), pods (freshly cooked) [33], [19], [43].

It is cultivated for ornamental purposes, but is also important for the medical field due to some principles and bioactive compounds [43]. Some studies have evaluated micro propagation in *Matthiola incana* L. [1], [20].

Vegetative growth parameters such as stem elongation, plant height, number of branches, fresh and dry weight of *Matthiola incana* were studied in relation to growth biostimulants [14], [22].

Studies on the influence of foliar fertilization in *Matthiola incana* L., evaluated the behavior of cut flowers [40], in terms of leaf number, leaf area, chlorophyll content, position and size of flowers.

Morphophenological variation of cut flowers and meiotic behaviour were studied at *Matthiola incana* L. [17].

The present study evaluated the behaviour of three ornamental species through flowers, in out-seasons cultivation conditions, and described, by mathematical models, the duration of flowering in relation to some ecological growth parameters and plants physiological indices.

MATERIALS AND METHODS

The aim of the study was to analyze the behavior of three species of ornamental plants through flowers, in off-season, in order to optimize some production parameters in relation to flowering time.

The biological material was represented by the species: *Lathyrus odoratus* L. (Lo); *Antirrhinum majus* L. (Am), and *Matthiola incana* (L.) W.T. Aiton (Mi), respectively; Lo, Am and Mi, are abbreviations used in the article for the species studied.

The species studied are annual, and to obtain flowers in the off-season, they were sown in the third decade of September, in a protected conditions (greenhouse).

After emergence, during the plant growth period, 12 series of measurements were made, at different time intervals, between December 1 and March 23, and the plants height (H, cm) was evaluated until the growth stabilized. Associated with each measurement of plant height, the temperature in the protected area was also recorded (T, °C).

The beginning of flowering (Bf) and end of flowering (Ef) were recorded for each species. The interval between Bf and Ef represented total time of flowering (Ttf) in days, for each of the studied species.

The interdependence relationship between Ttf and plant height (H, cm), respectively temperature (T, °C) of the growing period was evaluated.

The experimental data were analyzed to evaluate the statistical safety, the presence of variance (ANOVA test), the level of correlations and interdependence between the studied parameters. PAST software [13], and Wolfram Alpha software [47] were used for data analysis.

RESULTS AND DISCUSSIONS

The three species of ornamental plants, *Lathyrus odoratus* L., *Antirrhinum majus* L., and *Matthiola incana* (L.) W.T.Aiton,

respectively, have been studied in relation to growth and flowering in off-season conditions.

For this, seedlings were produced by sowing them in conditions of protected space, respectively in the greenhouse. This ensured the germination and growth of plants, in protected environment conditions, to obtain flowers in the off-season.

Plant growth was analyzed in relation to temperature (T, °C). The height of the plants in dynamics was determined between December 1 and March 23, during 12 moments of determination, and the values are presented in Table 1.

Table 1. Values of plant height in the studied species, in relation to the time period and temperature

Measured period	Temperature (T)	Plant height (H)		
		Lo	Am	Mi
	(°C)	(cm)		
1 XII	20.1	30.30	23.50	12.10
16 XII	21.2	34.30	25.60	15.10
8 I	22.6	37.20	27.60	17.70
15 I	23.2	40.40	29.50	19.70
22 I	23.5	45.90	31.00	22.70
5 II	23.8	50.50	33.50	25.30
19 II	24.2	53.20	35.50	28.80
26 II	25.3	57.30	40.50	30.80
2 III	25.7	60.40	42.50	35.30
9 III	25.4	63.50	44.10	38.80
16 III	26.4	66.90	46.20	40.80
23 III	27.2	70.10	50.20	46.80
SE		±3.84	±2.53	±3.17

Lo - *Lathyrus odoratus* L.; Am - *Antirrhinum majus* L.
Mi - *Matthiola incana* (L.) W.T. Aiton
Source: original data, obtained under the experimental conditions.

The graphical distribution of plant height, in the three studied species, with the variation interval and the standard errors, is shown in Figure 1.

The variation of plant height in the species *Lathyrus odoratus* L., in relation to the temperature, during the studied vegetation period, was described by a polynomial model of degree 3, equation (1), in statistical safety conditions, according to R^2=0.975, p<<0.001, F=105.52. The graphical distribution is shown in Figure 2.

$$H_{Lo} = -0.1868\,T^3 + 13.54\,T^2 - 319\,T + 2{,}491 \quad \text{..... (1)}$$

where: H_{Lo} - *Lathyrus odoratus* plants hight (cm); T – temperature (°C)

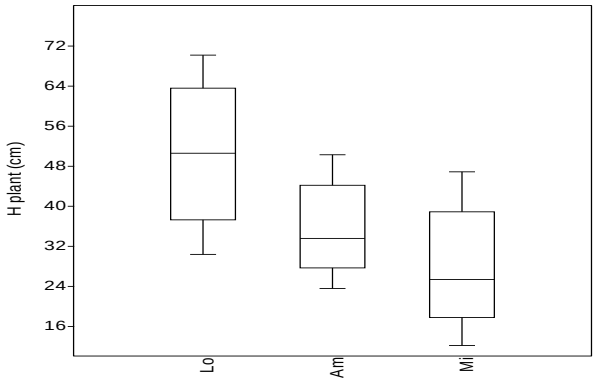

Fig. 1. Graphical distribution of plant height, with variation range and standard error
Source: original graph based on experimental data.

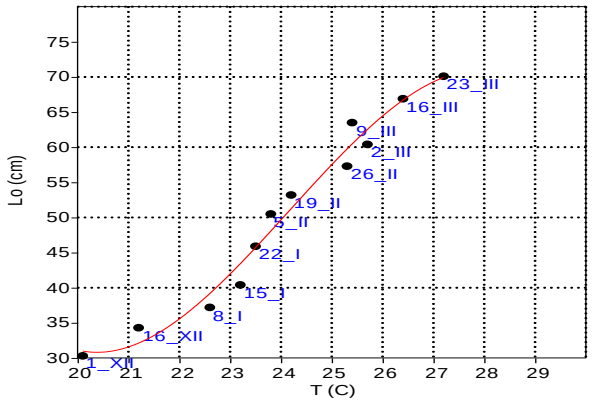

Fig. 2. Graphic distribution of plant height in *Lathyrus odoratus* L., as s function of T (°C)
Source: original graph based on experimental data.

In the case of *Antirrhinum majus* L., the variation of plant height, in relation to the average temperature (T), recorded during the study period, was described by a polynomial model of degree 3, equation (2), in statistical safety conditions according to R^2=0.987, p<<0.001, F=198.16.

The graphical distribution is presented in Figure 3.

$$H_{Am} = -0.09542\,T^3 + 7.138\,T^2 - 172\,T + 1{,}385 \quad \text{..... (2)}$$

where: H_{Am} - *Antirrhinum majus* plants hight (cm); T – temperature (°C)

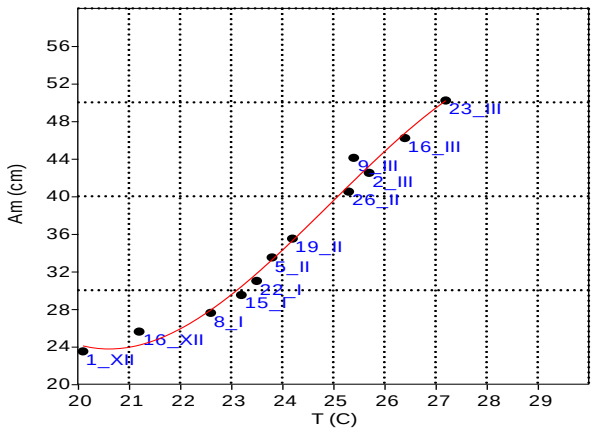

Fig. 3. Graphic distribution of plant height in *Antirrhinum majus* L., in relation to T (°C)
Source: original graph based on experimental data.

Plant height variation in the species *Matthiola incana* (L.) W.T. Aiton, in relation to the average temperature (T), during the vegetation period, was described by a polynomial model of degree 3, equation (3), in statistical safety conditions, according to R^2=0.971, p<<0.001, F=88.7. The graphical distribution is presented in Figure 4.

$$H_{Mi} = -0.06338\,T^3 + 4.951\,T^2 - 122.3T + 984.3 \quad \text{..... (3)}$$

where: H_{Mi} - *Matthiola incana* plants hight (cm); T – temperature (°C)

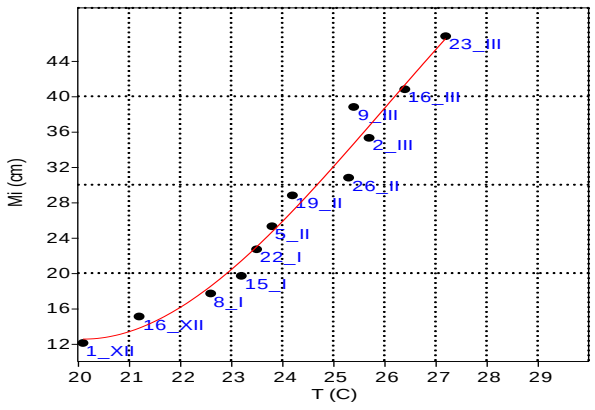

Fig. 4. Graphic distribution of plant height in *Matthiola incana* (L.) W.T. Aiton, depending on T (°C)
Source: original graph based on experimental data.

The three species studied had a different flowering period. *Lathyrus odoratus* L. had the beginning of flowering (Bf) on February 14, and end of flowering (Ef) on March 5, with a total time of flowering Ttf = 19 days. *Antirrhinum majus* L. had the beginning of flowering (Bf) on April 20, and the end of flowering (Ef) on October 3, with a total time of flowering Ttf = 166 days. *Matthiola incana* (L) W.T.Aiton had the beginning of flowering (Bf) on March 2, and the end of flowering (Ef) on September 28, with a total time of flowering Ttf = 210 days. The graphical distribution of Ttf, in the three studied species, is presented in Figure 5.

The variation of the total time of flowering (Ttf) in relation to the temperature (T, °C) and to the height of the plants (H) recorded during the study period, for each species was analyzed.

For the species *Lathyrus odoratus* L. total time of flowering (Ttf) as a function of temperature (T, °C) and plant height (H_{Lo}, cm) was described by equation (4), in statistical safety conditions (R^2=0.998, p<<0.001), with the graphic distribution in Figures 6 and 7.

Based on ANOVA test data, the statistical safety p parameter had values p≤0.001 for all terms of equation (4). 4

Under these conditions, for the species *Lathyrus odoratus* L. the optimal values for x and y in relation to Ttf_{Lo} were calculated and the values were found: x_{opt}=24.86 °C (T), and y_{opt}=56.74 cm (H_{Lo}).

$$Ttf_{Lo} = ax^2 + by^2 + cx + dy + exy + f \quad \text{..... (4)}$$

where:

Ttf_{Lo} – total time of flowering, *Lathyrus odoratus* specie;

x – T (°C), y – H_{Lo} (cm);

a, b, c, d, e, f - the equation (4) coefficients;

a=-0.0690423915208798;
b=-0.00137306729486659;
c=2.30309937489746;
d= -0.339417886897436;
e=0.0199181927841958;
f=0.

The values obtained showed that in off-season growing conditions for the optimization of Ttf in the species *Lathyrus odoratus* L., control of plant temperature and height is necessary, they can be managed, and they can lead to optimizing the time of flowering.

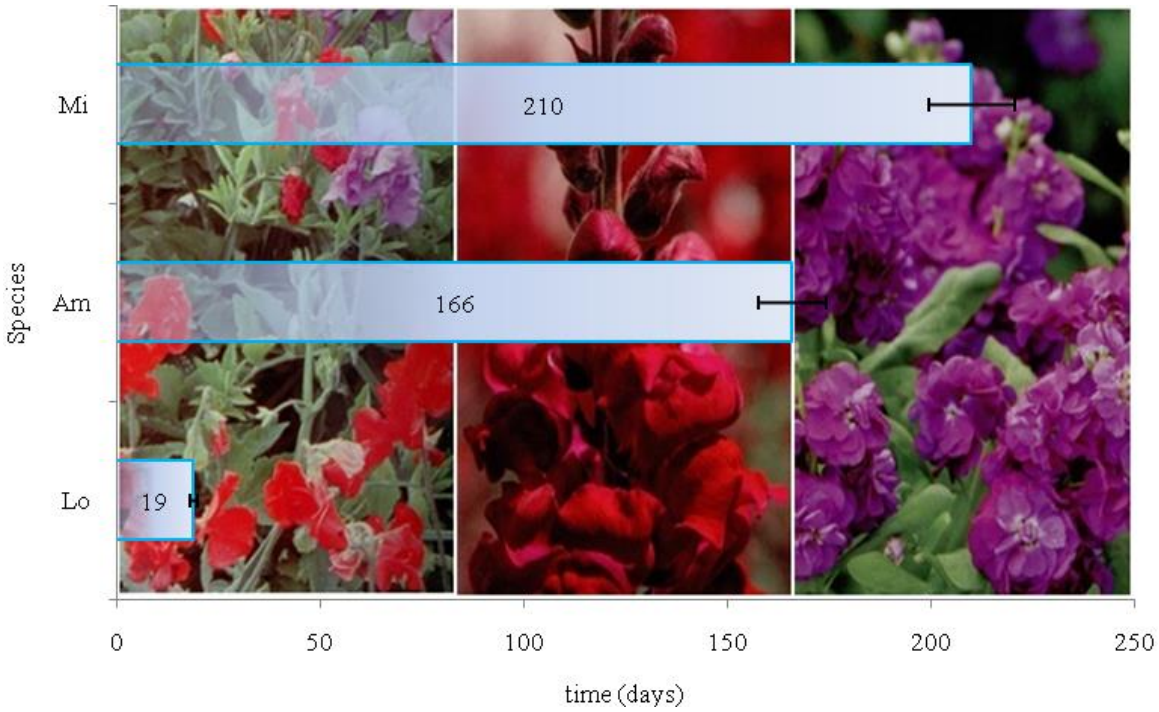

Fig. 5. Graphical representation of Ttf for the studied species; left - *Lathyrus odoratus* L.; middle - *Antirrhinum majus* L.; right - *Matthiola incana* (L.) W.T.Aiton
Source: original graph based on experimental data.

In practical conditions, for the production of flowers in off-season, for the species *Lathyrus odoratus* L., it is recommended to ensure an average growth temperature around 24.86 °C, and plant height of 56.74 cm. Temperature can be controlled in conditions of protected space, respectively greenhouse.

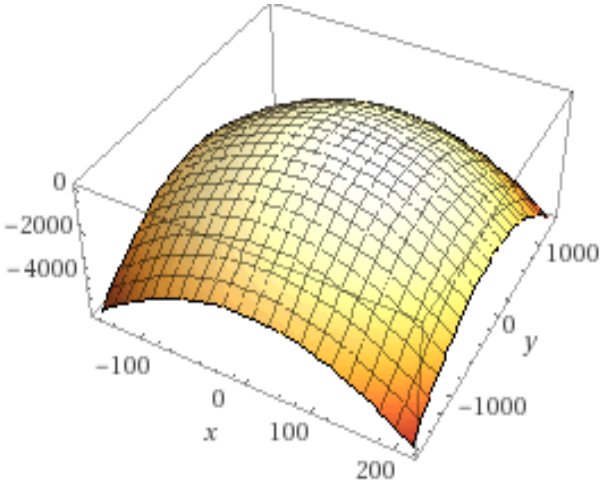

Fig. 6. 3D distribution of Ttf_{Lo} for *Lathyrus odoratus* L. specie, according to T (x-axis) and H_{Lo} (y-axis)
Source: original graph based on equation (4) data.

In order to control the vigor of the plants in terms of height, around the optimal value found in studied conditions (56.74 cm), watering and nutrient supply are recommended, in relation to the soil status, known, classical by soil analysis, or in real-time by sensors [34].

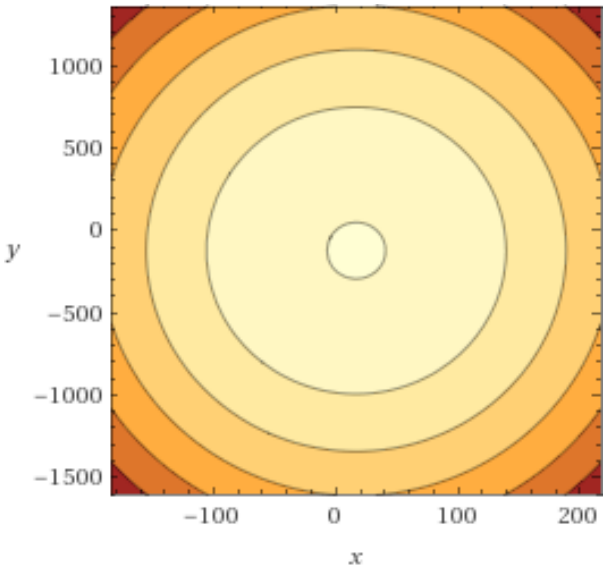

Fig. 7. Isoquants graphic distribution of Ttf_{Lo} in relation to T (x-axis) and H_{Lo} (y-axis) for *Lathyrus odoratus* L.
Source: original graph based on equation (4) data.

For the species *Antirrhinum majus* L., total time of flowering (Ttf) as function of temperature (T, °C) and plant height (H_{Am})

was described by equation (5), in statistical safety conditions (R^2=0.998, p<<0.001). The graphical distribution is shown in Figures 8 and 9.

$$Ttf_{Am} = ax^2 + by^2 + cx + dy + exy + f \quad (5)$$

where:
Ttf_{Am} – total time of flowering, *Antirrhinum majus* L. specie;
x – T (°C), y – H_{Am} (cm);
a, b, c, d, e, f - the equation (5) coefficients;
a= -0.680045822394766;
b= -0.0350370759388762;
c= 21.3384929031298;
d= -4.93089825850534;
e= 0.310930500817678;
f=0.

Based on the ANOVA test values, the statistical safety parameter p, had values p << 0.001 for all terms of equation (5).
Under these statistical safety conditions, for the species *Antirrhinum majus* L. the optimal values for x and y were calculated to ensure optimal Ttf_{Am}, and the values x_{opt}=27.65 °C (T), and y_{opt}=52.31 cm (H_{Am}) were found.
In practical conditions for producing flowers in off-season for the species *Antirrhinum majus* L. it is recommended to ensure an optimal average plant growth temperature around 27.65 °C and plant height of 52.31 cm.

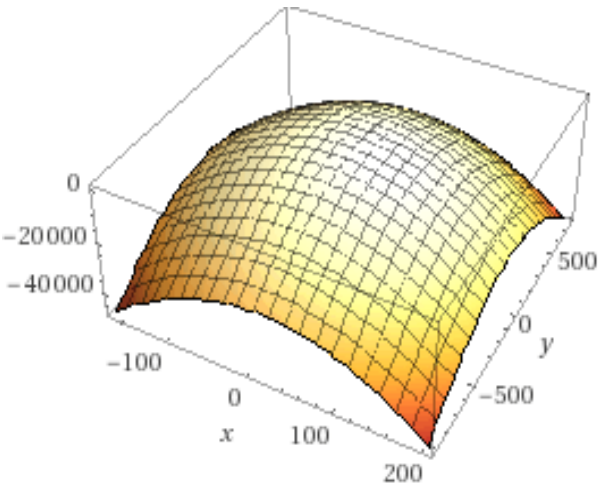

Fig. 8. 3D distribution of Ttf_{Am} for *Antirrhinum majus* L., according to T (x-axis) and H_{Am} (y-axis)
Source: Original graph obtained based on the values of the equation (5).

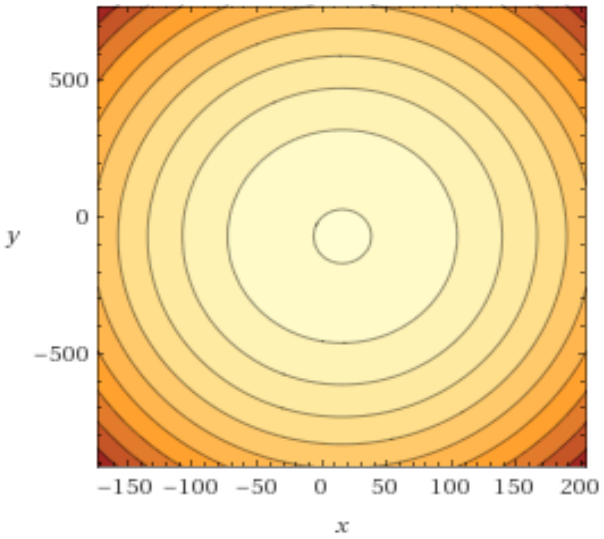

Fig. 9. Graphic distribution in the form of isoquants, of Ttf_{Am} in relation to T (x-axis) and H_{Am} (y-axes) for *Antirrhinum majus* L.
Source: original graph based on the values of the equation (5).

For the species *Matthiola incana* (L.) W.T.Aiton, total time of flowering (Ttf) as a function of temperature (T, °C) and plant height (H_{Mi}) was described by equation (6), in statistical safety conditions (R^2=0.999, p<<0.001). The graphical distribution is presented in Figures 10 and 11. Based on ANOVA test values, the statistical safety parameter p presented values p << 0.001 for all terms of equation (6).

$$Ttf_{Mi} = ax^2 + by^2 + cx + dy + exy + f \quad (6)$$

where:
Ttf_{Mi} – total time of flowering, *Matthiola incana* (L) W.T.Aiton. specie;
x – T (°C), y –H_{Mi} (cm);
a, b, c, d, e, f - the equation (6) coefficients;
a= -0.602135483536352;
b= -0.0214155544573716;
c= 22.5227850256692;
d= -4.31446898999081;
e= 0.229170367365739;
f=0.

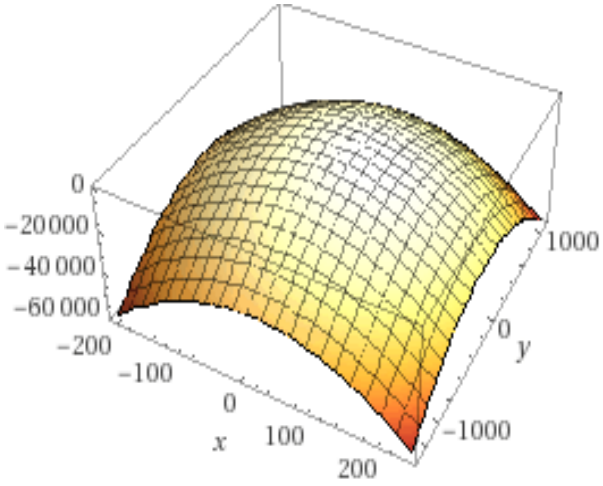

Fig. 10. 3D distribution of Ttf_{Mi} for *Matthiola incana* (L) W.T.Aiton, depending on T (x-axis) and H_{Mi} (y-axis)
Source: original graph, obtained based on the values of the equation (6).

Optimal values for x and y in *Matthiola incana* (L.) W.T.Aiton were found at x_{optMi}= 25.64 °C (T), and y_{optMi}=36.47 cm (H_{Mi}), respectively, values to ensure optimal flowering as total flowering time (Ttf).

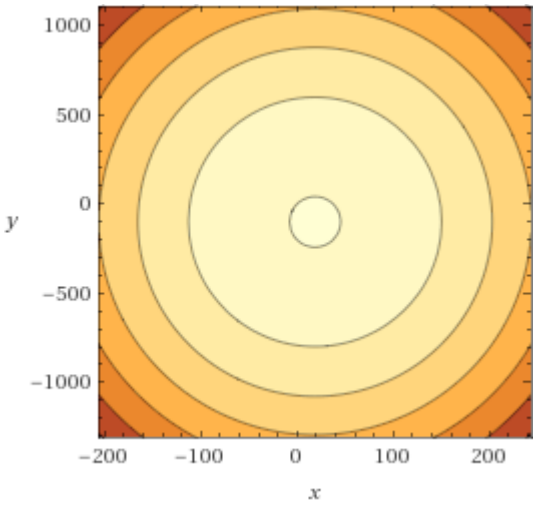

Fig. 11. Graphic distribution in the form of isoquants, of Ttf_{Mi} in relation to T (x-axis) and H_{Am} (y-axis) for *Matthiola incana* (L.) W.T.Aiton.
Source: original graph obtained based on the values of the equation (6).

In order to direct the growth and vigor of the plants, in the species *Matthiola incana*, in terms of plant height, around the optimal value found (56.74 cm) in the experimental studied conditions, and which ensured the optimal flowering time (Ttf), adequate maintenance works are recommended, by watering and fertilizing, in relation to the soil content.

A synthetic presentation of the optimal values for T (°C) and H (cm), in the case of the three ornamental species studied, in off-season conditions, is shown in Figure 12.

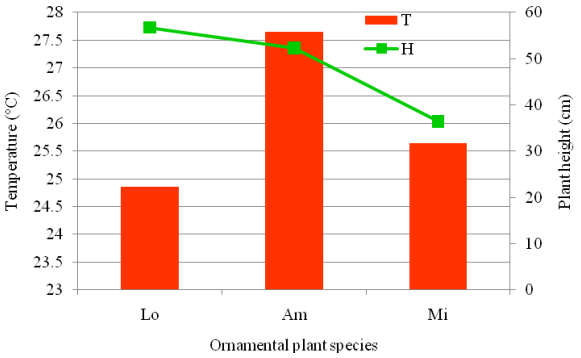

Fig. 12. Graphic representation of optimal values for T (°C) and H (cm) for ornamental plant species studied
Source: original graph obtained based on the x,y optimal values calculated

The highest temperature requirements were recorded for *Antirrhinum majus* L. species, and the smallest to the *Lathyrus odoratus* L. species. This means that they require a differentiated management of growing conditions, in terms of temperature.

In all three species studied, it is important to monitor the health of plants. Imaging tests and analyzes are very effective for early estimation of possible leaf pathogen attacks [9]. This can facilitate decisions for effective treatments.

Ornamental flowering plants have been studied in relation to flower color and influencing factors (internal and external to the plant organism), for the understanding and control of flowers for ornamental purposes and to increase their market value [10], [48]. Some studies have aimed to improve the ornamental and floral attributes of decorative plants [26].

In order to evaluate certain physiological indices at the foliar level of the plants, such as the foliar surface, as an expression of the growing conditions, non-destructive models were promoted [35], [36], or different software applications to estimate the health status of plants [8], [9].

The study of the behavior of some off-season ornamental species is important, in order to obtain ornamental plants of interest, in

relation to market and consumer demand. The product market and consumer demand are very dynamic and require ongoing studies [30], [31], [23].

Sangma et al. [37], analyzed the behavior of 8 genotypes of chrysanthemum (*Dendranthema grandiflora*) by modifying the photoperiod by coating with various materials.

Recent studies have evaluated alternative, soil-free environments for growing ornamental plants, and *Matthiola incana* L. was one of the species studied in relation to paper waste (PW), and olive-stone waste (OSW) in different combinations [6]. There are also many other artificial environments for cultivating horticultural plants, and especially ornamental ones [34]. *Matthiola* has also been studied in response to saline wastewaters with different N contents [12].

Different influencing factors for the growth, development and quality of ornamental plants through flowers were studied: soil or artificial growth media [34], water regime, light, temperatures etc. [44].

In protected areas, such as greenhouses, temperature is an important factor that influences the quality of flowers both directly and in interaction with light. Temperature influences plant growth rate, production time, and in interaction with light (lighting duration and spectrum) influences flower quality attributes, such as plant height, biomass, number of branches, number of flowers, flower size [4], [44]. Therefore, temperature is an important vegetation factor for ornamental crops and is controlled and directed in protected areas, in order to produce ornamental plants for certain events, or certain market-specific data [32], [25], [3].

The present study highlighted the importance and relationship between temperature and total time of flowering in the three species of ornamental plants studied, in off-season conditions, and was in concordance with other studies on the role and importance of temperature in the quality of ornamental species. Also, physiological indices of the plants, such as height, were analyzed in relation to the total time of flowering.

The simultaneous influence of temperature and plant height on the total time of flowering was analyzed, and optimal values for the two parameters of the production process were obtained.

CONCLUSIONS

Ornamental plant species *Lathyrus odoratus* L., *Antirrhinum majus* L., and *Matthiola incana* (L.) W.T.Aiton had specific behaviors under off-season cultivation conditions.

Plant growth was influenced by the temperature in the protected space (greenhouse), and grade 3 polynomial models described variations in plant height relative to temperature.

Total time of flowering (Ttf), as a qualitative aspect, varied in relation to the species, but the influence of growth conditions (temperature) and plant height on Ttf variation was recorded. Regression analysis facilitated the obtaining of models that described the variation of Ttf and the optimal values of T (°C) and plant height (H, cm) for an optimal period of flowering (Ttf).

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LAVINIA F - THE FIRST ROMANIAN WINTER PEA CULTIVAR CREATED AT NATIONAL AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE FUNDULEA, ROMANIA

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Abstract

Lavinia F is a winter pea (Pisum Sativum L.) cultivar created at National Agricultural Research and Development Institute Fundulea (NARDI), registered in 2020 and obtained through sexual hybridization and selected by pedigree method from Dorica/Checo hybrid population. The new entry is of aphyla type, with an early vegetation period, of 213-216 days. Is was released based on superior agronomic adaptation, winter hardiness and tolerance to harsh winter condition. The plant height ranges between 70 and 90 cm, with a good resistance to lodging, better resistance to diseases, drought and pests. The flower color is white, with spherical, smooth grains and yellow pericarp. It is a high yield variety with an improved level of quality. A good yield potential was estimated in newly developed Lavinia F cultivar 4210 kg/ha in 2018 and 4017 kg/ha in 2019, in Ludus. The Thousand Grains Weight (TGW) of the winter pea cultivar analysed during 2018-2019 varied between 204 g (Cogealac) and 235 g (Luduș) in 2018, and in 2019 between 166 g (Negresti) and 229 g (Inand). The objective of the present study was to describe a new culture in Romania, which is sowed in autumn, namely Lavinia F the new cultivar of winter pea.
The results presented in this paper show that the first cultivar of winter pea is adapted to climate conditions in Romania and will be a new challenge for farmers.

***Key words*:** *winter peas, cultivar, yield, winter hardiness*

INTRODUCTION

Pea (*Pisum sativum* L.) is the second most important food legume worldwide after common bean (*Phaseolus vulgaris* L.). Currently, Canada is one of the world's major pea producers. The increasing demand for protein-rich raw materials for animal feed or intermediary products for human nutrition have led to a greater interest in this crop as a protein source [8]. Selection for high yield, high seed protein concentration and early maturity has been extensively practiced by pea breeders to develop cultivars with superior performance [11].

Pea is an important annual legume crop grown in temperate regions for its high seed protein concentration. It leads to environmental benefits due to its capacity to acquire nitrogen via atmospheric N2 symbiotic fixation [5, 6, 7], nevertheless it is particularly sensitive to abiotic stresses. By climate change, heat stress and drought are very detrimental to the yield, especially for spring pea [1, 12]. Breeders are now developing winter pea varieties, more likely to avoid these stresses occurring at the end of the crop cycle, because they flower earlier. However, the high level of frost risk in winter could limit the extent of peas even in a warming climate.

The benefits of the autumn-sowing in such environments are a longer vegetative growth and an increased biomass production and grain yield, while the larger plants produced under these conditions are more suitable for mechanical harvesting [10]. Growth under cool conditions can result in an increase of grain yield ranging from 50 to 100 % [4, 10].

Winter peas (*Pisum sativum* L.) could be considered as an alternative. The late summer to early autumn planting, confers to winter peas all of the advantages of spring-planted peas as: a relative low water request and conventional crop management practices with existing farm equipment. In addition, their greater yields as compared with spring peas

seems to be more economic, while the late-summer planting avoid the vagaries, narrow planting window, and variable conditions that constrain spring-planted peas.

Winter pea has a greater yield potential than the spring sown pea. Regrowth or branching habit in pea has the potential to increase seed production. Earlier spring growth and flower initiation enable the pea crop to avoid heat and water stress later in summer that also improve the yield potential [2]. Plant **s**urvival as effect of drifting snow or other overwintering conditions [9] may differ across a field from a full survival in some locations to a reduced or no survival in others. Winter peas are broadly adapted to dryland production in all regions where winter wheat is grown, and the improved cold hardiness of winter peas rivals that of winter wheat. Early maturity is an essential attribute for dry area crop adaptation, especially when the majority of precipitation falls in winter [6]. The winter forage pea varieties are suitable for arid regions. The utilization of winter forage pea under a high water deficit results in higher and more stable aboveground biomass and protein yields, enhancement of the ratio between symbiotic and fertilizer nitrogen in organic farming and a more economic use of the agricultural land.

Winter peas may become a more reliable and profitable alternative for canola crop [3]. The winter peas breeding program has started at NARDI Fundulea in 2010, by using a germplasm originated from USA (Specter and Windham) and Austria, (Checo).

The aim of this work was to evaluate the yield potential and other agronomic traits of the first Romanian winter pea cultivar created at NARDI Fundulea, and registered in 2020.

MATERIALS AND METHODS

Lavinia F is the first Romanian winter pea (*Pisum sativum* L.) cultivar released at NARDI Fundulea. The new cultivar it is a *F5* line selected by the pedigree method from Dorica /Checo cross, the parental lines beeing of Romanian (Dorica) and Austrian (Checo) origins. By creating the new winter pea cultivar *Lavinia F* we have tried to combine the high TGW of Dorica (spring pea cultivar) with the good winter hardiness and earliness from Checo (winter pea).

Following the selection process, was identified a genotype with good winter hardiness, associated with high yield and a good adaptability to the climatic conditions from Romania.

Experimental results obtained in centers of the State Institute for Varieties Testing and Registration (SIVTR) during the period 2018-2019, and also those obtained at NARDI Fundulea, were accessed to characterize the new cultivar *Lavinia F*, in comparison to Nicoleta used as control variety.

The statistical analyses of data have been evaluated by ANOVA.

RESULTS AND DISCUSSIONS

Agronomic and quality traits of *Lavinia F* winter pea variety, analysed in the centres of SIVTR and NARDI Fundulea in period 2018-2019 compared to the Nicoleta control cultivar are presented in Table 1.

Table 1. Agronomic and quality characteristics of *Lavinia F* cultivar in comparison with Nicoleta control cultivar

Characteristics	Lavinia F	Nicoleta
Plant: anthocyanin pigmentation	Absent	Absent
Plant: height (cm)	70-90	60-75
Leaf: colour	green	green
Leaf: leaflets	Absent	Absent
Leaf stipule: size	Medium	Medium
Plant: time of beginnig of flowering	early	early
Flower: colour	White	White
Pod: lenght	medium-long	medium-long
Pod: colour	green	green
Seed: shape	spherical	Spherical
Seed: ground colour of testa	Yellow	Yellow
Seed: hilum colour	Yellow	Yellow
Vegetation period (days)	213-216	215-219
Protein content (%)	22.1% -23 %	23.8 %-24.5 %
Winter hardiness (1-9)	1	4
Resistance to lodging (1-9)	1	3
Resistance to Erisiphe pisi (1-9)	1	1
Resistance to Ascochyta pisi (1-9)	2	2

Source: according to the questionnaire The International Union of the Protection of new Varieties of Plants (UPOV).

Lavinia F, an aphyla type, with an early vegetation period, of 213-216 days, is the first winter pea cultivar created at NARDI Fundulea and registered in 2020.

The plant height ranges between 70 and 90 cm, with a good winter hardiness and lodging, better resistance to diseases, drought and pests. The flower color is white, with spherical, smooth grains and yellow pericarp.

In the most yield trials carried out between 2018 and 2019 in the SIVTR network, characterized by a high variability of environmental conditions, yield performances of *Lavinia F* overcome those achieved by the *Nicoleta* (Table 2).

The yield of *Lavinia F* cultivar varied between 1,681 kg/ha at Cogealac and 4,210 kg/ha in Luduş, in 2018. On average, over the two years of testing, the winter pea cultivar *Lavinia F* recorded yields which ranged between 2,743 kg/ha and 4,114 kg/ha. With an average yield increase between 22% and 59%.

Table 2. Yield of the winter peas cultivar from NARDI Fundulea tested in SIVTR network during 2018-2019

Test center	**Cultivar**	**Yield**				**Average (2018-2019)**	
		2018		2019			
		kg/ha	%	kg/ha	%	kg/ha	%
Negreşti	Nicoleta (control)	2,913	100	1,777	100	2,345	100
	Lavinia F	4,156	143	2,099	118	3,128	133
Luduş	Nicoleta (control)	4,041	100	2,656	100	3,349	100
	Lavinia F	4,210	104	4,017	151	4,114	122
Inand	Nicoleta (control)	1,682	100	2,388	100	2,035	100
	Lavinia F	2,843	169	2,868	120	2,856	140
Cogealac	Nicoleta (control)	269	100	3,186	100	1,728	100
	Lavinia F	1,681	625	3,804	119	2,743	159
Average for all centers	Nicoleta (control)	2,226	100	2,502	100	2,364	100
	Lavinia F	3,223	145	3,197	129	3,210	136
	LSD 5%	3,904	-	2,051	-	1,815	-
	1%	5,549		2,916		2,580	

Source: the results obtained in centers of the SIVTR.

Considering the mean values of yield obtained in 2018 and 2019, at NARDI Fundulea, for the both cultivars, yields realised by the new winter pea cultivar *Lavinia F,* in comparison to the control variety were significantly higher. (Table 3).

Table 3. Average yield of cultivar Lavinia F compared to the cultivar Nicoleta, during two years of testing at NARDI Fundulea

Test center	**Cultivar**	**Yield**		**Average (2018-2019)**	
		2018	2019		
		kg/ha	kg/ha	kg/ha	%
Fundulea	Nicoleta (control)	1,925	3,133	2,529	100
	Lavinia F	4,156	2,099	3,128	151

Source: the results obtained at NARDI Fundulea.

The vegetation period of the winter peas cultivars tested in the SIVTR network varied according to the local and the year climatic conditions.

Thus, in 2018, the vegetation period of *Lavinia F* varied between 199 days in Luduş and 240 days in Negreşti, and in 2019 between 149 in Cogealac and 243 days in Negreşti (Table 4).

On average over the two experimental years, the vegetation period of cultivar *Lavinia* F varied between 185 days and 242 days.

Table 4. The vegetation period of the winter peas cultivar from NARDI Fundulea tested in SIVTR network during 2018-2019

Test center	Cultivar	Vegetation period (days)		Average (2018-2019)
		2018	2019	
Negrești	Nicoleta (control)	241	248	245
	Lavinia F	240	243	242
Luduș	Nicoleta (control)	212	240	226
	Lavinia F	199	235	217
Inand	Nicoleta (control)	204	222	213
	Lavinia F	204	223	214
Cogealac	Nicoleta (control)	220	149	185
	Lavinia F	220	149	185
Average for all centers	Nicoleta (control)	219	215	217
	Lavinia F	216	213	215
LSD 5%		47	120	66
1 %		67	171	94

Source: the results obtained in centers of the SIVTR.

The TGW of the winter pea cultivar analysed in the SIVTR network during 2018-2019 varied between 204 g (Cogealac) and 235 g (Luduș) in 2018, and in 2019 between 166 g (Negresti) and 229 g (Inand) (Table 5).

Table 5. TGW of the winter peas cultivar from NARDI Fundulea tested in SIVTR network during 2018-2019

Test center	Cultivar	TKW (g)		Average (2018-2019)
		2018	2019	
Negrești	Nicoleta (control)	255	171	213
	Lavinia F	220	166	193
Luduș	Nicoleta (control)	230	145	188
	Lavinia F	235	207	221
Inand	Nicoleta (control)	246	232	239
	Lavinia F	223	229	226
Cogealac	Nicoleta (control)	185	212	199
	Lavinia F	204	210	207
Average for all centers	Nicoleta (control)	229	190	210
	Lavinia F	220	203	212
LSD 5%		65	91	54
1 %		92	130	77

Source: the results obtained in centers of the SIVTR.

On average, over the two years of testing, the TGW and the test weigh of the cultivar *Lavinia F* is approximately equal to those of the cultivar Nicoleta (control) (Table 6).

Table 6. The test weigh of the winter peas cultivar from NARDI Fundulea tested in SIVTR network during 2018-2019

Test center	Cultivar	MH(Kg)		Average (2018-2019)
		2018	2019	
Negrești	Nicoleta (control)	76	76	76
	Lavinia F	79	76	78
Luduș	Nicoleta (control)	73	81	77
	Lavinia F	75	81	78
Inand	Nicoleta (control)	75	80	78
	Lavinia F	75	79	77
Cogealac	Nicoleta (control)	80	84	82
	Lavinia F	79	83	81
Average for all centers	Nicoleta (control)	76	80	78
	Lavinia F	77	80	79
LSD 5%		7.2	8.6	6
1 %		10	12	8.7

Source: the results obtained in centers of the SIVTR.

CONCLUSIONS

Lavinia F is the first winter pea (*Pisum sativum* L.) cultivar released at NARDI Fundulea, in 2020, characterized by desirable agronomic traits as superior adaptation ton crop conditions, earliness, a good level of winter hardiness associated to a higher yield potential.

Experimental trials carried on in four centers of the SIVTR network during 2018-2019, revealed the very high yield potential in *Lavinia F* raising to 3210 kg /ha on average, exceeding the yield of control (cultivar Nicoleta) with a percentage of 36%. In conditions from NARDI Fundulea the results for this parameter were even higher, respectively of 51 %. The quality in *Lavinia F* cultivar was found as beeing inferior when compared to this of the control, suggesting a negative correlation between the both traits, that yield and protein content. The improved desirable agronomic traits of the Romanian winter pea cultivar *Lavinia F*, are suited for an efficient field croping in the farming system.

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CAUSALITY AND VAR ANALYSIS OF TURKISH MILK PRODUCER PRICE

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Abstract

In this study, there are many influential indicators on the milk producer price which are 4 separate functions: milk production, maize price, clover prices and straw price. This study explores the application of the VAR analysis approach to time series data of producer milk prices covering the period from January 1st, 2010 to December 31st, 2019. The data were taken from the database of the Turkish Statistical Institute. One-way causality relation at 5% level of significance towards milk producer price denoted clover price were detected. In this case, it is possible to say that there is a link between milk producer price and clover price. VAR analysis results show milk production, maize price, clover price and straw price effects on milk producer price.

***Key words*:** *milk producer price, milk production, maize price, clover price, straw price, granger causality, var analysis*

INTRODUCTION

Raw milk prices in Turkey determined in accordance with the principles of the "Regulation on Purchase and Sale in Raw Contractual Procedure" published in the Official Gazette dated 16 April 2015 and numbered 29328 [16]. Milk price factors such as market conditions, seasonal fluctuations in milk quantity, supply and demand balance, milk quality and geographical location are effective. According to quality and parity, the raw milk reference price is determined by bargaining between industrialists and producer representatives. The National Milk Council brings together the representatives of producers and industrialists and later announces the "the recommended price". Milk price is mostly determined via the supply and demand balance.

Agricultural prices are compiled for the purpose of making calculations about the changes in economic welfare and purchasing power of producers who are engaged in agricultural activities. The raw milk/feed parity shows how much feed a producer will buy with the income from the sale of 1 liter/1 kg of raw milk. And, the generally accepted parity is 1.5. However, in Turkey, the raw milk/feed parity has remained below 1.5 for many years and the average raw milk/feed parity for 2019 has been calculated as 1.22 [15]. The milk production in Turkey was realized 9,506,028 metric tones in 2019. Comparing the years 2018 and 2019, the production of milk decreased by 5.26%. Producer price milk ratio was up to 20.70% [22].

Especially, households' consumption for milk as unpacked milk from buying producers. The demand of milk relies on various factors for example economic factors, socio-economic and cultural factors. Because, buying milk from producers is cheaper than market price. For this reason, consumers prefer buying milk directly from producers. Producer prices are crucial elements of microeconomic indicators because agricultural establishments in an economy follow these indicators. The fluctuations in the milk price have a significant effect not only on producers but also on the food industry and consumers. Government managements can play an important role in trying to maintain stability in milk production and prices by implementing suitable policies. Thus, an exact and accurate forecasting strategy for milk prices and production by a forecasting technique is

necessary to assist the government's decision-making for subsequent months. The relations between the food demand, one of the household expenditure items which occupies an important place in human life, (bread and cereals; meat, fish and poultry; oils, milk, dairy products, and egg; fresh, dry, frozen vegetables and fruits; fast food and various food; alcoholic and non-alcoholic beverages) and the factors affecting these expenditure items will be examined in econometric terms [20].

This study applies time series analysis to assess the trend of the Republic of Turkey's milk prices on a monthly basis over the period from 2010 to 2019. The data was gained from The Turkish Statistical Office's (Turkstat) database. The trend analysis of milk prices over time is crucial due to the profound influence this indicator has on agricultural commodity prices. Granger causality and the VAR analysis were used as the time series method to analyze the trend of the producer milk price variables during the study period. The paper examined the milk producer price and the other variables effecting on milk prices. We used in here VAR model to determine between the relationship milk price and the other variables. This method calculated the impulse response functions. The EViews 10 Econometrics package was used for the estimation of the research analysis.

Time series data analysis has been an increasingly more important subject in various research areas such as economics, agricultural economics, econometrics, statistics, business, psychology, engineering, social sciences and etc.

The direct impact of the exchange rate on agricultural prices and/ or exports is quite significant [3] [4] [1].

They intend to find further empirical evidence to investigate whether the dairy cooperatives' oligopoly power that is implicit in the dynamic pricing games exists and how it influences the beverage milk margins from 1983 to 2012 [2].

Researchers investigate the implications of hedonic pricing for price dynamics of different commodities [5]. They studied the U.S. fluid milk market has been experiencing two trends in the recent decade: the fast growth of private label milk and organic milk. They find that socio-demographic factors still play important roles in household choice of milk types, and fluid milk, as a whole, is an inferior good [6]. They studied an evolution of the margin risks was performed using the relationship between excess price yield, prices of margin and conditional volatility of milk [9]. Dynamic relationships among weekly retail prices for milk from three regions of Kyrgyzstan are studied in an error correction framework. These results are related to the levels of state-run milk marketing facilities versus private-run milk marketing facilities and surplus versus deficit milk production in each region [12]. Although it isn't exactly the same, causality is closely related term to the idea of cause-and-effect [13]. They stressed that Gross Domestic Product and Energy Consumption [14]. Researchers investigate the nonlinear adjustment between consumer and producer prices in the Greek milk sector using a threshold error correction autoregressive model [17]. He mentioned that the Holt-Winters methods can be used for forecasting time series data that have both trend and seasonal patterns [19]. They used the VAR models to examine the relationships in agricultural prices [21]. He emphasized the granger-causality can also be tested in a VAR framework, in this case the multivariate model is extended in order to test for the simultaneity of all included variables [10].

The first part of this paper provides an overview of the literature about milk price trends and their importance for Turkish agricultural sector. The second and third parts give the research methodology used in the paper. The author emphasizes the Granger causality and VAR analysis. Finally, the last part contains the empirical results of the research.

MATERIALS AND METHODS

Data

In this study, the data set contains 120 monthly time series observations for the period 2010 through 2019. The data could be

viewed as being in five different variables: Milk producer prices, milk production, maize price, clover price, straw price. All of these data were obtained from Turkish Statistical Institute [22].

Econometric model

In order to implementation of the Granger causality analysis, all of the series should be stationary. The unit root test is using the determine the degree of stationary. Unit root tests in the analyzes are Dickey Fuller test (DF), Augmented Dickey Fuller test (ADF) and Philips-Perron test (PP). ADF was used to test the stability of the variables in this research. The Akaike Information Criteria (AIC) was used to determine the optimal number of delays.

The mutual relationships between variables in VAR modelling are revealed by Granger Causality tests. In addition, Granger Causality tests, which show the causality relationships between variables, are tests in VAR form and are very sensitive to the length of the lag. The Granger Causality test is applied to stationary series at the appropriate delay level. For the VAR model in which the variables included in the study are included in the system as binary at the level where they are stationary, the length of the lag was decided according to the AIC information criterion. The results obtained for each variable pair are listed. After deciding on the appropriate lag length, the causality test was applied and the results were presented. He proposed a time series data-based approach in order to determine causality [11].

Vector Auto Regressive (VAR) model is defined as a dynamic simultaneous equations system in literature. All variables such as dependent, independent and endogenous variables are determined at first and determined variables effect each other in the system [18].

Software program

During the model estimation and analysis were made by Eviews 10 Econometrics package program.

RESULTS AND DISCUSSIONS

The lag lengths for all estimated models in this study were selected by Augmented Dickey-Fuller [7] [8]. The results of the lag length determination are given below in the following results.

Unit Root Tests Results

Maize prices series

The graph of the corn price variable over time is obtained as follows. According to the figure, the series contains a stochastic trend. In order to provide variance stability and linearity, the logarithm of the series is taken first. Although the general trend of the logarithmic maize price variable over time has not changed, it can be said that the variance decreases due to the smaller numbers as a result of logarithmic transformation.

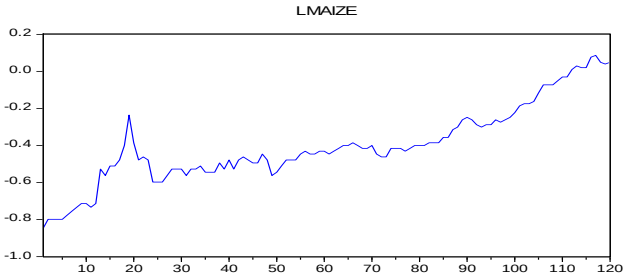

Fig. 1. The monthly maize prices (kg/TL) from January 2010 to December 2019

Source: Author's own calculation.

The number of delays suitable for the ADF Unit Root test to be applied to the logarithmic maize price series was found to be k = 12 according to the AIC information criteria. At this lag level, according to the ADF unit root test, the lmaize variable is not stationary. When looked at the 1st rank difference level, k = 12 was found and when the 1st order difference is taken, it is accepted that the series became stationary.

Table 1. Unit root test for maize price series

Level of significance	Intercept and trend $t_{\hat{\delta}}$ =-1.00323	Intercept and none $t_{\hat{\delta}} = -11.04886$	None $t_{\hat{\delta}}$ =10.72654
%1	-4.037668	-3.486551	-2.584707
%5	-3.448348	-2.886074	-1.943563
%10	-3.149326	-2.579931	-1.614927
DF Statistics	$t_{\hat{\delta}} < \tau_{\tau}$	$t_{\hat{\delta}} < \tau_{\mu}$	$t_{\hat{\delta}} < \tau$
Decision	H_0 Reject	H_0 Reject	H_0 Reject

Source: Author's own calculation.

Milk production series

The graphic of the milk production variable is obtained as follows. According to the figure, the series includes the stochastic trend as well as the seasonal change. Before proceeding to the ADF unit root test, the series should be seasonally adjusted. Seasonal change in the series exhibits an additive structure. Therefore, the milk production variable has been seasonally adjusted using the Additive Moving Averages method. The logarithm of the seasonally adjusted milk production variable is used. The seasonally adjusted logarithmic milk production (lmilkpro) variable with respect to time is as follows.

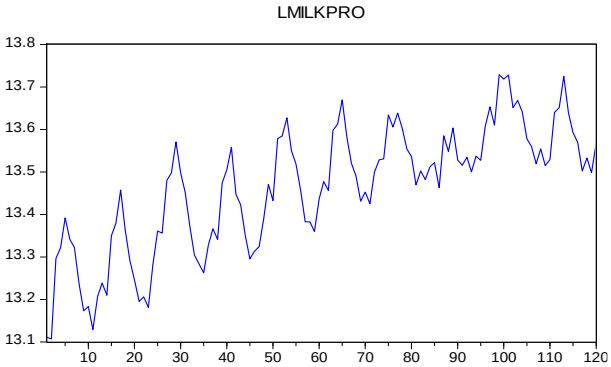

Fig. 2. The monthly milk production (tonnes) from January 2010 to December 2019
Source: Author's own calculation.

The appropriate delay number for the ADF Unit Root test to be applied to the logarithmic milk production series was found to be k = 12 according to the AIC information criteria. According to ADF unit root test at this latency level, the variable lmilkpro is not static. When looked at the 1st rank difference level, k = 12 was found and when the 1st order difference is taken, it is accepted that the series became stationary.

Table 2. Unit root test for milk production series

Level of significance	Intercept and trend $t_{\hat{\delta}}$ =2.708390	Intercept and none $t_{\hat{\delta}} = -2.640462$	None $t_{\hat{\delta}}$ = 2.419105
%1	-4.046072	-3.492523	-2.586753
%5	-3.452358	-2.888669	-1.943853
%10	-3.151673	-2.581313	-1.614749
DF Statistics	$t_{\hat{\delta}} < \tau_{\tau}$	$t_{\hat{\delta}} < \tau_{\mu}$	$t_{\hat{\delta}} < \tau$
Decision	H₀ Reject	H₀ Reject	H₀ Reject

Source: Author's own calculation.

Straw price series

The graph of the straw price variable over time is obtained as follows. According to the figure, the series contains a stochastic trend. In order to provide variance stability and linearity, the logarithm of the series is taken first. Although the general trend of the logarithmic straw price variable with respect to time has not changed, it can be said that the variance decreases due to the smaller numbers as a result of logarithmic transformation.

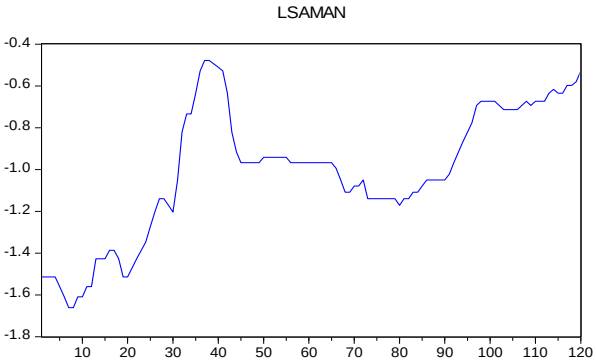

Fig. 3. The monthly straw price (kg/TL) from January 2010 to December 2019
Source: Author's own calculation.

The appropriate delay number for the ADF Unit Root test to be applied to the logarithmic straw price series was found to be k = 12 according to the AIC information criteria. At this delay level, the lstraw variable is not stationary according to the ADF unit root test. When looked at the 1st rank difference level, k = 12 was found and when the 1st order difference is taken, it is accepted that the series became stationary.

Table 3. Unit root test for straw price series

Level of significance	Intercept and trend $t_{\hat{\delta}} = -5.60000$	Intercept and none $t_{\hat{\delta}} = -5.626511$	None $t_{\hat{\delta}} = -5.672818$
%1	-4.038365	-3.487046	-2.584707
%5	-3.448681	-2.886290	-1.943563
%10	-3.149521	-2.580046	-1.614927
DF Statistics	$t_{\hat{\delta}} < \tau_{\tau}$	$t_{\hat{\delta}} < \tau_{\mu}$	$t_{\hat{\delta}} < \tau$
Decision	H₀ Reject	H₀ Reject	H₀ Reject

Source: Author's own calculation.

Clover price series

The graph of clover price variable over time is obtained as follows. According to the chart, the series contains a stochastic trend. In order to provide variance stability and linearity, the logarithm of the series is taken first. Although the general trend of the logarithmic clover price variable with respect to time has not changed, it can be said that the variance

decreases due to the smaller numbers as a result of the logarithmic transformation.
The appropriate delay number for the ADF Unit Root test to be applied to the logarithmic clover price series was found to be k = 12 according to the AIC information criteria. At this delay level, according to the ADF unit root test, the Lclover variable is not stationary.

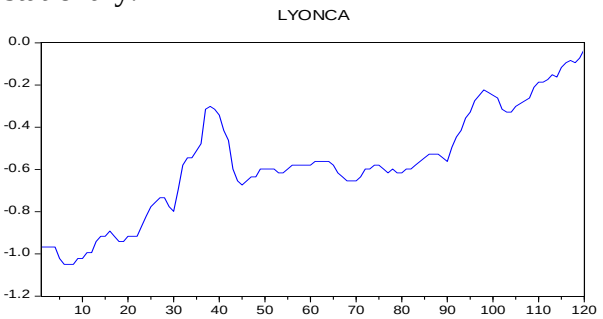

Fig. 4. The monthly clover price (kg/TL) from January 2010 to December 2019
Source: Author's own calculation.

When looked at the 1st rank difference level, k = 12 was found and when the 1st order difference is taken, it is accepted that the series became stationary.

Table 4. Unit root test for clover price series

Level of significance	Intercept and trend $t_{\hat{\delta}} = -6.44$	Intercept and none $t_{\hat{\delta}} = -6.44697$	None $t_{\hat{\delta}} = -6.232822$
%1	-4.037668	-3.486551	-2.584707
%5	-3.448348	-2.886074	-1.943563
%10	-3.149326	-2.579931	-1.614927
DF Statistics	$t_{\hat{\delta}} < \tau_{\tau}$	$t_{\hat{\delta}} < \tau_{\mu}$	$t_{\hat{\delta}} < \tau$
Decision	H_0 Reject	H_0 Reject	H_0 Reject

Source: Author's own calculation

Milk producer price series

The graph of the milk producer price variable over time is obtained as follows. According to the chart, the series contains a stochastic trend. In order to provide variance stability and linearity, the logarithm of the series is taken first. Although the general trend of the logarithmic milk producer price variable with respect to time has not changed, it can be said that the variance decreases due to the smaller numbers as a result of logarithmic transformation.

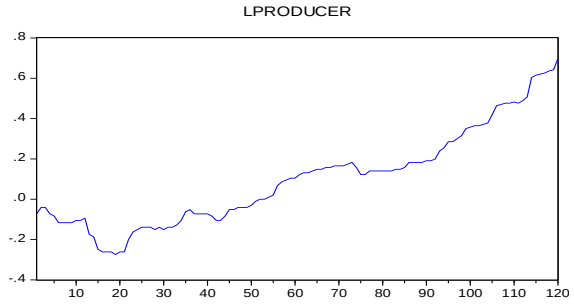

Fig. 5. The monthly milk producer price (kg/TL) from January 2010 to December 2019
Source: Author's own calculation.

The appropriate delay number for the ADF Unit Root test to be applied to the logarithmic milk producer price series was found to be k = 12 according to the AIC information criteria. At this lag level, the lproducer variable is not static according to the ADF unit root test. When looked at the 1st rank difference level, k = 12 was found and when the 1st order difference is taken, it is accepted that the series became stationary.

Table 5. Unit root test for milk producer price series

Level of significance	Intercept and trend $t_{\hat{\delta}} = -8.55010$	Intercept and none $t_{\hat{\delta}} = -7.763973$	None $t_{\hat{\delta}} = -7.263529$
%1	-4.037668	-3.486551	-2.584707
%5	-3.448348	-2.886074	-1.943563
%10	-3.149326	-2.579931	-1.614927
DF Statistics	$t_{\hat{\delta}} < \tau_{\tau}$	$t_{\hat{\delta}} < \tau_{\mu}$	$t_{\hat{\delta}} < \tau$
Decision	H_0 Reject	H_0 Reject	H_0 Reject

Source: Author's own calculation.

Granger Causality Test Results

Reciprocal causality relationship between dmaize and dproducer variables:

When testing the mutual causality relationship between dmaize and dproducer variables, the solution is as follows.

$$maize_t = \sum_{i=1}^{7} \alpha_i maize_{t-i} + \sum_{j=1}^{7} \beta_j producer_{t-j} + u_t producer_t$$

$$= \sum_{i=1}^{7} \lambda_i maize_{t-i} + \sum_{j=1}^{7} \delta_j producer_{t-j} + w_t$$

$$H_0: \beta_j = 0$$

$$H_1: \beta_j \neq 0$$

Table 6. Granger causality tests for dmaize and dproducer

Lags: 7			
Null Hypothesis:	Obs	F-Statistic	Prob.
DMAIZE does not Granger Cause DPRODUCER	112	1.34424	0.2380
DPRODUCER does not Granger Cause DMAIZE		1.17424	0.3247

Source: Author's own calculation.

Decision: According to Granger causality analysis results, at 5% level of significance DMAIZE does not Granger Cause DPRODUCER and DPRODUCER does not Granger Cause DMAIZE.

Reciprocal causality relationship between dmilkpro and dproducer variables:

When testing the mutual causality relationship between dmilkpro and dproducer variables, the solution is as follows.

$$milkpro_t = \sum_{i=1}^{12} \alpha_i milkpro_{t-i} + \sum_{j=1}^{12} \beta_j\, producer_{t-j} + u_t producer_t$$
$$= \sum_{i=1}^{12} \lambda_i milkpro_{t-i} + \sum_{j=1}^{12} \delta_j\, producer_{t-j} + w_t$$
$$H_0: \beta_j = 0$$
$$H_1: \beta_j \neq 0$$

Table 7. Granger causality tests for dmilkpro and dproducer

Lags: 12			
Null Hypothesis:	Obs	F-Statistic	Prob.
DMILKPRO does not Granger Cause DPRODUCER	107	0.88451	0.5656
DPRODUCER does not Granger Cause DMILKPRO		1.64938	0.0941

Source: Author's own calculation.

Decision: According to Granger causality analysis results, at 5% level of significance DMILKPRO does not Granger Cause DPRODUCER and DPRODUCER does not Granger Cause DMILKPRO.

Reciprocal causality relationship between dstraw and dproducer variables:

When testing the mutual causality relationship between dstraw and dproducer variables, the solution is as follows.

$$straw_t = \sum_{i=1}^{1} \alpha_i straw_{t-i} + \sum_{j=1}^{1} \beta_j\, producer_{t-j} + u_t producer_t$$
$$= \sum_{i=1}^{1} \lambda_i straw_{t-i} + \sum_{j=1}^{1} \delta_j\, producer_{t-j} + w_t$$
$$H_0: \beta_j = 0$$
$$H_1: \beta_j \neq 0$$

Table 8. Granger causality tests for dstraw and dproducer

Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
DSTRAW does not Granger Cause DPRODUCER	118	0.71587	0.3993
DPRODUCER does not Granger Cause DSTRAW		3.57260	0.0613

Source: Author's own calculation.

Decision: According to Granger causality analysis results, at 5% level of significance DSTRAW does not Granger Cause DPRODUCER and DPRODUCER does not Granger Cause DSTRAW.

Reciprocal causality relationship between dclover and dproducer variables

When testing the mutual causality relationship between dclover and dproducer variables, the solution is as follows.

$$clower_t = \sum_{i=1}^{1} \alpha_i clower_{t-i} + \sum_{j=1}^{1} \beta_j\, producer_{t-j} + u_t producer_t$$
$$= \sum_{i=1}^{1} \lambda_i clower_{t-i} + \sum_{j=1}^{1} \delta_j\, producer_{t-j} + w_t$$
$$H_0: \beta_j = 0$$
$$H_1: \beta_j \neq 0$$

Table 9. Granger causality tests for dclover and dproducer

Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
DCLOVER does not Granger Cause DPRODUCER	118	1.08889	0.2989
DPRODUCER does not Granger Cause DCLOVER		8.26577	0.0048

Source: Author's own calculation.

Decision: According to Granger causality analysis results, at 5% level of significance DCLOVER does not Granger Cause DPRODUCER but DPRODUCER is Granger Cause DCLOVER. That is, One-way causality relation at 5% level of significance towards producer denoted clover was detected. In this case, it is possible to say that there is a link between milk producer price and clover price.

VAR Analysis Results

In order to decide the system delay length, the AIC values obtained from the VAR models whose parameters are estimated are listed below, with the maximum delay length being 12 months.

The system reached the lowest AIC value with a lag length of k = 12. In VAR analysis, it is important to order variables in obtaining impulse-response functions and variance decomposition results. Especially if the cross correlations between the error terms of the variables are not zero, there may be large variations in the results obtained from different ordering of variables. Therefore, in the light of the results obtained from the Granger Causality test and a priori information obtained from the economic theory, the variables in the analysis were ordered from the most exogenous to the most internal. This ranking; maize price, milk production, straw price, clover price, producer milk price.

Table 10. VAR Lag Order Selection Criteria

Table 10. VAR Lag Order Selection Criteria

Endogenous variables: DMAIZE DMILKPRO DPRODUCER DSAMAN DYONCA

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1051.878	NA	2.18e-15	-19.56780	-19.44291*	-19.51717
1	1093.686	78.92854	1.60e-15	-19.88199	-19.13259	-19.57819*
2	1124.604	55.47919	1.43e-15	-19.99260	-18.61872	-19.43565
3	1137.978	22.74839	1.80e-15	-19.77530	-17.77692	-18.96518
4	1171.600	54.04554	1.55e-15	-19.93644	-17.31357	-18.87317
5	1197.007	38.46706	1.58e-15	-19.94406	-16.69669	-18.62762
6	1242.090	64.04380	1.12e-15	-20.31945	-16.44759	-18.74985
7	1274.970	43.63418	1.02e-15	-20.46672	-15.97038	-18.64396
8	1293.308	22.62293	1.24e-15	-20.34221	-15.22137	-18.26629
9	1326.563	37.91677	1.16e-15	-20.49650	-14.75117	-18.16742
10	1352.241	26.87843	1.30e-15	-20.50918	-14.13936	-17.92694
11	1395.133	40.88691	1.09e-15	-20.84360	-13.84928	-18.00820
12	1465.102	60.16071*	5.72e-16*	**-21.68415***	-14.06534	-18.59559

* indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Source: Author's own calculation.

Impulse-Response Functions

Firstly, if we look at the response of the milk producer price against a standard deviation shock that may occur at maize price, the milk producer price gives an increase in the first two months, but after the second month it experiences a rapid decrease until the third month. Milk producer price, which increased again from the third month, after experiencing minor fluctuations, returns to the pre-shock balance level from the sixth month and the shock becomes ineffective.

Secondly, if we look at the response of the milk producer price against a standard deviation shock that may occur in milk production, the milk producer price reacts in a decreasing direction in the first two months, but after the second month it experiences a rapid increase until the sixth month. After a decline in the sixth and seventh month, and after the seventh month, the milk producer price returns to the pre-shock balance level after this month, and the shock becomes ineffective.

As the third, if we look at the response of the milk producer price against a standard deviation shock that may occur in the hay price, the milk producer price reacts in a decreasing direction in the first month, but after this month it experiences a rapid increase until the fifth month. After experiencing a decline between the fifth and eighth months, after the eighth month, the milk producer price returns to the pre-shock equilibrium level from this month onwards and the shock becomes ineffective.

Fourthly, if we look at the response of the milk producer price against a standard deviation shock that will occur in the clover price, the milk producer price reacts in a decreasing direction in the first two months, but after this month it experiences a rapid increase until the sixth month. It is a sharp decline in the sixth month and continues until the eighth month. After the eighth month, the milk producer price returns to the pre-shock balance level after this month, after experiencing minor fluctuations, and the shock becomes ineffective.

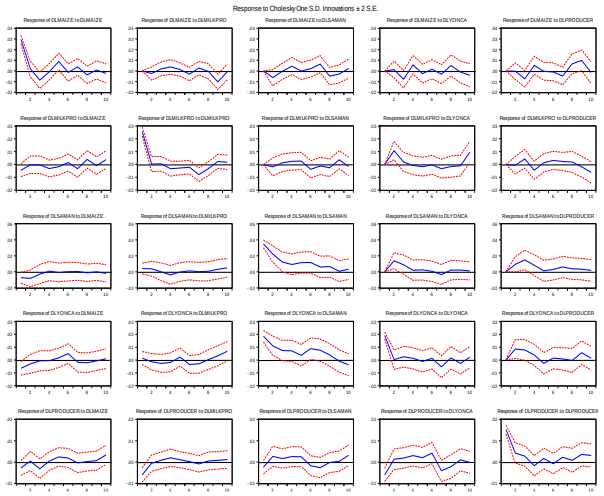

Fig. 6. Impulse-Response functions
Source: Author's own calculation.

CONCLUSIONS

After taking first difference of milk producer price, milk production, maize price, clover price and straw price series, these series are found in stationary. We can say that these series are first difference integrated I(1).

Two types of conclusions arise from this study. First, one-way causality relation at 5% level of significance towards milk producer price denoted clover price were detected. In this case, it is possible to say that there is a link between milk producer price and clover price.

Second, it is an empirical result from VAR analysis that milk production, maize price, clover price and straw price effects on milk producer prices.

If milk producer price, milk production, maize price, clover prices and straw price are enough supported by Turkish government, milk producer prices will be more competitive in the world and enough earnings for milk producers. The VAR analysis to determine the relationship between the agricultural gross domestic product and agricultural supports. Agricultural GDP is significantly affected by agricultural supports [18].

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MILK PRICE PREDICTING WITH HOLT WINTERS AND ORDINARY LEAST SQUARES

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Abstract

In this research, smoothing methods and the Ordinary Least Squares (OLS) method for predicting producer milk prices in Turkey is implemented. Holt-Winters multiplicative (HWM) method and Holt-Winters additive (HWA) method are included in the exponential smoothing methods. Producer milk prices data belong to January 1st, 2010 to December 31st, 2019 period and gathered from the Turkish Statistical Institute. According to the given results, OLS method is fitted the data and has good root mean square error (RMSE) and determination coefficients (R^2).

Key words**:** *Smoothing, Ordinary Least Squares, producer milk prices, Turkey*

INTRODUCTION

The milk production in Turkey was realized 9.506.028 metric tonnes in 2019. Comparison to the years between 2018 and 2019, milk production is decreasing 5.26%. Its producer price milk ratio was up to 20.70% [23]. Especially, household's consumption for milk as packed and unpacked milk from buying producers in Turkey. The demand of milk relies on various factors for example economic factors, socio-economic and cultural factors. Moreover, buying milk from producers is cheaper than market price. For this reason, consumers prefer buying milk directly from producers.

A multivariate Tobit system of monthly wholesale dairy prices where four prices are lower censored by the dairy price support programme. Using Maximum Simulated Likelihood (MSL) the effects of simulation noise are tested/ corrected for and the relevance of estimating multivariate versus the single Tobit equations discussed [2]. The feasibility of estimating a system of demand equations in the absence of price information using the approach developed by Lewbel (1989) [4]. The double-hurdle model typically used in cross-sectional data is extended to panel data structures. In the empirical application for milk purchases, it is found that generic advertising increases the probability of market participation as well as the purchase quantity and incidence [5]. An evolution of the margin risks was performed using the relationship between excess price yield, prices of margin and conditional volatility of milk [6]. They implemented on profit level of hazelnut production [7]. On smallholder dairy farmers' risk perceptions and management strategies have still received little attention in agricultural research of developing countries [8]. Climate change is likely to affect milk production because of the sensitivity of dairy cows to excessive temperature and humidity [11]. Technical Efficiency (TE) of dairy farms is estimated and analyzed with two methodologies: Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). Two federal milk policies are considered in this research: marketing policy and milk income loss policy [14]. The long and short run relationships between oil price and food price volatility as well as the causal link between them [15]. Income, price, and cross price elasticities under six aggregated product groups were estimated within the framework of the an almost ideal demand system approach for food expenditures; and estimation of household consumers' food demand in Turkey was analyzed [19]. The evolution of the dairy farm structure of Poland during the post-socialist period. Milk projections show that under the status quo,

milk quotas will be binding and overrun, whereas under the 'soft landing' scenario they appear to be only binding after 2010 [20]. The VAR analysis to determine the relationship between the agricultural gross domestic product and agricultural supports [17].

In order to evaluate the monthly producer milk price between 2010 and 2019 years, time series analysis was applied. This paper's aim is to predict the milk prices for the next years by using the smoothing method and regression method. The data was taken from The Turkish Statistical Institute's database [23]. The EViews 10 Econometrics package program was used for the estimation and analysis procedure.

In the first section, an overview of the literature about milk price and some agricultural commodities in the Turkish agricultural sector is revised. Research methodology is given in the second and third parts. Especially, in this section smoothing methods and OLS method are emphasized. And the last section has the empirical results.

MATERIALS AND METHODS

Material

The commodity monthly prices data from January 1st, 2010 to December 31st, 2019 were taken from the Turkish Statistical Institute [23].

Methods

HWM, HWA and OLS methods are estimated in this research. The major contributions of this paper are to search the effects of the initial trend values on forecasting accuracy and to obtain the best fitting forecasting results that are obtained by comparing these methods.

Forecasting methods are smoothing methods, the Box-Jenkins model, the Grey forecasting model, Ordinary Least Squares and so on. Especially, estimation of production, prices and other variables are made by these methods. Namely, both of these methods are being contribution to these forecasting areas. These estimation methods are given in the following section.

Seasonality is explained as a repeating behavior [12]. Holt Winters methods can be used for forecasting time series data that have both trend and seasonal patterns [9], [10], [13], [18]. Authors stressed the importance of mean absolute percentage error and computed this indicator [21], [22].

The multiple linear regression equation is as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki} + \varepsilon_i \quad (1)$$

where: Y_i is dependent variable, $X_1, X_2, \dots, X_k$ is independent variable, ε_i error term, $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \dots, \hat{\beta}_k$ are the estimated regression coefficients.

Package program. During the estimation and analysis process, Eviews 10 Econometrics package program was used.

There are some criteria to select the best model for making forecasts, such as root mean square error (RMSE) and determination coefficients (R^2). These criteria are explained as follows:

When the prediction error is a small value, the forecasted value belong to the model will be better. The RMSE statistics was used as the prediction error measure because it gives an accurate and exact statistics for comparing forecasting methods. He emphasized the RMSE [3]. There are some criteria to select the best model for making forecasts such as the mean absolute percentage error (MAPE), root mean square error (RMSE) and mean absolute deviation (MAD) [1].

$$RMSE = \frac{\sum_{t=1}^{T}(y_t - \hat{y}_t)^2}{T} \quad (2)$$

where: t is time period, T is total number of observations, y_t is actual value, and $\hat{y}_t$ is forecasted value at time t.

R^2 that is coefficient of determination shows percentage variation in y dependent variable which is explained by all the x independent variables together. Every variable added to all variables R^2 is getting high score and higher R^2 score the better value. Its score is always getting value between 0 and 1 [16].

$$R^2 = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2} = r^2 \qquad (3)$$

$$R^2 = 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2} \qquad (4)$$

RESULTS AND DISCUSSIONS

Descriptive statistics for the monthly milk prices from 2010 to 2019 are given in the following Fig. 1.

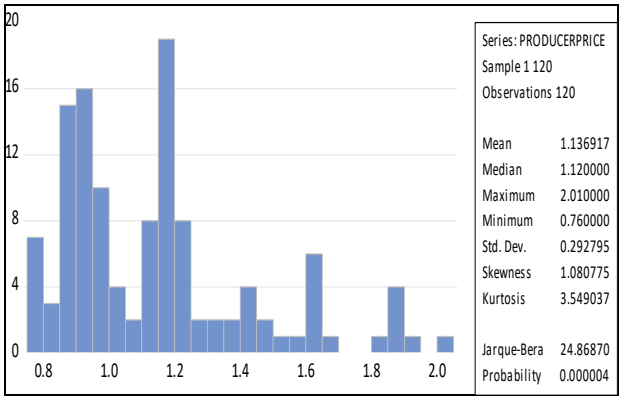

Fig. 1. Descriptive statistics for the monthly milk prices
Source: Author's calculations.

The nonstationary shape of the time series is seen in the Fig. 2. This time series will be analyzing. We can see this series' fluctuates that indicate the observation of a global trend or seasonality.

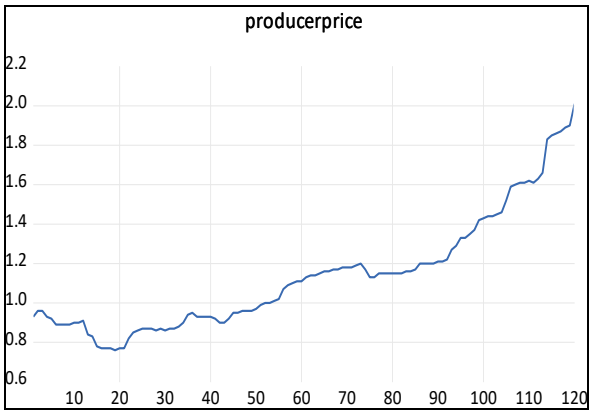

Fig. 2. The monthly producer milk prices (kg/TL) (X: month, Y: prices)
Source: Author's calculations.

The comparison of the raw data and the forecast data determined by the HWA method for producer milk prices are given in Fig. 3.

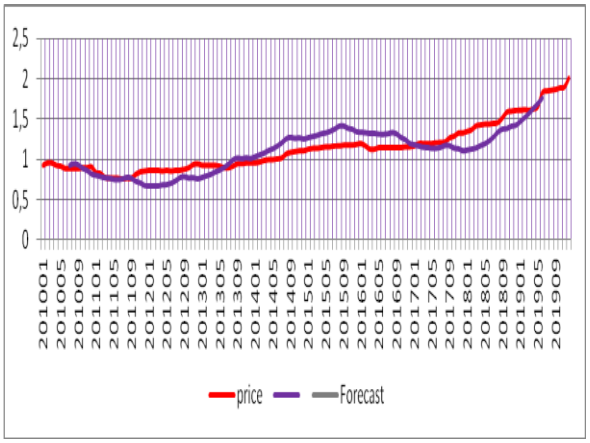

Fig. 3. The raw data and the forecast data for producer milk prices by HWA method
Source: Author's calculations.

The comparison of the raw data and the forecast data determined by the HWM method for producer milk prices are given as follows.

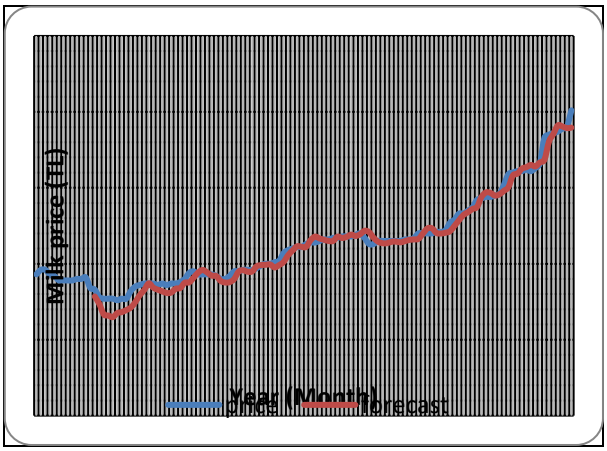

Fig. 4. The raw data and the forecast data for producer milk prices by HWM method
Source: Author's calculations.

In this paper, the weighing factors that result in the minimum RMSE were determined. The results were calculated by the HWA and HWM methods in Table 1.

Table 1. The optimal weighting factors for Jan 2010 to Dec 2019 using the HWA and HWM methods for producer milk prices

Methods	**Factors**		
	α	***β***	***γ***
HWA	0.009	1.000	0.000
HWM	0.673	0.077	1.000

Source: Author's calculations.

In this section, RMSE and R^2 belong to OLS results are given as follow in Table 2.

Table 2. RMSE and R^2 for the HWA, HWM and OLS methods for producer milk prices

Methods	**Statistics**	
	RMSE	R^2
HWA	1.994	NA
HWM	0.452	NA
OLS*	***0.124***	***0.82***

**OLS is the best model for making forecasts.*
Source: Author's calculations.

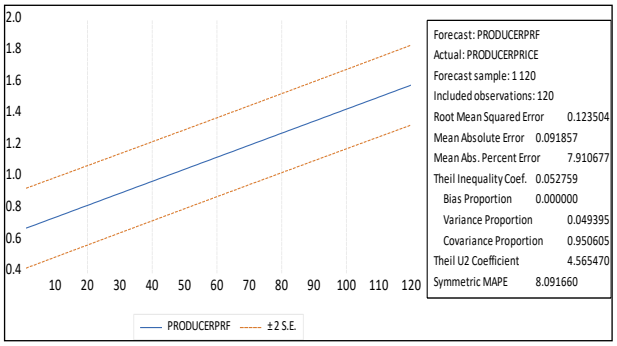

Fig. 5. Different statistics of OLS method for the monthly milk prices
Source: Author's calculations.

CONCLUSIONS

In this research, we proposed and used different initial values for the Holt Winters method to forecast producer milk prices in Turkey, and the results are deeply evaluated. The HWA and HWM methods were tested. During these tests, different initial values were tried and applied in the forecasting methods. The findings of this research revealed that the results generated by the HWA method had good accuracy for forecasting producer milk prices. To optimize the initial values, the RMSE was used in practice. For a time series, OLS method estimated in our study. Producer milk prices were taken as real values. Some statistical tests were evaluated according to the significance of the coefficients and used to test the residuals. The best indicator in this study was determined via the OLS model. The R^2 was evaluated for comparing the RMSE value. In conclusion, OLS is the best model for making forecasts according to RMSE and R^2.

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FINANCING OF UKRAINIAN DAIRY SERVICE COOPERATIVES

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Abstract

The article aimed to study current issues of financing of Ukrainian dairy service cooperatives. In particular, the authors' purpose was to gain a better understanding of capital components of agricultural dairy cooperatives in Ukraine, their funding options, and to propose the policy recommendations for supporting cooperatives as prospective means for agricultural development in Ukraine. The study found that currently, the main financing sources for Ukrainian dairy service cooperatives are members' payments, grants, and rented assets as credits are almost inaccessible for smallholder farmers. The survey showed that members, managers, and presidents of studies cooperatives think that the basic issues for the financing of Ukrainian dairy cooperatives are expensive credit capital, lack of the liquidity of cooperatives' funds, and limited access to better education about cooperative finances for both members and administration groups.

***Key words*:** *financing, service cooperatives, dairy cooperatives, Ukrainian cooperatives, smallholder farming*

INTRODUCTION

Since Ukraine gained independence in 1991, Ukrainian rural communities start to renew their interest in agricultural cooperation. At the beginning of the 2010s, Ukrainian smallholder farmers have started to cooperate for different reasons such as getting finances from authorities or community development (Bezus & Bilotkach, 2018) [6]. Now, more and more farmers try to integrate into the wave of collective business. Institutionally, for the next 10-15 years, Ukrainian farming cooperatives are to find their unique balanced sustainable development models within Ukrainian and international legal frameworks. Farmers groups' collective action is an important strategy for dairy cooperatives to become and remain competitive in rapidly changing markets' conditions in Ukraine.

It is hard to become a successful agrarian businessperson for a small farmer in Ukraine, as farmers' rural communities constantly have to fight poverty, handle low standards of living and mediocre infrastructure (Bezus & Burtak, 2018) [5]. Therefore, it is important to investigate the ways of the development of farmers' communities and support the agricultural sector of Ukraine's economy. One of the ways of supporting is promoting cooperation to provide the markets with fresh, high quality, and not overpriced produce.

Running cooperatives with the number of profitable family farms can help to develop rural territories, reduce poverty, and spread financial literacy among small-scale agricultural food producers in Ukraine. Improved agricultural practices can lead to higher social standards and decreasing the unemployment rate, especially in remote villages.

Previously to establishing a cooperative, it is important to perform a feasibility study and design a model helping to reduce the cost of producers, market their products better, and increase their incomes. The important part of a business model of an agricultural cooperative is the financing of all cooperative activities. Investigating current ways of financing the cooperatives is important for both updating the internal policies about small-scale agricultural production, rural development, and support of necessary

decentralization and social development reforms in Ukraine.

As of Ukrainian researchers, managers (both from the governmental and private sectors), and farmers, most of them support the definition of an agricultural cooperative provided by ICA (The Statement on the Cooperative Identity by International Cooperative Alliance). It states that a cooperative is "an autonomous association of person united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise." (ICA, 2005) [8].

There are different types of cooperatives in the world depending on the needs and goals of its members. The Law of Ukraine "On agricultural cooperation" defines two types of agricultural cooperatives: the production ones and service ones. Agricultural service cooperatives are a type of service cooperatives having several particular qualities. For instance, such cooperative's founders and members are the producers of agricultural produce, and yet they still are independent. Additionally, farming cooperatives' members have concrete goals such as decreasing the costs and increasing the income of their family agribusiness instead of maximizing the profits as opposed to the ordinary firm, etc. (Parliament of Ukraine, 1997) [11].

The current Ukrainian agrarian scientific society is deeply into studying the features of agricultural cooperatives, as they become an important part of the agricultural sector of Ukraine. Many of them focus on the practices of developed economies in farming cooperation and try to design new policies for Ukrainian farmers based on the experience of Germany, the UK, the Netherlands, etc. For instance, A. Revutska and L. Smoliy (2019) [12] have studied the parallels of globalization's influence on farming cooperatives in Ukraine and the EU. They suggested that the vegetables and berries growing service cooperative is the most sustainable and affordable cooperative model for rural communities in Ukraine (Revutska & Smoliy, 2019) [12]. Yu. Amelina and R. Bezus have been studying organic farming in Ukraine for over 10 years including prospects of financing for organic dairy and vegetable farming cooperatives in Kyiv and Dnipro regions of Ukraine (Bezus & Bilotkach, 2018 [6]; Amelina, 2016) [2]. O. Sakovska has paid a lot of attention to the legal bases of the financing of agricultural cooperatives in Ukraine (Sakovska, 2020) [13].

As of international studies on financing dairy cooperatives, the most recent reviews include articles on capital structure and financial performance of dairy co-operative societies in Kenya and dairy cooperatives' development in India (Buluma, Kung'u, Gicohi, 2017 [7]; Anbu, 2020) [3]. It is important to note the major survey of cooperative capital based on information of 300 biggest cooperatives performed and published within the Blueprint of the Co-operative Decade. It presented recommendations for policymakers to find solutions for better access to capital for cooperatives all over the world (Andrews, 2015) [4].

MATERIALS AND METHODS

This study has been conducted to gain a better understanding of capital components of agricultural dairy cooperatives in Ukraine, their funding options, and to propose the policy recommendations for supporting cooperatives as prospective means for agricultural development in Ukraine.

The study of financing the dairy cooperatives in Ukraine involves the analysis of statistic data from open access sources and dairy cooperatives' accounting reports, as well as the surveys conducted by the CoopAcademy, an educational department of the «Agricultural Extension Service» in the Dnipropetrovs'k region of Ukraine. 6 dairy cooperatives from Dnipro, Zaporizhzhia, Kherson, and L'viv regions producing up to 19% of cooperatives' milk in Ukraine (as of 2019) have been studied.

This study has been structured into three parts. Firstly, we found out the components of the cooperatives' capital at the stage of their establishing. Secondly, we studied the capital structure of the cooperatives as of the beginning of 2020. Finally, we determine the

current issues of cooperatives' financing by a phone survey of 50 respondents including presidents, managers, and members of the studied cooperatives.

RESULTS AND DISCUSSIONS

At the beginning of 2020, there were 2,275 agrarian cooperatives in Ukraine; 1,005 of them have a production purpose and the rest 1,269 are service cooperatives. The largest number of operating cooperatives is in Kyiv, Cherkasy, and Zaporizhzhia regions. However, not all of the registered agrarian cooperatives are operating currently. Thus, as of 2019, in total there were 735 operating agricultural service cooperatives, 186 of them were dairy cooperatives and 162 were tilling and harvesting cooperatives. Meat producing farmers have been united into 35 cooperatives; 113 cooperatives have had berries, fruit, and vegetables growing specialization; 4 cooperatives have been united for grain crops growing support, and 198 were registered for providing other services to farmers (State Statistics Service of Ukraine, 2020) [14].

Issues of financing of dairy cooperatives in Ukraine. Historically, small-scale agricultural production has been a key element in Ukrainian agriculture. Due to the wide range of production and marketing practices of Ukrainian dairy cooperatives and the limited number of long-term studies about farmers' cooperation in Ukraine, it is important to design financial plans for each cooperative individually.

The amount of Ukrainian dairy cooperative's capital depends on its type, a number of its members, the daily amount of milk to be sold, milking and storing equipment, type, and amount of services to be provided. Dairy cooperatives need financing to support their day-to-day operations and for such inputs as buildings, track for milk collection and delivery, milking machines for members, mini laboratories, and equipment.

In general, cooperative's capital consists of long-term, short-term types of capital and special organizational funds. Long-term capital means buildings and machines in cooperative, short-term capital is for financing such expenditures as salaries, inventories, and different types of supplies. Organizational funds are to provide expenses associated with an organization, registration, and running a cooperative. Also, it is for covering the fees such as permits for some types of cooperative activities if needed (Mishenin et al., 2017) [10].

At the beginning of the current wave of the cooperative movement in Ukraine (started approximately at 2000), their vast majority has registered themselves as non-profit organizations, yet about five years later, the management of the successful ones decide to run their cooperatives using taxation regimes for small-scale entrepreneurs due to many changes in policies towards agricultural cooperatives.

There are two types of sources for all-Ukrainian dairy cooperative capital. They are internal capital and external capital.

Usually, a cooperative get equity capital from members in the form of direct investment, a retained portion of income, or from the sale of products as per–unit capital. Direct investment of equity from cooperative members forms its portion of general capital in tree basic ways – membership fees, shares, and additional shares.

In case if the equity capital of cooperative paid by members is not enough to cover all the expenses needed to run it, then its managers must look for external sources of financing. Cooperatives may borrow the capital from state and commercial banks, credit unions for farmers, rural entrepreneurs, and external individuals. However, non-profit agricultural cooperatives usually get refuse from Ukrainian commercial banks because of limited repayment guarantees so about 50% of them changed its registration to a profit-generating organization violating the actual legislation.

Besides, to raise some part of funds dairy cooperatives may apply for grants from governmental agencies and international foundations. Borrowed capital may be categorized as a long-term or short-term loan. Short-term credit is to repay in one year and can be used to support everyday cash flow, to

buy supplies or services needed for ongoing operations in a cooperative. Another important function of short-term credit is covering a cash deficiency in case of payment delay from a milk factory or processing plant. Adherence of the cooperative to timing in payments for high-quality milk is an important issue for interaction with member farmers, especially in distant rural areas as it influences to their loyalty to cooperation idea.

Long-term credit helps cooperative to fund the purchase of fixed assets. A credit for funding storing buildings or equipment can have a repayment period of up to 8-10 years. Sometimes, long-term credits may be used for increasing the capital for operating purposes. However, this type of credit is not as accessible as a short-term one for dairy cooperatives because commonly the lender requires specific conditions for obtaining such a loan. For example, a bank can set the limits for the specific type of fixed assets or standards for economic performance indicators.

Once an agricultural cooperative starts to operate, its member farmers plan to generate the income to cover all the expenses and accumulate an adequate volume of equity for further development of the cooperative. Basic sources of equity generated are holding a part of cooperative income, and gathering per-unit retains from members. Retained money may become equity in the allocated or unallocated form. Allocated equity remains linked to the accounts of particular members. On the contrary, unallocated equity does not have a connection to the specific members' accounts and remain collected to support the cooperative in general. If the cooperative needs extra capital for expansion or modernization of fixed assets, then members may be asked to invest more money.

Managing income is a major issue for cooperative members and managers at the end of every fiscal year. After calculating all of the income and expenses, the accountant receives the fiscal result of the year. The general gathering may distribute any income left among the members or turn it into unallocated equity of cooperative. In the case of transforming income into cooperative members' payment, it becomes another form of retained payment or cash pay-outs. Otherwise, accumulated funds will finance the cooperative's business operations and growth for the next year. Retaining patronage is a reliable instrument of investment for ongoing farming cooperative, but only in the case of a successful year. If not, a lack of capital requires a new portion of investments from members and non-members. So sometimes, the cooperative's board sets a specific fund to retain 5%-10% of income after deducting expenses to cover financing challenges of poor business periods.

Deciding on the ways of the income distribution can be challenging for agricultural cooperatives. When obtaining refunds in a newly established cooperative, most of the member farmers vote for full pay-outs of income without retaining any portion of it at the end of the financial year. However, a few years later, farmers becoming more literate in cooperative running often decide against patronage refunds of financial results. Nevertheless, since income is the basic source of financing the cooperative, farmers may decline in investing having a successful year. This may lead to distancing from regular investments and other types of maintaining the cooperative. Therefore, the board and president have to balance carefully managing the surplus earnings to back the patronizing of the cooperative by farmers. As an alternative to raising funds from retained portions of surplus income, a dairy cooperative can try the model of per unit capital retaining. This method depends on the number of operations made by farmers with the help of cooperative.

Taxation of the cooperatives in Ukraine. The taxation regimen chosen during its official registration in the state registries impacts partly the funding model of cooperative.

Dairy service cooperatives in Ukraine commonly use one of the three most common taxation models:

- general taxation model,
- single tax model (special regimen),
- non-profit model.

Using the general taxation model means that agricultural cooperative has to pay all of the taxes and linked fees as for-profit enterprise

depending on the business model of a cooperative. The list of such taxes and fees may consist of enterprise profit tax (18%), VAT (20%), land tax, property taxes, and social contributions (Tax Code of Ukraine, 2020) [15]. Managing accounting, reporting, and paying all of the listed is hard to perform properly for rural businesses and lead to extra expenditures.

Until the beginning of 2017, there was a special regimen of VAT for agribusiness that allow to accumulate VAT payments at the farm's account and use them for further business development. Nevertheless, in 2017 such an option has been replaced with agricultural subsidies programs.

If the yearly income of cooperative amounts under UAH 7 mill., then it can use a single tax regimen. It is more preferable for a moderate dairy cooperative in rural Ukraine. Usually, the dairy cooperative business model fits into group 3 or 4 of single tax regimen users. According to the Tax Code of Ukraine, group 3 gets a tax rate of 5% of total income and no VAT payment obligation or 3% including such obligation. Besides, group 4 taxpayers' tax rate depends on agricultural land value rather than the amount of income or profit. Along with simplified tax calculations, a single tax regimen includes simplified rules for its accounting and reporting. Once choosing this regimen, farmers' cooperative is not obligated to pay enterprise profit tax and the number of other taxes including land tax (Tax Code of Ukraine, 2020) [15].

According to the authors' observations, efficient dairy cooperatives prefer to use a single tax regimen as using a general tax system is too costly, and non-profit status is hard to prove to the local tax authority.

The non-profit organization model may be chosen for rural dairy cooperative because of its mission and main goals, which are getting better marketing for local farmers, achieving access to cheaper credit, and providing services, yet not profit generation. However, until September of 2019, tax authorities have rarely agreed to register agricultural cooperatives as non-profit claiming that its charter does not have a direct restriction for surplus income distribution among its members. At the beginning of 2020, the situation has started to change. Among the observed cooperatives, all of them have been using a single tax regimen.

The capital structure of dairy service cooperatives in Ukraine. All of the cooperatives under study have been established in 2010-2011 and had a very similar capital structure when start running. Members' capital is the most reliable fund source for a new dairy cooperative in Ukraine, it usually accounts for 100% of newly established cooperative's capital. Membership fee (6%) and members' shares (10%) present about 16% of the capital and the other portion of 84% is the capital raised from selling additional shares to associated members (see Fig. 1).

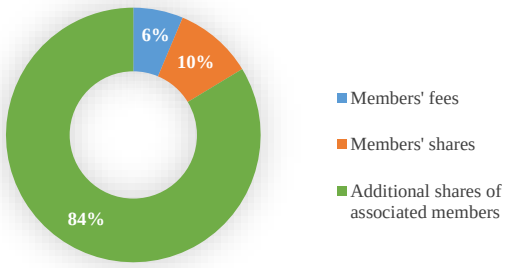

Fig. 1. Capital structure of newly established dairy cooperative in Ukraine
Source: studied cooperatives' reports 2020.

A balanced and detailed marketing strategy is essential for potential farmers' cooperative in rural Ukraine as it helps attract regular and associated members able to invest.

Unfortunately, credit capital is almost inaccessible for new dairy cooperatives in Ukraine. These funds are very expensive for smallholder farmers as they are hard to get without sufficient mortgage and the interest rate starts up from 14% for credits in UAH. Accessibility of cheap credit for agrarian entrepreneurs is a common problem in Ukraine and dairy cooperatives are no exception.

In 2020, the studied group of dairy cooperatives have already gained experience in its running and have passed several crises caused by both internal and external reasons. As soon the cooperatives had started to

succeed, members become trustier and more loyal to it. For instance, once a cooperative has managed to buy effective mini-laboratories for milk testing, members ready to invest more to buy something else like a big cooling tank, etc. With years passing, members can see that cooperative is helpful to their farm and local communities, therefore, the portions of such capital components as retained earnings and reserves appear and increase (Fig. 2).

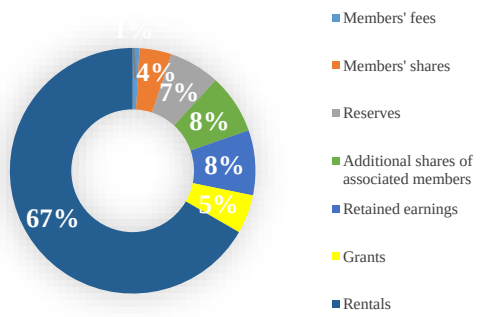

Fig. 2. Capital structure of dairy cooperative in Ukraine with 10 years of experience
Source: studied cooperatives' reports 2020.

As of the beginning of 2020, for the studied dairy cooperatives, retained earnings account for 8% and reserves especially for a goal as cooling of storing capacities accounts for 7% of capital. Members' fees and shares account for up to 5% of the capital of dairy cooperatives. After 10 years, additional shares to associated members account for up to 8% of such cooperatives' capital.

In some time after the cooperative began to succeed, local businesses and authorities consider the partnership with its members and management more acceptable. With gaining a good reputation, cooperatives may rent a range of means. Rented assets provided to it are very important for dairy cooperatives. In terms of rural Ukrainian communities, such assets may be both buildings of an old abandoned collective farm provided by local authorities and modern cooling tanks or milk-gathering trucks and stations. If the local authority's leader supports the farmers' cooperation activities than they may provide cars or laboratory equipment for free use. Currently, dairy cooperatives have up to 67% of capital in a rental form.

Furthermore, rural dairy farmers may apply for local or international grants. National grants may be covered by a local budget if it has something to offer, by regional subsidies or by national support programs of the Ministry of Agrarian Policy and Food of Ukraine (Ministry of Agrarian Policy and Food of Ukraine, 2019) [9]. As of 2020, grants account for 8% of the capital of the studied dairy service cooperatives.

Additionally, we have observed that the cooperatives with a general taxation regimen tend to have lower portions of retained earnings and reserves than those with a single tax regime and non-profit status due to high tax rates.

The phone interviews with members, presidents, and managers of 6 studied dairy cooperatives demonstrate that the basic issues for the financing of Ukrainian dairy cooperatives are expensive credit capital (42% of respondents), lack of the liquidity of cooperatives' funds (34% of respondents) and limited access to better education about cooperative finances for both members and administration groups (24% of respondents).

Regarding the access to credit capital for farmers, it has been always a sufficient problem for rural agribusiness development in Ukraine. Moreover, Ukrainian authorities have always tried to solve it, but due to the rapidly changing market and policy environment within Ukraine, their efforts were not successful enough. The new governmental program of affordable credits "5-7-9%" may be the brake in this problem yet the results of its implementation to analyse will appear only a few years later (Affordable credits program "5-7-9%", 2020) [1].

Improving liquidity of cooperatives' funds is an important part of a cooperative business strategy for creating development opportunities. To improve liquidity cooperative management, it needs to make cash flow plans. Even so, the current changing market environment may lead to situations when dairy cooperatives need cash to pay the producers or banks but milking plants or processing factory delays with their payments for a week or two. Delays of payments to members may cause the withdrawing the

membership of fewer producers and increasing their engagement with local milk intermediaries. In remote rural areas of Ukraine, it might lead to cooperative closure due to decreasing the amount the milk to be sold to the plant. Delays of payments to banks (or other creditors) cause the fines generation according to the credit agreement. The core articles of current legislation on agricultural cooperation has been updating since 2013 due to the lobbying of activists' groups. Among other problems, new laws were aimed to protect the economic and social rights of cooperatives' members yet the articles on protecting the farmers' rights are hard to use for protection in real life. Unprotected status discourages farmers and prevents them from cooperating that may bring them back to poverty. At this point, dairy farmers' cooperatives need to have effective, transparent, and understandable procedures to protect their interests in the best way even in very remote areas of Ukraine.

Another issue for farmers' cooperation and its financing is a lack of professionals in this sphere. Massive practical and scientific publications about this topic have started to spread since the middle of the last decade so now there are very few reliable knowledge bases for cooperative members. This situation has been changing since international NGOs entered Ukraine to spread their practices yet still it is not enough because of the high demand for such educational services. To get further development, dairy cooperation needs more knowledge investments like extension services. Most active agencies of such services have been working in Kyiv, Dnipro, and L'viv regions of Ukraine.

CONCLUSIONS

Ukrainian dairy cooperatives finance their activities like any other enterprise, by raising the capital. However, such cooperatives financing methods and capital components differ from those used by non-cooperative as cooperative members provide capital to the cooperative.

In cases, if these types of funding are not enough, borrowing from non-members is a good strategy, yet the returns from such borrowing should cover the cost of borrowing and provide the surplus for cooperative and members. As of 2020, most of the Ukrainian smallholder dairy farmers still have a hard time getting cheap credits for their small businesses so group action regarding borrowing for cooperatives' operating capital may be a good resolution.

As of the beginning of 2020, for top dairy service cooperatives in Ukraine, members' fees and shares account for up to 5% of its capital, retained earnings account for 8%, and reserves for such special goals as cooling or storing capacities account for 7% of capital. After 10 years, additional shares to associated members account for 8% and rented assets account for 67% of such cooperatives' capital. Local grants account for 8% of the studied dairy service cooperatives.

According to survey results, the basic issues for Ukrainian dairy cooperatives are expensive credit capital (42% of respondents), lack of the liquidity of cooperatives' funds (34% of respondents), and limited access to better education about cooperative finances for both members and administration groups (24% of respondents).

For over twenty years, the policymakers in Ukraine try to solve the problem of credit accessibility for smallholder farmers; however, the policies towards this issue still needs improvement of its funding and implementation mechanisms.

Delays of payments to members often cause the withdrawing of their membership, discourage farmers, and prevent them from further cooperation. Sometimes, it means the end for the local cooperative leading to fully unprotected status for farmers and decreasing their social standards. Farmers need to learn how to protect their economic and social rights through the updated legislation on agricultural cooperation and its effective procedures to be developed.

For increasing the number of successful dairies in Ukraine, both public and private institutions have to pay more attention to the development of such matters as extension services or similar agencies because rural

dairy farmers need modern education in this sphere.

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THE IMPACT OF ORGANIC FERTILIZER WITH EFFICIENT MICROORGANISMS ON SOIL QUALITY AND MAIZE PRODUCTIVITY

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Abstract

The paper presents the results of research on the impact of organic fertilizers, obtained from poultry manure with and without pro prebiotic PoultryStar^{R}me^{EU}, on the microbiological and biochemical quality of soil and corn productivity. For this purpose, initially, an experiment was organized in the practical conditions of the individual poultry enterprise "GT Nicolaescu V." from village Fagureni, district Straseni, in which material for the study was used the probiotic PoultryStar^{R}me^{EU}, and the object of research were broiler chickens ROSS 308. Subsequently, the manure obtained was subjected to traditional composting, and after 9 months, it was were injected into the soil. As a result of research, it was found that organic fertilizers have improved the microbiological and biochemical quality of the soil by increasing 10 times the amount of beneficial microorganisms, the content of organic matter - by 48.02% - 114.81% and humus - by 15.14% - 10.56%, thus stimulating the physiological development (height) of the plants by 7.69% - 10.53% and increasing the corn grain harvest by 5.98% and by 17.45% the amount of straw (organic matter) compared to the control group.

Key words**:** *compost, manure, humus, maize, organic matter*

INTRODUCTION

Obtaining organic agricultural production is a matter of global impotance for sosiety. The global environmental situation, including the regional, has worsened in the last century due to the industrialization and chemicalization of agriculture, the storage, preservation and unreasonable use of organic waste [3].

The implementation of the technology for regenerating of soil fertility and increasing the productivity of agricultural crops using organic fertilizers, obtained as a result of the use of different bioconversion technologies of organic waste, aims at towards the development of organic agriculture (ecological), which is a modern technique of plant cultivation, of the fattening of animals and to produce food using methods and technologies that are close to nature's laws - does not use synthetic fertilizers and pesticides, stimulators and growth regulators, hormones, antibiotics and intensive breeding systems of plants and animals [3; 5].

Organic farming assumes a return to the values of traditional agriculture, but not and to these methods. The process and procedures for obtaining ecological products are regulated by strict production rules and principles, which start from the quality the soil needs to have till to achieving the final product. This system of agricultural development can be adopted by own convictions or being influenced by growing demands on food security, maintaining unpolluted environment and not least for economic reasons. Whatever would be the reasons of transition to organic agriculture (ecological), greening resources and final production is important for minimizing the harmful effects of farming practices on the environment and consumer health [3; 11].

Fertility and biological activity of the soil must be maintained and improved by:

a) cultivation of legumes, green manure plants or deep-rooting plants in an appropriate crop rotation;

b) the incorporation of ecological substances in the soil in the form of compost (fertilizer) from manufacturing units, in accordance with the rules of production.

It can also be used derivative products originating from the livestock farms or domestic animals (manure), whether they come from units of breeding of animals, complying with the existing national regulations or, in their absence, recognized international practices referring to agricultural ecological production [4].

Compost from bird manure is one of the most affordable organic fertilizers [2].

Poultry manure is the most concentrated organic fertilizer, containing on average 1.46% nitrogen, 2.39% phosphorus (P_2O_5) and 1.16% potassium (K_2O). The organic matter in the composition of bird droppings has an average weight of 26%, but the coefficient of variation exceeds 64%. Therefore, in different batches of manure the content of organic matter can vary between 8% and 60% [10].

Most of the time bird droppings contain pathogens that can have a negative impact on human health, aquatic life and wildlife. For this purpose it is necessary to use new methods in the technological process of bioconversion of organic waste for the decontamination of pathogenic microflora from bird droppings with subsequent reduction of their composting time [1; 7].

Currently, effective microflora (EM) preparations are widely used for this purpose [6; 9].

One of the beneficial mycoflora preparations marketed in Republic of Moldova is the pro/prebiotic PoultryStar^{R}me^{EU}, a symbiotic product for birds, which stimulates the beneficial intestinal microflora through the combined action of carefully selected probiotic microorganisms and prebiotic fructooligosaccharides. The probiotic strains, from the preparation, Bifidobacterium animalis spp., Lactobacillus salivarius spp., Enteroccocus faecium were isolated from the intestines of healthy birds [2; 7].

In this context, the aim of the work was to determine the impact of organic fertilizers, obtained from poultry manure with and without pro/prebiotic PoultryStar^{R}me^{EU}, on the microbiological and biochemical quality of the soil and the productivity of corn.

MATERIALS AND METHODS

In the practical conditions of the individual poultry enterprise "GT Nicolaescu V." from the village of Fagureni, distrct Straseni, an experiment was organized in which 2 batches of chickens were included (including one - control and one - experimental). The chickens from the control group consumed age-specific combined fodder, and those from the experimental group consumed the same fodder combined with the addition of pro/prebiotic PoultryStar^{R}me^{EU} (produced by the Austrian company "Biomin"), in a proportion of 1.0 kg/t of feed. The duration of the experiment was 45 days. At the end of the research, the manure was collected from the room and transported to places specially designed for traditional air fermentation for a period of 9 months.

Experimental compost I was obtained as a result of traditional fermentation of broiler manure that consumed age-specific combined forage.

Experimental compost II was obtained as a result of traditional fermentation of broiler manure that consumed the same fodder combined with the addition of pro/prebiotic PoultryStar^{R}me^{EU}.

Both types of compost were evenly distributed, on the experimental lots, from the consideration of 10 t/ha. Maize was sown 3 weeks after incorporation of compost into the soil.

The determination of the microbiological composition of the soil and compost was performed using culture media, according to the usual methods [8].

The biochemical indicators of the soil, the compost were determined according to the usual methods [12; 13].

RESULTS AND DISCUSSIONS

Initially, the biochemical composition of experimental compost I and II and soil was studied at the initial stage (Table 1) and 3 weeks after compost incorporation (Table 2).

The value of the humus content of experimental compost II exceeded that of experimental compost I by 15.23%. The

content of total nitrogen and organic matter in experimental compost II was lower by 26.76% and 51.95%, respectively, compared to that of experimental compost I.

Table 1. Biochemical composition of compost and soil at the initial stage

Indicators	Compost experimental		The original soil, sampling depth, cm	
	I	II	0-10	10-20
Total nitrogen %	3.25±0.17	3.21±0.28	0.29±0.05	0.26±0.05
Organic substance,%	3.25±0.17	24.15±0.22	4.61±0.94	6.06± 0.11
Humus content, %	41.37±4.62	47.67±2.69	3.10±0.28	3.73±0.11

Source: Own calculation.

As a result of the research of soil samples collected from a depth of 0-10 cm of lot II and III, after 3 weeks from the incorporation of experimental compost I and II, the organic matter and humus increased by 40.50% and 48.02%; 3.43 and 15.14% respectively compared to their content in the soil of the control group (Table 2).

Table 2. Soil biochemical composition

Lots	Sampling depth, cm	Total nitrogen, %	Organic substance,%	Humus content, %
Lot I	0-10	0.35±0.03	4.79±2.03	3.50±0.13
	10-20	0.20±0.02	7.11±0.04	3.41± 0.14
Lot II	0-10	0.33±0.12	6.73±0.05	3.62±0.20
	10-20	0.20±0.13	7.12±0.08	3.67±0.08
Lot III	0-10	0.40±0.15	7.09±0.40	4.03±0.00
	10-20	0.28±0.09	7.16±0.03	3.77±0.24

Source: Own calculation.

In the soil samples collected from a depth of 10-20 cm, essential changes took place in the humus content of the soil of lot II and III, which exceeded that of the samples collected from the control group, respectively by 7.62 % and 10.56%, and the content of the organic matter has not changed significantly.

The results of the microbiological research of the hi soil samples, after 3 weeks from the incorporation of the compost (table 3, 4), showed quantitative changes of the microorganisms.

Thus, in soil samples collected from soil depth 0-10 cm, the maximum amount of NTG (total number of germs) 8.0×10^6 CFU/g was found in the lot III sample, and the minimum 6.0×10^5 CFU/g in the one in the control lot I.

Table 3. Microbiological content of soil samples collected from experimental batches, collected from a depth of 0-10 cm, CFU/g

Indicators	Lot I	Lot II	Lot III
NTG	6.0×10^5	1.1×10^6	8.0×10^6
Lactobacillus spp.	7.0×10^4	3.0×10^4	6.0×10^4
Bifidobacterium spp.	5.4×10^5	4.2×10^5	3.5×10^5
Clostridium spp.	2.1×10^3	9.0×10^5	2.0×10^5
Bacillus spp.	7.0×10^5	7.0×10^5	2.0×10^5
Fungi	1.5×10^5	6.7×10^4	1.1×10^5

Source: Own calculation.

In the sample taken from a depth of 10-20 cm of lot III was found a 10 times higher amount of effective microorganisms Lactobacillus spp., Bifidobacterium spp. and Bacillus spp., compared to lot II and control lot I.

In all soil samples the amount of fungi varied insignificantly, in the range of 10^4-10^5 CFU/g, with levumiform fungi predominating.

Table 4. Microbiological content of soil samples collected from experimental batches, collected from a depth of 10-20 cm, CFU/g

Indicators	Lot I	Lot II	Lot III
NTG	1.5×10^6	3.3×10^6	9.0×10^5
Lactobacillus spp.	4.5×10^4	5.0×10^4	2.0×10^5
Bifidobacterium spp.	6.0×10^5	7.0×10^5	7.6×10^6
Clostridium spp.	2.0×10^2	6.0×10^5	3.0×10^5
Bacillus spp.	5.1×10^5	9.8×10^5	1.9×10^6
Fungi	4.0×10^5	3.5×10^5	1.1×10^5

Source: Own calculation.

As a result of the biochemical analyzes of the soil samples collected at the end of the experiment, after 5 months from the beginning of the experiment (Table 5), at a depth of 0-10 cm of lot III, compared to the control, a higher amount of total nitrogen, organic matter and humus respectively by 6.45%, 27.15%, 13.37%. The content of total nitrogen and humus, at a depth of 10-20 cm in lot III, exceeded that of the respective control lot by 8.33% and 12.22%, and the content of organic matter was decreased by 2.03%.

Table 5. Biochemical composition of the soil at the end of the experiment

Lots	sampling depth, cm	Total nitrogen, %	Organic substance,%	Humus content, %
Lot I	0-10	0.31±0.03	5.12±0.54	3.44±0.13
	10-20	0.24±0.02	7.40±0.53	3.52±0.07
Lot II	0-10	0.28±0.00	6.42±1.80	3.67±0.05
	10-20	0.24±0.02	7.88±0.03	3.73±0.08
Lot III	0-10	0.33±0.03	6.51±0.02	3.90±0.13
	10-20	0.26±0.02	7.25±0.18	3.95±0.10

Source: Own calculation.

At the end of the experiment, in the soil samples collected from the control and experimental lots, NTG, Bifidobacterium spp., Clostridium spp. and Bacillus species varied in the limit 10^5 CFU/g (Table 6 and 7), and the amount of Lactobacillus spp. and fungi ranged from 10^4-10^5 CFU/g.

Table 6. Microbiological content of soil samples at the end of the experiment, collected from a depth of 0-10 cm, CFU/g

Indicators	Lot I	Lot II	Lot III
NTG	2.6×10^5	3.9×10^5	4.6×10^5
Lactobacillus spp.	7.9×10^4	1.3×10^5	1.2×10^5
Bifidobacterium spp.	1.8×10^5	4.7×10^5	3.2×10^5
Clostridium spp.	2.5×10^5	2.7×10^5	3.6×10^5
Bacillus spp.	3.1×10^5	4.8×10^5	3.5×10^5
Fungi	5.1×10^4	2.2×10^5	8.2×10^4

Source: Own calculation.

Table 7. Microbiological content of soil samples at the end of the experiment, collected from a depth of 10-20 cm, CFU/g

Indicators	Lot I	Lot II	Lot III
NTG	1.8×10^5	4.9×10^5	4.5×10^5
Lactobacillus spp.	1.1×10^4	1.9×10^5	9.0×10^4
Bifidobacterium spp.	4.5×10^5	3.7×10^5	8.7×10^5
Clostridium spp.	1.7×10^5	3.5×10^5	8.6×10^5
Bacillus spp.	$2,5\times10^5$	3.0×10^5	8.6×10^5
Fungi	7.6×10^4	1.2×10^5	1.1×10^4

Source: Own calculation.

During the experiment (from emergence to harvest), observations were made on the physiological development of corn in various phenological phases.
According to the maize growing technology, 3 maize plants per linear meter were left on all lots. As a result, 96 plants were left on each of the lots. In order to determine the influence of experimental compost I and II on the physiological development of maize, during the development of the experimental period, 8 measurements of the height of maize plants were performed. Four of the measurement results are shown in Table 8, because the difference in plant height in the other measurements was 1-2 cm.

Table 8. Average height of maize plants during the experimental period

Lot	Measurement times and plant height, meters			
	Round I	Round II	Round III	Round IV
	13.06. 18	28.06.18	27.07.18	19.09.2018
Lot I	0.26± 0.01	0.76± 0.05	1.90 ± 0.04	2.03± 0.01
Lot II	0.26± 0.01	0.76± 0.02	1.95± 0.06	2.11± 0.04
Lot III	0.28± 0.02	0.84± 0.07	2.09 ± 0.06	2.22± 0.04

Source: Own calculation.

Analyzing the results presented in Table 8, it was found that the height of the plants from lot III exceeded that of the plants from lot I control by 7.69%, 10.53%, 8.38%, 9.36%. In the last two rounds of measuring the height of maize plants, it was found that the height of the plants in the lot II exceeded by 1.56% and 3.94% respectively that of the plants in the control lot. The results of the study of maize development depending on the phenological phases (ear and cob formation) are presented in Table 9.

Table 9. Study of the phases of formation of ears and cobs in the field experiment

Counting day	Lot, number of plants with ears and cobs					
	Lot I		Lot II		Lot III	
	ears	cobs	ears	cobs	ears	cobs
30	-	-	-	-	2	-
40	13	-	12	-	23	4
50	18	2	17	3	29	8
60	90	64	91	65	96	89
70	96	72	96	75		96
80		96		96		

Source: Own calculation.

Maize in the beginning phase of the formation of cobs is represented in Photos 1, 2 and 3.
The physiological development of the maize the milk phase of the cobs is represented in Photos 4, 5 and 6.

Photo 1. Lot I (No fertilizer)
Source: Own determination.

Photo 2. Lot II (Fertilizer without EM)
Source: Own determination.

Photo 3. Lot III (Fertilizer with EM)
Source: Own determination.

Photo 4. Lot I
Source: Own determination.

Photo 5. Lot II
Source: Own determination.

Photo 6. Lot III
Source: Own determination.

As a result of the observations, it was found that the formation of ears and cobs in corn on lot III began, respectively after 50 and 54 days, and the total formation of ears and cobs was found 62 and 64 days after the emergence of corn. On the control group and the experimental group II, both the ear formation phase and the cob formation phase started later, respectively 4 days and 7 days, then those on the lot III. The total number of cobs in these groups formed 5 days later than in lot III.

Table 10. Grain/cob and corn straw harvest

Lot	Harvest t/ha		Maize straw
	cobs	corn grains	harvest, t/ha
Lot I	12.550	9.036	5.845
Lot II	12.950	9.324	6.050
Lot III	13.300	9.576	6.865

Source: Own calculation.

After a period of five months, at the end of the experiment, the harvest of cobs and corn straw collected from the lots included in the experiment was determined by weighing. The results of the crop evaluation are presented in Table 10 and Fig. 1.

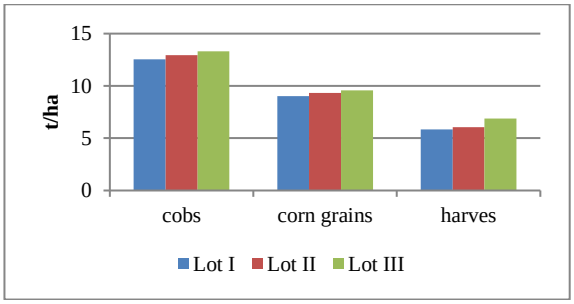

Fig. 1. Grain/cob and corn straw harvest
Source: Own calculation.

It is obvious that experimental compost I and II had a more effective influence on the harvest of cobs and corn straw. The yield of

cobs and grains (calculated from the consideration t/ha) of maize cultivated with experimental compost fund I, exceeded it by 3.19%, and that of maize cobs cultivated with experimental compost fund II exceeded it by 5.98% that of the control group.

Analyzing the corn straw harvest obtained, it was found that from the lots II and III fertilized with compost, a harvest was obtained that exceeded the one collected from the control lot I, respectively by 3.51% and 17.45 %.

The production obtained can be used for:

- feeding animals (cattle, sheep, goats, etc.)
- use as bedding for animals;
- pellet production (solid biofuel);
- the return of a significant part of the organic matter in the soil.

So, as a result of research, it was found that experimental composts I and II used for soil fertilization had a beneficial influence, improving soil quality and increasing the yield of cobs and corn straw per unit area.

CONCLUSIONS

Fertilization of the soil with compost obtained from bird droppings with and without pro/prebiotic PoultryStar^{R}me^{EU} contributed to:

• improvement of the microbiological quality of the soil by quantitatively increasing, 10 times, the efficient microorganisms Lactobacillus spp., Bifidobacterium spp. and Bacillus spp. at a depth of 10-20 cm of the soil compared to the first control and lot II;

• increasing the amount of organic matter and humus, at a depth of 0-10 cm of the soil, corresponding to 48.02% and 15.14%, and to 10-20 cm respectively by 114.81% and 10.56%, in comparison with their content in the soil of lot I;

• stimulating the physiological development (height) of the plants, in the four phenological phases, by 7.69%, 10.53%, 8.38%, 9.36% compared to the lot I;

• increase of the corn grain and straw biomass harvest, respectively by 5.98% and 17.45%, compared to that of the lot I.

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RESEARCH REGARDING YOUNGER CONSUMERS ATTITUDE, IN RELATION WITH SHEEP MEAT CONSUMPTION

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Abstract

The paper is based on the study of various reports and different type of articles regarding the EU sheep meat production and sheep meat's quality. In order to determine the Romanian consumers' perception regarding the quality of sheep meat, a questionnaire was prepared which was completed during April-June 2020 by 118 students from Sibiu and Bucharest. Sheep meat is consumed throughout the year in the families of the young people investigated (27.9). It is purchased mainly fresh (85.6%) and comes from their own farm or from other farmers (77.2%).The most well-known and consumed sheep meat preparations are lamb steak (75.4%) and pastrami (67.8). Sheep is cooked at home, in the family (85%). The young generation believes that the most effective way to promote the consumption of sheep meat is the advertising made from person to person..The data on the composition of sheep meat are generally known. The biggest influence on the consumption of sheep meat had on the respondents their family (74.6%). Promoting the consumption of sheep meat among young people contributes to the development of the sheep sector in particular and to sustainable rural development in general.

***Key words*:** *sheep meat, quality, consumers, behaviour, consumption, local market*

INTRODUCTION

The number of sheep in the U.E. 28 was 86.8 million heads in 2017, the largest growing countries being the United Kingdom (23.3 million heads), Greece (16 million heads) and Romania (10 million heads) [6].

In the period 2005-2014, almost all EU Member States recorded decreases in sheep herds, between 3 and 38%, except for Romania (+ 25%) and Greece (+ 4%) [7].

Various studies and statistics on meat consumption / capita show that the countries with the highest meat consumption per capita in 2019 were: USA (100.87 kg), Israel (89.99 kg), Australia (89.62 kg), Argentina (88.25 kg), Chile (81.33 kg), Brazil (78.85 kg), Canada (79.19 kg) [11]. The level of meat consumption of different types per capita is influenced by the production price, population income, cultural norms, religion, environmental protection norms and concern for health [18]. Worldwide, the highest consumption of sheep meat per capita was recorded in 2019 in Australia (6.18 kg), Turkey (4.26 kg), New Zealand (3.6 kg) and China (3.24 kg). A study published by FAO shows that the average global consumption of sheep meat / capita in 2015 was 2.1 kg, expecting its increase by 2030 to 2.4 kg [1, 16]. A study published in 2012 showed that EU countries with a consumption of more than 2 kg of sheep meat / capita in 2008 were Greece (11.1 kg), Great Britain (6.1 kg), Ireland (4.9 kg), Bulgaria (4.6 kg), Spain (3.8 kg), France (3.6 kg), Portugal (2.9 kg), Romania (2.3 kg) [10]. For Romania, the justification for the low consumption of sheep meat can be attributed to consumption habits and the relatively high price compared to poultry or pork. The distribution of consumption by types of meat worldwide in 2018 was as follows: pork, 40.1%, chicken, 33.3%, beef 21.4%, sheep and goat, 5.2% [15, 19].

In Romania there were in 2016 a number of 3,422,040 small farms, of which 25% were exclusively vegetable farms, and 71% (2,430,100) owned between 0-5 LSU (LSU = Livestock units. A LSU is equivalent to a dairy cow. The number of animals (heads) is converted into LSU using a set of coefficients

reflecting the feed requirements of the different animal categories.) The classification of agricultural farms in Romania according to UAA shows that in 2016, there were a number of 3,140,770 (91.8%) who owned less than 5 ha (UAA = Utilized agricultural area) [5]. The local taste, specific to gastronomic tourism is depend on different food genetic resources. Extensive sheep farming can make a major contribution to sustainable rural development [3, 17, 20].

Changes that may occur in consumer preferences for a particular type of meat or for switching to vegetarian or vegan diets, as well as concerns about the impact of animal husbandry on the environment may lead to major changes in meat consumption. Consumers are increasingly concerned about the treatments provided during animal husbandry, slaughtering and meat processing [12]. The study published in 2012 by Meulen, van der H. et al. shows that in the U.E. the number of sheep meat consumers under the age of 35 is also low and that the potential level of sheep meat consumption is influenced by factors such as the age profile of consumers, consumers' perception of the price of sheep meat compared to other types of meat [10]. There are differences in preferences for sheep meat consumption between the main regions of the country: higher requirements in the south-eastern part of the country where there are Greek and Turkish influences and in the centre of the country, an area with a tradition of sheep farming [8, 21]. The application of different promotion and advertising techniques can significantly influence the eating and buying behaviour of sheep meat [2, 4, 13, 14].

The main purpose of the paper is to know, how the younger consumers of Sibiu and Bucharest perceive the market of sheep meat and their habits regarding the purchase and consumption of this kind of meat.

MATERIALS AND METHODS

The paper is based on the study of various reports and different type of articles regarding the EU sheep meat production and meat quality.

To know the habits of young consumers regarding the purchase and consumption of sheep meat, a sociological survey was carried out, using as a working instrument a questionnaire, structured in four parts: 1. data on respondents; 2. data on the consumption of sheep meat in the family (number of persons in the family, number of persons consuming sheep meat in the family, frequency of consumption of sheep meat, form in which it is purchased and preferred commercial category, place of purchase, the person who is responsible for purchasing the sheep meat, the characteristics of the meat underlying the purchasing decision); 3. data on the consumption of sheep meat dishes (most often eaten, home-cooked sheep meat dishes, place of consumption of dishes made from sheep meat, person in the family which cooking this type of meat, knowledge of the benefits of sheep meat on human health); 4. data on the promotion of sheep meat consumption (the most important sources of information on sheep meat, the perception of the usefulness of the forms of promotion).

The demographic data regarding the respondents: sex, age, domicile, last graduated school, labour market status, field of activity, number of family members and income/family. After the elaboration of the questionnaire it was distributed online, and it was completed by 118 respondents (students) during the period April-June 2020. The data were systematized, statistically processed and interpreted.

RESULTS AND DISCUSSIONS

Few studies have been conducted at both international level and in Romania regarding the consumption of sheep meat.

Data on consumption preferences

Sheep meat is consumed by 92% of the respondents. People who do not eat mutton say they do not like its taste.

The young people investigated stated that they most often eat sheep meat on the occasion of the Easter holidays (55 people, respectively, 46.6%). However, it is observed that 10.1% of young people usually eat sheep meat at least

once a week, while 17.8% consume this type of meat 1-2 times during a month.

A significant share of respondents (45.7%) usually eat both lamb and meat from adult sheep, while 30.5% of respondents consume only lamb.

Habits related to sheep meat purchase

There are differences in the form in which sheepmeat is purchased. Thus, 32 people (27.1%) say they buy live animals, while 78 people (66%) buy carcass or carcass parts. Only 8 people (6.8%) prefer to buy sheep meat products.

Sheep comes from their own household in the case of 21 people (17.8%) or is bought directly from farmers by the families of 70 of the respondents (59.4%). Other places to buy this type of meat are agri-food markets (11%), hypermarkets (8.5%) or producers' shops (3.4%).

Almost 75% of those surveyed (73.8%) are willing to pay between 21 and 30 lei for a kilogram of sheep meat, while 26.2% believe that this type of meat should be paid less than 20 lei/kg.

In a study published in 2017 by Iliușiu E. et al. the main reasons for the decision to purchase sheepmeat are listed: taste, freshness, color, commercial appearance and shelf life [9].

In the present case, in order to find out which is the most important element taken into account when purchasing sheepmeat, the respondents chose: the shelf life (63.6%), the appearance and consistency of the meat (53.4%), the smell (59.3%) and meat color (42.4%). It follows that young people attach great importance to the shelf life as well as to the commercial aspect of the meat.

Sheep meat is bought fresh by 85.6% of respondents, while refrigerated or frozen meat is purchased by 5%. However, approx. 9.4% of those surveyed usually buy both types of meat.

The person in the family responsible for purchasing the sheep meat is most often the husband / father (for 60.2% of respondents), while this type of meat is purchased by the wife / mother in less than 25% of the families (21 ,2 %).

Data on sheepmeat dishes consumption

The most known and consumed in the family sheep dishes are: steak (75.4%), pastrami (67.8%), lamb tripe (63.6%), stew (52.5%), soup of lamb (50.8%), sausages (49.2%), grilled mutton (46.6%), kebap (32.2%) and shaorma (31.4%). Other dishes of this type of meat are very little known and consumed.

Among the sheep dishes that are bought in stores or eaten in restaurants, the respondents mentioned: sausages, pastrami, kebap, lamb on a whim.

Approx. 85% of respondents said that this type of meat is cooked and eaten at home, the most common dishes cooked in the family being lamb soup and steak.

In general, sheep meat is cooked in the family by both spouses (65.9% of cases), only by the wife (19.5%) or only by the husband (11%).

Consumer knowledge about the composition of sheepmeat and its health benefits

The answers provided by the respondents allow us to state that data on the composition of sheep meat are generally known.

Thus, 83.9% of respondents know that this type of meat has a high content of iron and zinc. Also, 75.4% of people know that this type of meat contains carnitine, responsible for energy production, and 68.6% admit the high content of Omega3 fatty acid. Based on the knowledge about the composition of sheep meat, 54.2% of respondents say that it is an easily digestible meat, and 45.7% that it is a natural aphrodisiac.

Data on the promotion of sheep meat consumption

The biggest influence on the consumption of sheep meat had on the respondents: family (74.6%), relatives and friends (52.5%), participation in traditional fairs (37.3%), participation in gastronomic events (32.2%).

It is noted that the most important means of promoting the consumption of sheep meat belongs to the family. This aspect is also confirmed by the fact that 64.4% of the respondents stated that they have knowledge related to sheep meat in the family. Information about sheep meat also comes from farmers (12.7%) or relatives / friends (7.6%). It should be noted that 15.7% of those

surveyed mentioned other sources of information.

In the view of those surveyed, the most important forms of promotion of sheep meat are very widely perceived. Thus, the advertising made from person to person is of the greatest importance or very important for 49.15% of the respondents. Online promotion is of medium or high importance in the case of 47.45% of respondents. The organization of specific meals to the sheepfold is perceived as having an average importance by 45.8% of respondents. Participation with a stand in profile fairs may have the greatest or greatest importance in promoting the consumption of sheep meat in the case of 45.8% of those surveyed. Culinary demonstrations may have the greatest or greatest importance in the view of 44.9% of respondents. At the same time, it is noted that 56.7% of respondents consider the distribution of leaflets and brochures is inefficient. On-farm product tasting can significantly contribute to the promotion of sheep meat consumption (48.3%), while organized tastings in public places are perceived as being of great importance only by 31.36% of those surveyed. A share of 47.45% of the respondents' state that the advertising in the media have a low efficiency, and 49.15% state that the documentary films fail to stimulate the consumption of sheep meat. Approx. 45% of those surveyed believe that events dedicated to the promotion of sheep species can have a high impact on the promotion of sheep meat consumption.

At the same time, 44.06% of those surveyed believe that specific tourist boarding houses can make a significant contribution to promoting the consumption of sheep meat.

The main characteristics of the studied sample are: 80.5% are young people, under the age of 30; the domicile of the respondents is in equal proportions both in the urban and in the rural environment; the families of the respondents consist of 3-5 people in the case of 77% of them; the average monthly income of the family is less than 6,000 lei (57.4%); the respondents have at least a high school diploma (62.7%) being currently students or master students of an agricultural faculty; In 73% of families there is at least one person who consumes sheep meat (Table 1).

Table 1. Demographic profile of respondents

Variable	Operational variable	Respondents distribution, number (%)
Sex	Male	57 (48,3)
	Female	61 (51,7)
Age	<20	28 (23,7)
	21-30	67 (56,8)
	31-40	9 (7,6)
	41-50	10 (8,5)
	51-60	4 (3,4)
Net income/month/ Family	2001-4000 lei	38 (31,9)
	4001-6000 lei	30 (25,5)
	>6000 lei	50 (42,6)
Number of persons in the family	2	18 (15,3)
	3-4	68 (57,6)
	5	23 (19,5)
	>5	9 (7,6)
Domicile	Urban	59 (50)
	Rural	59 (59)
Education level	High school	74 (62,7)
	University degree	34 (28,8)
	Post graduated	10 (7,6)
Number of people in the household who eat sheep meat	1	24 (20,4)
	2	31 (26,3)
	3	31 (26,3)
	4	18 (15,3)
	5	11 (9,3)
	6	1 (0,8)
	7	2 (1,7)

Source: Survey Data (2020).

CONCLUSIONS

In Romania, consumers prefer to buy mutton in carcass form directly from the farmers they know or from local markets, benefiting from lower prices. There is also an accentuated seasonality of the demand for mutton on the occasion of the Easter holidays and the autumn period.

In general, a growing segment of the young population is willing to pay an additional price for good quality meat.

Sheep meat is consumed throughout the year in the families of the young people investigated (27.9). It is purchased mainly fresh (85.6%) and comes from their own farm or from other farmers (77.2%).

The most well-known and consumed sheep meat preparations are lamb steak (75.4%) and pastrami (67.8). Sheep is cooked at home, in the family (85%). The young generation believes that the most effective way to

promote the consumption of sheep meat is the advertising made from person to person..

The data on the composition of sheep meat are generally known. The biggest influence on the consumption of sheep meat had on the respondents their family (74.6%), which also have the most important means of promoting the consumption of sheep meat.

The promotion of the consumption of sheep meat must be done in close connection with the activity on the farms. It is necessary to organize gastronomic events specifically for young people, attended by farmers, nutritionists, chefs, focusing on the beneficial effects of consumption on human health and environmental protection.

The organization of gastronomic events with specific, especially in areas with a tradition in sheep breeding, which promotes the consumption of sheep meat, contributes to the creation of a culinary culture.

Promoting the health benefits of eating sheep meat will determine the association of sheep meat with its quality and various nutritional benefits.

The future of the sheep sector depends on its ability to respond to the seasonal needs of sheep meat, improving the cooperative spirit along the supply chain and encouraging the certification of specialized niche products, registered as local, traditional or PDO and PGI products.

Promoting the consumption of sheep meat among young people contributes to the development of the sheep sector in particular and to sustainable rural development in general.

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THE MAIN CHARACTERISTICS OF AGRICULTURE AND RURAL DEVELOPMENT IN THE CENTRAL REGION OF ROMANIA

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Abstract

The paper presents the main features of agriculture and rural development in the Central Region. The Central Region consisting of 6 counties covers 14.3% of the country's territory. Mureș and Covasna counties have the largest share of rural space (over 87%). The agricultural area of the region (1,900.4 thousand ha) represents 13% of the existing area at national level. It has the following categories of use: arable 40%, pastures 34%, hayfields 25.3%, vineyards 0.5%, orchards 0.5%. In the Central Region there are approx. 394 thousand agricultural holdings. In 2018, the 56 thousand sheep farms in the region, owned 22.76% of the existing sheep farms nationwide. The 72 thousand cattle farms in the region owned 17.48% of the national cattle herd. Agriculture in the Central Region has an important and diversified natural potential. The share of the rural population in the region is 42.4%. The share of the population employed in agriculture and forestry in 2018 was 16.8% of the regional labor force. As at national level, the population employed in agriculture is aging and has a low level of education (96.4% of people in agriculture have only practical experience). Mureș County has the largest share in the value of regional agricultural production (24.2%). In 2019, four food products made in the Central Region out of the seven existing at national level were registered on the European quality schemes (PGI and PDO). The agri-food sector in the region is boosted by professional training courses for farmers, IT platforms that connect small farmers and buyers, the organization of fairs, exhibitions, culinary and agricultural festivals.

Key words**:** *animal breeding, agriculture, rural development, sustainable development, education, certified products and traditional recipes*

INTRODUCTION

The Central Region occupies an area of 34,100 km^2, which represents 14.3% of Romania's territory. The counties that belong to the Center Region are Alba, Brasov, Covasna, Harghita, Mures and Sibiu. According to National Institute of Statistics (NIS) data, the population of the Central Region, at the beginning of 2016, was 2.3 million inhabitants, with a density of 69 inhabitants/sq km. The Central Region ranks first place at national level in sheep farming and in the cultivation of sugar beet, potatoes, hops, green fodder, hemp and flax for textile fibers. The Central Region also ranks 3rd position at national level in cattle farming and rye cultivation [1, 2, 3].

MATERIALS AND METHODS

In order to write this work, a number of specific agricultural indicators were analysed, such as: the share of rural space by counties; categories of use of the agricultural area; herds of animals by species; number of agricultural holdings; competitiveness of the agricultural sector; population employed in agriculture; the level of education of the population employed in agriculture; the value of agricultural production. Also, local products and traditional dishes from the region were identified. Examples were given of institutions and organizations in the Central Region involved in education, training and innovation in the agri-food field. Statistical data and information needed for the analysis of those indicators in the Central Region were taken from the National Institute of Statistics (NIS); Ministry of Agriculture and Rural Development (MARD); National Agency in Zootechny; National Commission of Statistics; Centre Development Agency. In order to realise this paper numerous specialized bibliographical references have been consulted.

RESULTS AND DISCUSSIONS

Geographical delimitation of the analyzed rural environment

The geographical delimitation of the rural environment analyzed at the level of the Central Region was based on the criterion of administrative-territorial division, which thus supports the statistical information. Thus, the counties with the largest share of the rural area are Mureș and Covasna (almost equal), followed by Harghita County (Figure 1). At the opposite pole is Brașov County, followed by Alba and Sibiu.

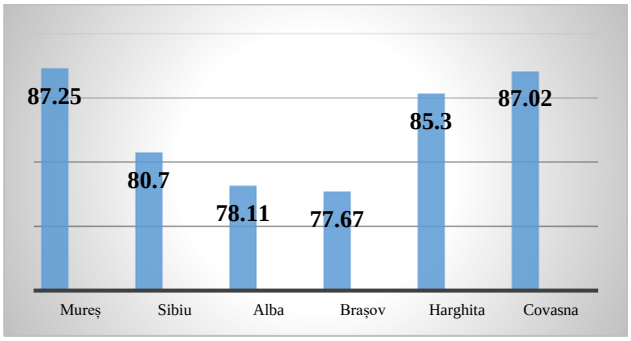

Fig. 1. The share of rural space in the counties of the Central Region (%)
Source: own design based on the statistic data from [3].

At the end of 2015, there were 357 communes in the Central Region. These represent 12.5% of the total number of communes in Romania. These communes belong to 1,788 villages, which represent 13.8% of the total number at national level. Most communes are in the counties of Mureș (91) and Alba (67), and the fewest in the counties of Covasna (40) and Brașov (48) [3].

The agricultural area of the Central Region

The agricultural area of the Central Region is 1,900.4 thousand ha representing 55.7% of the total area of the region and 13% of the agricultural area of Romania.

According to the mode of use, the structure by categories of the agricultural area is: arable 40%, pastures 34%, hayfields 25.3%, vineyards 0.5%, orchards 0.7%.

As can be seen from Table 1, the largest shares of agricultural areas are recorded in Mureș and Harghita counties (61.2% respectively, 59.6% of the total area). Harghita County has as a share, the largest areas of pastures and hayfields (approximately 80% of the agricultural area), and the smallest area is in Covasna County (50.1% of the total area). Covasna County has the largest area covered by forests and forest vegetation (44.5% of the total area).

The cultivated area at the level of the Central Region, by crops was in 2018 the following : fodder 33%, corn 30%, wheat and rye 17%, potatoes 7%, barley and barley 6%, vegetables 3%, sunflower 2% and beets 2 % [1].

Table 1. The structure of the Agricultural Surface of Centre Region at the end of year 2015 (ha)

	Total surface	Agricol Surface	From which :				
			Arable	Pastures	Meadow	Vineyard	Orchards
Romania	23,839,071	14,684,963	9,422,529	3,313,785	1,528,046	215,382	205,221
Reg. Centre	3,409,972	1,909,376	769,004	641,985	475,174	9,080	14,133
Alba	624,157	328,164	131,608	119,562	71,585	4,493	916
Brașov	536,309	282,698	123,749	97,086	60,440	3	1,420
Covasna	370,980	186,172	83,327	60,932	40,899	-	1,014
Harghita	663,890	396,538	91,716	146,962	157,060	35	765
Mureș	671,388	410,250	221,563	109,618	72,265	1,879	4,925
Sibiu	543,248	305,554	117,041	107,825	72,925	2,670	5,093

Source: own calculation, based on the statistic data from [2, 3, 14].

Exploitation of meadows in the Central Region

The Central Region ranks 1st place atnational level in terms of grassland. By sustainably capitalizing on mountain pastures, livestock could be significantly increased, while maintaining their current area. The maintenance and exploitation of grasslands must comply with the requirement to maintain biodiversity [19].

Animal breeding in Region Centre

Animal husbandry is relatively well developed in all counties of the region. In the mountainous area, the large areas of natural

pastures and meadows are favorable for animal husbandry, constituting the main agricultural activity. Sheep farming, a traditional activity of the inhabitants of the Cindrel Mountains, the Sebeș Mountains and the Bran area, has been in slight decline in the last decade due to the difficulties regarding the capitalization of the production. Mureș and Harghita counties are famous for the quality of their cattle. Mureș County also has a strong pig breeding sector. Poultry farming has registered a strong development in recent years by building large and modern farms, located mainly in the counties of Alba and Brasov. A significant number of the approximately 394 thousand farms in the Central Region owned livestock. Thus, in 235 thousand farms were registered birds, 145 thousand farms owned pigs, about 72 thousand farms raised cattle, almost 56 thousand households had sheep and 52 thousand farms were registered horses [2, 3, 15]. The total number of animals registered in the Central Region in 2018 was: 2.31 million sheep, 141 thousand goats, 374 thousand pigs, 345 thousand cattle, 53 thousand horses, 211 thousand bee families and almost 8 , 5 million bird heads. It is noteworthy that in the Central Region grow 22.76% of sheep and 17.48% of existing cattle at national level [1]. At the county level, most cattle were registered in Harghita and Mureș, and the largest herd of dairy cows was registered in Brașov and Harghita counties (Table 2) [3].

Table 2. Total number of cattle at national level and in the Central Region (heads, 2016)

Specification	Total	of which:		
		State sector	Privat sector	Family farms
National level	**2,163,050**	**6,050**	**2,157,000**	**1,943,273**
Centre Region	**373,810**	**7,606**	**372,254**	**319,029**
ALBA	64,203	101	64,102	54,627
BRASOV	59,425	789	58,636	47,246
COVASNA	39,710		39,710	39,710
HARGHITA	89,089		89,089	1,943,273
MURES	71,601	456	71,145	319,029
SIBIU	49,782	210	49,572	54,627

Source: own calculation, based on the statistic data from MARD [16].

The largest flock of sheep is found in Sibiu County, most pigs in Brașov County, and the counties were ranked first places for birds were Brașov, Mureș and Alba. (Table 3 and 4) [18].

Tabel 3. Total number of sheep at national and Central Region level as at 30 June 2017 (heads)

Counties	Total	Public	Private	Family farms
TOTAL	**13,770,857**	**20,259**	**13,750,558**	**13,222,785**
Centre Region	**2,847,975**	**1,672**	**2,842,293**	**2,766,762**
ALBA	478,072	0	478,072	476,000
BRASOV	573,225	0	573,225	516,750
COVASNA	216,900	0	216,900	216,900
HARGHITA	318,642	0	318,632	313,462
MURES	626,619	1,397	625,222	623,000
SIBIU	634,517	275	634,242	620,650

Source: own calculation, based on the statistic data from MARD, Accesed on 20th september 2020 [16].

Table 4. Total number of pigs at national and Central Region level, 2016 (heads)

Counties	Total	of which:	
		State sector	Family farms
TOTAL	**3,757,212**	**11,518**	**2,014,165**
Centre Region	**380,757**	**188**	**226,849**
ALBA	89,798	188	84,979
BRASOV	115,851	-	42,700
COVASNA	31,673	-	31,673
HARGHITA	29,207	-	28,526
MURES	71,750	-	19,940
SIBIU	42,478	-	19,031

Source: own calculation, based on the statistic data from MARD [16].

According to the existing data on the specialized website of the National Agency for Animal Husbandry, at the level of the Central Region there are several breeding companies that keep genealogical registers for purebred animals. Their number at the level of the central region and by species is: cattle: 3, buffaloes: 1, horses: 1; sheep: 1 [6].

Accredited associations for the control of their own individual performance of breeding animals (6 for cattle, 1 for sheep and 1 for goats) also operate in the region [6].

Competitiveness of the Agri-Food sector in the Central Region

The turnover of the agri-food sector is approx. 7% of the total Central Region. The highest share of the value of agricultural production in the regional total had in 2017 Mureș County (25%) [1].

Population employed in agriculture in the Central Region

In the Central Region, the share of urban population is 57.6%, which places it among the most urbanized regions of the country.

The main occupation of the rural inhabitants of the Central Region is agriculture, which benefits from an important and diversified natural potential.

The population employed in agriculture at the end of 2014 represented almost 23% of the total employed population of the region. Only a small part of them had the status of employees. In 2018, the share of the population employed in agriculture and forestry was 16.8% of the regional labor force [1, 2].

Table 5. Population employed in agriculture and forestry at the end of 2014 (thousand people)

	Totally employed population	Population employed in agriculture and forestry	No. average of employees in agriculture, and forestry
Centre Region	1,026.4	230.5	12.98
Alba	159.6	45.3	2.77
Brașov	240.5	29.3	2.98
Covsana	83	23.1	1.66
Harghita	130.5	40.7	1.77
Mureș	230.2	65.5	2.34
Sibiu	182.6	26.6	1.46

Source: own calculation, based on the statistic data from NIS [15].

Proportionally, the largest population employed in agriculture in 2018 was in the counties of Harghita (23.6%), Mureş (21.8%) and Alba (21.6%), and the lowest in the counties of Brașov (9, 11%) and Sibiu (10.6%).

Table 6. Structure of the population employed in agriculture by age in 2013 (%)

	Under 35 years old	Between 35-54 years	Over 55 years
Romania	4.7	30.8	64.4
EU28	5.9	37.7	54.9

Source: own calculation, based on the statistic data from Eurostat [11].

As shown in various specialized studies and according to the European Commission's indicators on the age structure of the population employed in agriculture, it is observed that both at European level and especially in Romania, the population employed in agriculture is aging [17, 22].

Another feature that characterizes the population employed in agriculture is the low level of education. Most people have only practical experience. The phenomenon is observed in all European Union countries, but in Romania it is more accentuated.

Thus, at the level of the Central Region 96.4% of the population employed in agriculture have only practical experience, 3.1% have basic training and only 0.5% have complete agricultural training [1].

The value of the agricultural production of the Central Region

In 2014, the value of the agricultural production of the Central Region was 8,989 million lei, representing 12.1% of the value of Romania's agricultural production, 11% of the value of vegetable production, 14.5% of the value of animal production and 7.3% of agricultural services.

Mureș is the county with the highest share of the value of regional agricultural production (24.2%) followed by Alba county (almost 20%), and Covasna and Sibiu counties with the lowest share (12.6% and 11.7% respectively).

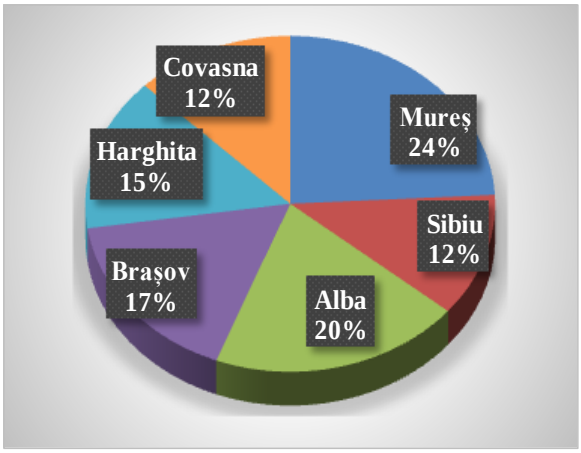

Fig. 2. The share of counties in the value of regional agricultural production achieved in 2014
Source: own design based on the statistic data from [2, 3].

Agriculture is an area of interest of foreign investment funds for the purchase of land and

farms, but also for their cultivation and operation. The land in Romania has major advantages for investors, due to the fact that there are very large areas of land that can be included in the area of organic crops, which raises the price of the final product. Another advantage is the price of agricultural land, which is quite low compared to other European countries.

Local, traditional and culinary products and recipes originating from the Central Region recognized at national and European level

For the implementation of agricultural policies, the so-called quality schemes were created at national and European level: traditional product, Romanian traditional recipe, protected designation of origin (PDO), protected geographical indication (PGI), guaranteed traditional specialty (TSG), mountain product.

At national level, 1,719 food products are certified under these quality schemes [4, 5, 19, 20, 23, 24].

In 2015, out of the total of 542 traditional products existing in the National Register of Traditional Products (RNPT), approximately 45% or 242 traditional products are from the Center Region. The largest number is meat products (104), followed by dairy products (60), bakery and pastry products (52). The county with the most registered traditional products is Brasov (158 traditional products), followed by Alba county (48 traditional products) and Covasna county (21 traditional products) [2, 3].

In 2016, at national level, there were 116 well-known Romanian recipes registered, out of which 21 by companies with headquarters in the Central Region. Most products are milk (9 products) or meat (9 products) followed by bakery products.

In 2020, 255 producers with 1,021 products certified on this quality scheme are registered in the National Register of Mountain Producers [5].

Regarding the food products recognized at European level, Romania had in 2019 seven products. Among them, the following products come from the Center Region: Telemea de Ibănești (DOP), Telemea de Sibiu, Novac smoked from Ţara Bârsei and Salam de Sibiu (IGP) [1, 2, 4, 5].

Education, training and innovation in agriculture in the Central Region

Vocational training and innovation in agriculture in the Central Region is provided by various institutions and organizations, including: Adept Foundation, Mihai Eminescu Trust Foundation, AgroEco Viscri Association, World Vision Romania Foundation (demonstration farm and agricultural training and consulting center - Agrovision Crit farm), farmers' associations, departments of the Agency for Payments and Interventions in Agriculture and of the County Directorates of Agriculture and Rural Development [12, 13, 25]. In the last 20 years they have implemented hundreds of projects with different funding for farmers' training, marketing of agricultural products, biodiversity conservation, food security and rural development.

The profile faculties in the Central Region that train specialists in the field of agriculture and food industry provide theoretical and practical training in a classic or online system [7]. Also, in collaboration with various institutions, higher education teachers have provided vocational training courses for farmers in the region.

At the level of the Central Region there are three research institutes and five research stations [1].

Innovation in agriculture can be exemplified by the creation of the “malltaranesc” IT platform of the Growing Romania Together Association. This is an interface between manufacturers and buyers, the products ordered online can be delivered by courier. On the platform are offered over 600 certified products made by approx. 1,300 farmers and craftsmen [8].

Another example of continuing consumer education on local products and gastronomy and contribution to rural development is the activity of the My Transylvania Association. Their values are sustainability, connection with nature, sustainable development, involvement and continuing education [9]. The association organizes alternative events

and implements innovative projects aimed at supporting small local producers. The online store "Eat Local" has recently been launched, through which food can be bought directly from producers.

In the sustainable management of the forest fund of the region, solutions based on information technology are proposed, which start from the identification of needs and offer viable, high quality, open source solutions [10].

The promotion of local, traditional or ecological products, the organization of events in rural areas and vocational training contribute to the sustainable development of the agri-food sector [21, 23, 24].

CONCLUSIONS

Strengths of the agricultural sector in the Central Region

The Central Region occupies top positions in the following sub-domains of agriculture:

- 1st place at national level: sheep herds, cultivation of sugar beet, potatoes, hops, green fodder and hemp and flax for textile fibers,
- 2nd place at national level: cultivation of tobacco and alfalfa,
- 3rd place at national level: herds of cattle, cows, buffaloes and heifers and rabbits and rye cultivation;
- Out of the 100 strongest Romanian brands, 14 are brands from the food industry in the Central Region;
- Presence of active clusters that support businesses in the regional agri-food sector;
- It has products and recipes originating from the Central Region recognized at European level.
- Also, of the Romanian food products recognized on different European quality schemes, four originate on the territory of the Central Region;
- The agri-food sector in the Central Region is stimulated by organizing fairs, exhibitions, culinary and agricultural festivals;
- There are opportunities for initial and continuing training in agriculture and the food industry.

Challenges for the agricultural sector in the Central Region:

• Subsistence agriculture predominates, and this results in a series of efficiency problems;
• The population working in the field of agriculture is aging and with a low level of education.

Recommendations

Research institutes and stations can be involved in the development of sub-domains within the agricultural sector of the Central Region by ensuring quality seeds, providing specific technologies and equipment, developing good practice guides (particularly for improving grasslands).

There is a need to preserve valuable local genetic material: creating a seed bank and maintaining indigenous breeds of animals (especially sheep). The Central Region has a comparative advantage over potato crops, sugar beet, medicinal plants.

To support local animal breeders, they should be encouraged to develop their own capacity to capitalize on raw materials of animal origin.

It is necessary to certify on different quality schemes the products obtained in small farms, especially those in the mountain area.

It is necessary to educate children and inform consumers about the benefits of consuming certified products. By consuming local products, especially mountain dishes, we contribute to the maintenance of traditional agricultural activities. This leads to the development of mountain households, as well as the maintenance of the population in mountain areas.

There is a need for vocational training of small farmers, including for the higher use of agricultural products and the involvement of educational institutions in this type of activity.

Research topics should focus on agricultural applications of research conducted at the level of technical universities in the region.

Actions are needed to increase the safety of local agricultural products.

It is necessary to make agriculture profitable, to develop related economic activities, to create viable economic alternatives in rural areas.

In order to make better use of the products made in the Central Region, it is necessary to set up zonal centers for processing agricultural

products of animal origin under the subordination/supervision of the relevant authorities. These would be an important support for small farmers and an additional guarantee for consumers in terms of food safety.

Applied research could help to stimulate the association of small agricultural producers in order to streamline the supply and sale of their own products (eg agricultural warehouses).

Projects can be implemented to improve the marketing of local products and to educate consumers about local food and products.

Local governments must continue to be involved in organizing promotional events and farm visits. Through these local events we can strengthen consumer confidence and attachment to regional agri-food products (the concept of "open farms" for students, promoting authentic agrotourism).

Innovation in the agri-food sector needs to create applications on the phone to inform farmers about different technical solutions. Digital and automation applications are needed for farm management. They may include staff training programs or advisory services for farmers.

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ANALYSIS REGARDING THE EVOLUTION OF THE CEREAL SECTOR IN THE NORTH-EAST REGION OF ROMANIA

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Abstract

This paper analyzed the evolution of the cereal sector in the North-East Region of Romania, in the period 2015-2019. In order to carry out a more realistic study, a series of quantitative indicators specific to the cereal sector were analyzed. Also, the factors that directly influenced the results obtained in this sector were highlighted. In the North-East Region, the corn crop is on the first place in the ranking of cereal crops. This culture also holds a significant place at the macro-regional level. In 2019, in the North-East Region, 464,008 ha were cultivated with corn out of a total of 966,729 ha, cultivated in Macroregion Two, which represents 48%. A significant role in the economy of the cereal sector in the North-East region is played by the wheat culture. In this region, in 2019, 25.78% of the areas related to this cereal crop registered at the level of the Macroregion Two were cultivated. The largest productions were made at the corn crop. The productions made for this crop in 2019 were differentiated at the level of the counties in this region. The increase of the productivity of all medium and long-term cereal crops will be possible if farmers adopt an agriculture, in which new technologies will occupy a central place. The data used in the paper were collected from the National Institute of Statistics.

Key words**:** *cereal area, cereal production, Romania, North-East Region*

INTRODUCTION

The North-East development region of Romania (Figure 1) is located in the North-East part of the country, with an area of 3,684,983 hectares, which represents over 15% of the registered area at national level. This region consists of six counties, 506 communes and 2,414 villages. The counties that are found in this development region are: Bacău; Botoșani; Iași; Neamț; Suceava and Vaslui.

According to the published information, a series of economic activities are practiced in the rural area of the North-East development region, which have a special impact on the regional economy, as follows:

-cultivation of cereal, sugar beet and potatoes in most counties;
-pomiculture (Suceava, Iași, Neamț);
-viticulture (Bacău; Vaslui, Iași);
-livestock;
-wood exploitation and processing (Neamț, Bacău and Suceava).
-rural tourism (Neamț, Suceava and Bacău).

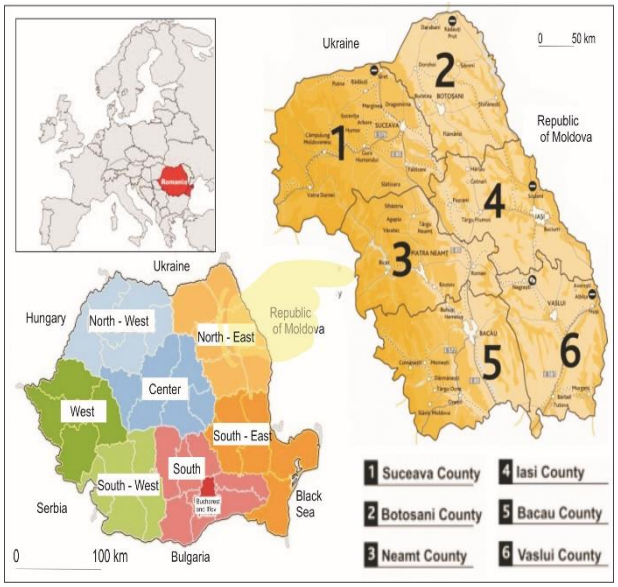

Fig. 1. Map of the North-East Development Region
Source: own processing from GIS open sources.

In the North-East development region, the cereal culture is present in all the component counties, but in different proportions. In this sense, according to statistical data, the most significant areas cultivated with grain cereals are found in the counties: Botoșani; Iași and Vaslui. Regarding the yields obtained for cereal crops, on the one hand, they varied from one year to another, and on the other hand they varied from one county to another. The change in cereal production was due to several factors, such as: organic; technological and ecological. Larger cereal products could be obtained if in this region the arrangements for irrigation were used at maximum. It should be noted that in the North-East region a little over 6% of the agricultural area has irrigation facilities [10, 16, 2, 1].

In this region, the cereal crop occupies important areas, because the soils here are suitable for such crops, but also because there is workforce for this sector. Cereals from this region, as well as from other development regions of Romania are sold both on the domestic market and on the foreign market [4, 5, 14, 17]. Cereals are so in demand because they represent the staple food for a large part of the world's population, being used in various forms. Another significant aspect is that cereals are the raw material for other sectors of activity, but also animal feed [6, 7].

In general, cereals have a number of characteristics that place them in the group of the most appreciated and valuable plants, because they represent the central support for human life and their activity. In this sense, it is important to mention the 1: 6 ratio between proteins and carbohydrates, which has a beneficial impact on the human body [9, 15].

Both at national and regional level, an important indicator for the agricultural sector is the value of agricultural production. At national level, in 2018, the value of agricultural production was 86.349 million lei (current prices). Higher values were recorded in the regions: South-Muntenia, South-East and North-East.

The North-East development region in 2018, is positioned on the 3rd place in terms of the value of agricultural production, namely, 13,652 million lei, of which: 9,092 million lei for vegetal production and 4,475 million lei for animal production. The production of cereals also had a significant contribution in the vegetal production [12].

MATERIALS AND METHODS

The present research is focused on the evolution of the main cereal crops identified in the North-East region of Romania. The key indicators that were the basis for achieving the results in the cereal sector in this development region were analysed. In order to achieve the previously stated objective were analysed: areas cultivated with the main categories of cereals at the regional level, in the period 2015-2019; areas cultivated with corn in 2019, in the counties of the North-East Region; areas cultivated with wheat in the counties of the North-East Region, in 2019; cereal productions made at regional level during 2015-2019; corn production made in the counties of the North-East Region of Romania, in 2019; wheat production obtained in 2019, in the counties of the North-East Region.

The data processed in the paper were provided by the National Institute of Statistics through the Tempo online database, for the period 2015-2019.

In order to highlight, as concisely as possible, the research results were used to present them in graphic and tabular form.

RESULTS AND DISCUSSIONS

According to the data published by INS, in 2014 the agricultural area of the North-East Development Region was 2,124,775 ha, respectively 47.73% of the total registered by Macroregion Two. The largest areas were found in the counties: Vaslui (400,721 ha); Botoșani (392,761 ha) and Iași (381,256 ha), and the smallest in Neamț County (281,649 ha).

Within the North-East Development Region, the arable area had the largest share (65%), ie 1,381,790 ha and was followed by pastures with 491,639 ha (23%). Vineyards and orchards recorded the lowest percentages, of 2% and 1%, respectively (Figure 2).

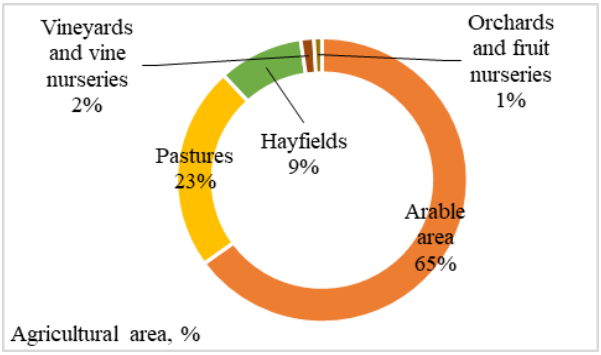

Fig. 2. Agricultural area of the North-East Development Region, by categories of use (%)
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

By categories of land use, the largest areas were found as follows: arable (298,741 ha) in Botoșani county, pastures (90,512 ha) in Suceava county; hayfields (74,179 ha) in Suceava County; vineyards and vine nurseries (11,679 ha) in Iași county and orchards and fruit nurseries (6,783 ha) in Iași county.
From the presented statistical data, it is found that, among the field crops, the most cultivated cereal in the period 2015-2019, in the North-East Development Region was the corn for grains. It registered the largest area in 2016, of 479,687 ha. In the top of cereal crops in this region are positioned the following crops such as: wheat (168,028 ha in 2015); oat (35,605 ha in 2015); barley (30,840 ha in 2017) and rye (3,859 in 2018) (Figure 3).

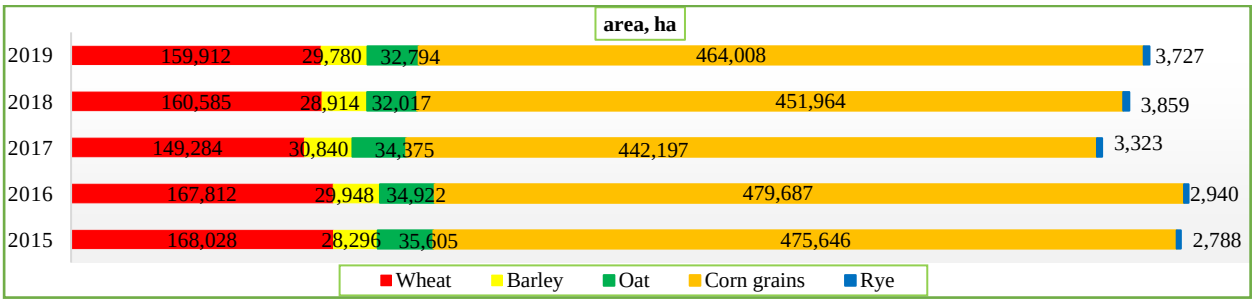

Fig. 3. Dynamics of cultivated areas with the main cereal crops in the North-East Development Region
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

In 2019, compared to 2015, a differentiated evolution of the areas cultivated with cereals was noticed at the level of the North-East Development Region. There were decreases for the areas cultivated with corn, wheat and oats, and the largest percentage decrease was being recorded for oat, of 7.89% (Table 1). Unlike the previously mentioned decreases, there were also increases of the cultivated areas with barley by 5.24%, in 2019, compared to 2015. Also for the same analysis period, there was an increase of the cultivated areas with rye 33.68%. Another significant aspect is represented by the fact that the surfaces cultivated with cereals in the North-East Region underwent significant mutations in the analysed period compared to 1990, according to the published statistical data. For example, in 2019, compared to 1990, the following changes were found: the areas cultivated with corn and oat increased by 22.73% and 128.07%, respectively, while for wheat and barley the cultivated areas decreased by 52.97% and 53.07%, respectively. These changes were caused by a number of endogenous and exogenous factors.

Table 1. Areas cultivated with main cereals, 2015-2019 (ha)

Specifi-cation	2015	2016	2017	2018	2019	2019/ 2015 %
Corn	475,646	479,687	442,197	451,964	464,008	97.55
Wheat	168,028	167,812	149,284	160,585	159,912	95.17
Oat	35,605	34,922	34,375	32,017	32,794	92.11
Barley	28,296	29,948	30,840	28,914	29,780	105.24
Rye	2,788	2,940	3,323	3,859	3,727	133.68

Source: Own calculation based on NIS, Tempo On-line Database, 2020, [13].

An important role in substantiating the decisions of the main economic agents operating in the cereal sector both at regional and national level, was played by exogenous factors [3]. Among them it is necessary to mention: the demand for certain categories of cereals manifested on the market; competitive pressure and commercial practices specific to

this sector of activity; market situation; the size of the subsidies; legal and economic framework, etc.

In 2019, within the North-East Development Region, 48% (464,008 ha) of the total areas established with corn in Macroregion Two (966,729 ha) were cultivated. This culture was found in all the counties that make up the North-East Development Region (Figure 4), but in Botoșani County the largest area was found, of 108,669 ha. At the opposite pole was Suceava County, with 37,759 ha.

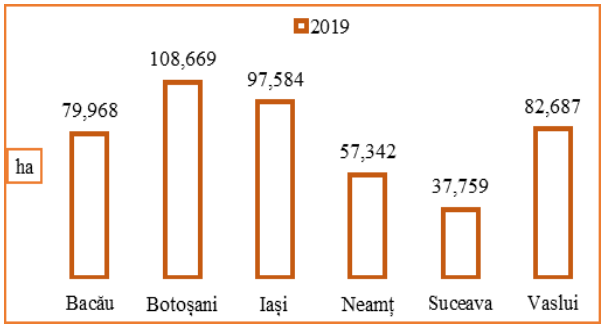

Fig. 4. Areas cultivated with corn for grain in the counties of the North-East Development Region
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

Compared to 1990, NIS showed that the areas cultivated with corn for grain increased in all 6 mentioned counties, on average, by 30% (Figure 4). For wheat cultivation, the situation was as follows in 2019: in the North-East Development Region, 25.78% (159,912 ha) were cultivated, out of the total areas established with wheat in Macroregion Two (620,334 ha). The counties with the largest areas were Vaslui (36,687 ha) and Iași (36,018 ha), and the smallest areas were found in Bacau County (15,371 ha) (Figure 5).

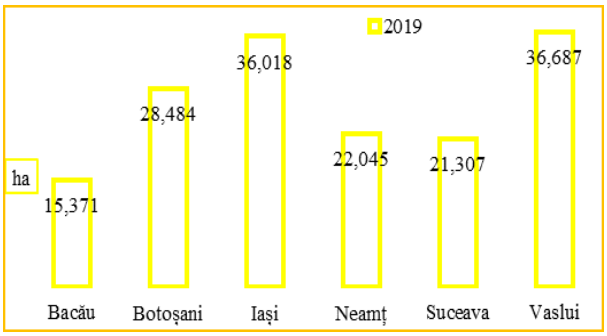

Fig. 5. Areas cultivated with wheat in the counties of the North-East Development Region
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

From the analysis of the data presented by NIS, compared to 1990, for the wheat crop, the areas established with wheat in the 6 counties of the North-East Development Region decreased, on average, by 50%.

Figure 6 shows the productions obtained for the main cereal crops established in the period 2015-2019. For 2019, the following were obtained: 2,683,185 tons of corn grains; 644,769 tons of wheat; 91,546 tons of barley; 67,170 tons of oat and rye 10,700 tons.

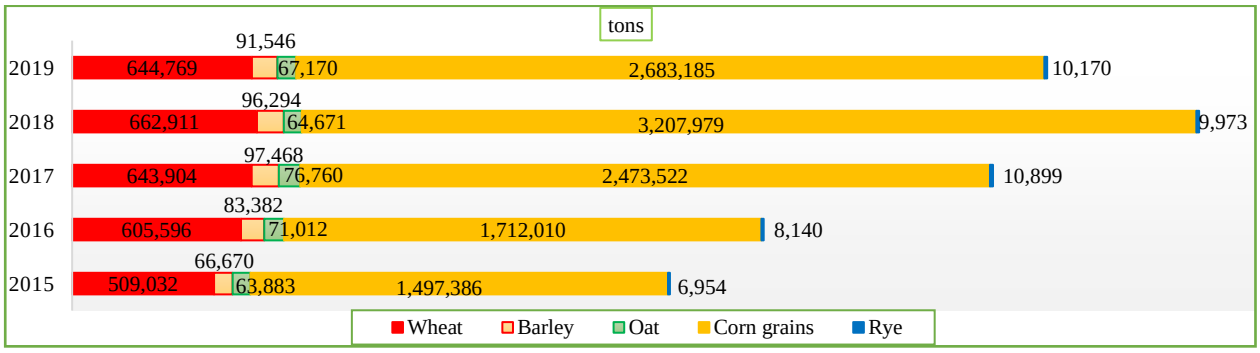

Fig. 6. Dynamics of productions obtained for the main cereal crops in the North-East Development Region;
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

The year 2018 meant for corn grains and wheat the obtaining of the largest productions in the analysed period, as follows: 3,207,979 tons for corn grains and 662,911 tons for wheat. For oat and barley, in 2017 reference productions were made for the period 2015-2017. Thus, 97,468 tons of barley and 76,760 tons of oat were harvested. For the rye crop, a maximum production was reached, also in 2017, of 10,899 tons.

In the productions obtained in 2019, there were increases for all important cereal crops,

compared to 2015 (Table 2). The highest increase was registered for corn, of 79.19%, and the lowest for oat, of 5.15%.

Table 2. Productions obtained for the main cereal crops, 2015-2019 (tons)

Specification	2015	2016	2017	2018	2019	2019/2015 %
Corn	1,497,386	1,712,010	2,473,522	3,207,979	2,683,185	179.19
Wheat	509,032	605,596	643,904	662,911	644,769	126.67
Oat	63,883	71,012	76,760	64,671	67,170	105.15
Barley	66,670	83,382	97,468	96,294	91,546	137.31
Rye	6,954	8,140	10,899	9,973	10,170	146.25

Source: Own calculation based on NIS, Tempo On-line Database, 2020, [13].

In order to highlight as well as possible, the evolution of cereal productions in the North-East region, it is necessary to specify a positive aspect, namely, that there were significant increases in 2019 compared to 1990: corn and oat. These increases in production were mainly due to: the application of modern cultivation technologies and the use of qualitative varieties and hybrids. For wheat and barley, the productions decreased by 34.70%, respectively 52.15%, simultaneously with the decrease of cultivated areas [13].

In the period 2015-2019, cereal crops benefited at national level from a series of forms of support that stimulated the economic agents in the cereal sector. The main forms of support were: direct payment schemes; transitional national aid; state aid for the gasoline used in agriculture [11]. The main forms of support granted at national level, together with the direct contribution of endogenous factors, have led, on the one hand, to the increase of the surfaces afferent to the cereal crops, and on the other hand, to the increase of the realized yields. Among the contributing endogenous factors in this sector we mention: equity; the level of qualification of the personnel from agriculture; technical equipment; modern production technologies; farm management, etc. [3].

In 2019, the productions of corn grains within the counties afferent to the North-East region registered different values. The most significant production was registered in Botoșani county (656,634 tons), and the lowest was registered in Suceava county (213,450 tons) (Figure 7). In 2019, in Botoșani County, 24.47% of the total production achieved in the North-East region was achieved.

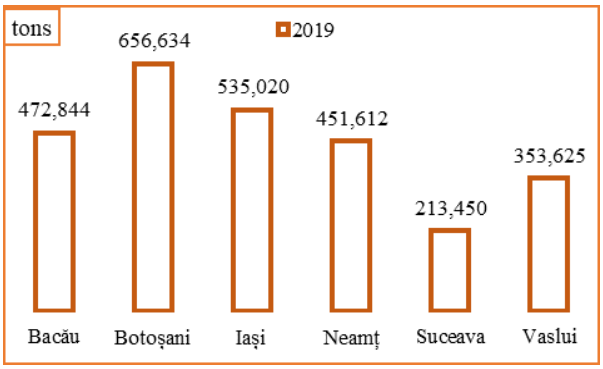

Fig. 7. Obtained productions of corn grains in the counties of the North-East Development Region
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

The wheat productions realized in the counties from the North-East region varied between 59,109 tons-146,955 tons, in 2019 (see Figure 8). From the statistical data presented and analysed it emerged that Iasi County achieved the highest wheat production, of 146,955 tons, representing 22.79% of the production achieved in the North-East region.

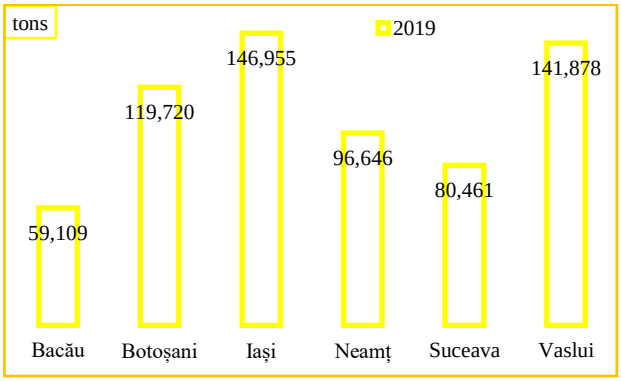

Fig. 8. Obtained productions of wheat in the counties of the North-East Development Region
Source: Own processing based on NIS, Tempo On-line Database, 2020, [13].

Currently, both nationally and regionally, economic agents in the cereal sector want an upward trend in productivity, due to the growing demand both domestically and externally. In order to achieve this goal, there is now a huge opportunity for Romanian farmers, namely, the practice of "precision

agriculture". This type of agriculture is in fact an innovative agriculture that is mainly based on the application of new technologies.
The practice of this type of agriculture presents a series of advantages for the farmers in the cereal sector such as: the efficient use of all the production factors used; cost reduction; profit increase, etc. [8]. It is necessary to emphasize the fact that the practice of this type of agriculture presents a major disadvantage, namely, the high prices for the new technologies. In this context, farmers will be aware of the need for association in agriculture, in order to adapt more easily to market requirements.

CONCLUSIONS

Going through the information presented in the paper, regarding the cereal sector in the North-East development region of Romania, a series of conclusions were drawn:
-Grain corn ranks first in cereal crops. The area cultivated with corn reached a maximum point in 2016 (479,687 ha);
-In 2019, compared to 2015, there was a small decline in areas cultivated with corn. These areas decreased by 2.45%;
-In opposition with corn was the area cultivated with rye. It registered the smallest area, of 2,788 ha (2015). However, in 2019, there was an increase in area by 33.68%, compared to 2015;
-Corn cultivation is present in all counties within this region, but in different proportions. Thus, at the level of 2019, Botosani county registered the largest cultivated area with corn, of 108,669 ha. The smallest area with corn, also for 2019 was registered in Suceava County (37,759 ha);
-The areas cultivated with wheat in the counties from this region, in 2019, varied between 15,371 ha (Bacau) - 36,687 ha (Vaslui);
-Regarding the areas cultivated with wheat in 2019, compared to 1990, in the counties in this region, there was a decrease, on average by 50%;
-The productions made for the main cereal crops varied during the analysed period. The most significant productions were registered in 2018, for corn grains (3,207,979 tons) and for wheat (662,911 tons);
-In 2019, there was an increase in grain production by 79.19, compared to 2015;
-The lowest yields were recorded for rye culture. This ranged from 6,954 tons (2015) - 10,899 tons (2017);
-Botoșani County, in 2019, ranked first in the production of corn made with 656,634 tons, respectively 27.47% of the total production made in the North-East region;
-Iasi County achieved the highest wheat production (146,955 tons) in 2019, compared to the rest of the counties in the North-East region.
In order to increase the competitiveness of the cereal sector in the North-East Region of Romania, it is necessary for farmers in this sector to turn more and more to the practice of a modern agriculture, in which the use of new technologies is the key element.

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DEVELOPMENT OF ECOLOGICAL BEEKEEPING IN BULGARIA: STATUS AND PROSPECTS

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Abstract

In recent years, organic production has been one of the sectors that has grown in terms of areas, animals and number of people involved in a control system, successfully applied in Bulgaria, even in times of crisis. The reasons why organic production develops favourably are diverse and are related to the recognized benefit for the development of rural regions and the environment, as well as to the need and preferences of consumers for healthy and quality foods and also to the excellent prerequisites for the development of organic production in Bulgaria and the support of organic producers under the Rural Development Programme. The aim of this article is to analyze the status and development of organic beekeeping in Bulgaria, as well as to highlight some issues faced by organic livestock sector, and thus to stimulate and encourage the development of the potential Bulgarian organic beekeeping. The research is based on official statistical data of Ministry of Agriculture, Food and Forestry. Bulgaria is a traditional producer of different types of organically certified honey with excellent quality indicators and a large part of the production is exported to the world market. There is a need for research, analysis and evaluation of the status of ecological beekeeping in Bulgaria.

Key words**:** *organic beekeeping, honey, organic products, Bulgaria*

INTRODUCTION

In recent years, organic production has been one of the sectors that has grown in terms of areas, animals and number of people involved in a control system, successfully applied in Bulgaria, even in times of crisis.

Beekeeping is an important and lucrative agricultural industry. This is due both to the extremely valuable products that are obtained from beekeeping – honey, wax, propolis, royal jelly, and to their useful role in increasing the yields of nearly 50 species of agricultural plants by pollinating them. Honey is a natural product, considered a high nutritive value food and therapeutic qualities and justifies why honey is used in human consumption, in medicine, in food industry [7].

Many factors have influence on the beekeeping programmes in different countries [9].

Bulgaria is a traditional producer and one of the main exporting countries of organic honey in the world [2]. Organic livestock farming in Bulgaria faces serious issues – farmers have to produce certified products and at the same time they have to achieve sustainable levels of cost effectiveness, which would allow them to realize higher profits and maintain their market positions [3].

To the favorable climate, a wide variety of honey plants and the overlap of beekeeping in the economic life of the camp, define Bulgaria as typical beekeeping country. Development of beekeeping as livestock subsector provides both additional income and alternative employment for the population of the less developed rural areas in Bulgaria [4].

MATERIALS AND METHODS

The aim of this article is to analyze the status and development of organic beekeeping in Bulgaria, as well as to highlight some issues faced by organic livestock sector, and thus to stimulate and encourage the development of the potential Bulgarian organic beekeeping.

The reasons related to the favourable development of organic production in Bulgaria are diverse and are related to the recognized benefit for the development of

rural regions and the environment, as well as to the need and preferences of consumers for healthy and quality foods and also to the excellent prerequisites for the development of organic production in our country and the support of organic producers under the Rural Development Programme.

The organic livestock sector in Bulgaria is less developed than organic plant production, but the analysis of the data in recent years has shown a positive trend in the annual increase of organically raised animals. Considering the support opportunities for organic livestock farming within the framework of the new programming period, this trend was also maintained in 2016. Organic livestock farms in Bulgaria raise mainly cattle, sheep, goats and bees. Bees account for the largest share of organic livestock production, followed by sheep (Table 1). In recent years there has been a significant growth of farmers engaged in organic beekeeping and Bulgaria is approaching the top leaders in the industry, in the best European countries, such as Spain. Organically raised bee colonies increased by more than 25% in 2016, which reached 31.35% of the total bee colonies raised in Bulgaria. In 2016, 1,489,516 tons of honey were produced from organic beekeeping, which was 64 tons less than the previous year and equals to 14.57 % of the total honey produced in the country for the accounting year - 10,218 t honey for 2016.

Table 1. Animals in a control system (animals in transition are included)

	Number of organically raised animals in 2016	**Total number of animals raised in 2016**	**% of organically raised animals from the total number of animals raised in 2016**
Cattle	9,718	557,900	1.74
Sheep	26,809	1,360,100	1.97
Goats	8,242	237,500	1.65
Bee colonies	236,462	754,105	31.35

Source: Ministry of Agriculture, Food and Forestry (MAFF), according to the data from the annual reports of organic production controllers, 2016 [5].

Several consecutive years have been marked with low yields for beekeepers and poor condition of bee colonies, and this year the situation is particularly severe. Producers even have to seek additional income because their beekeeping activity alone proves insufficient.

The organic market in Bulgaria is relatively new and still too small, but at the same time it is fast-growing. Over the past few years there has been a boom in the market for organic products in Bulgaria. The number of specialized shops is increasing, as well as the number of large retail chains involved in the distribution of organic food. The consumers believe that organic food, though more expensive than non-organic, is healthier, tastier and is produced in ways that protect and preserve the environment. Consumer confidence in the quality of these foods is higher, because of the strict control and standards of production.

Most of the Bulgarian organic food and products are bound for foreign markets. Bulgaria is a traditional producer of different types of organically certified honey with excellent quality indicators and a large part of the production is exported to the world market.

RESULTS AND DISCUSSIONS

Beekeeping is an important and lucrative agricultural industry. This is due both to the extremely valuable products that are obtained from beekeeping – honey, wax, propolis, royal jelly, and to their useful role in increasing the yields of nearly 50 species of agricultural plants by pollinating them. Biological value of bee products is due to the rich content of enzymes, vitamins, amino acids, antibiotics, hormones, etc., which are easily absorbed by the body and play the role of natural medications. A large number of these components are found in medicinal plants and bees just collect them in their ready-to-be-used form [8].

By October 1, 2019, bee colonies were 867.6 thousand, which is 10.8% more than the previous year. The bee colonies from which honey was harvested in 2019, reached 702.8 thousand (14.5% more) and the honey harvested was 11,518 tons - 11.4% more than in 2018. The average yield of honey from a bee colony decreased by 2.4%, to 16.4 kg. For the period from January 1st to September 30th, 2019, bee farms harvested 7,835 tons of honey (4.0% less than the previous period), and by January 1st, there were 1,544 tons of unrealized honey from previous years and by October 1st, 2019, 5,223 tons remained for realization (59.0 % more than October 1st, 2018). The number of farms with bee colonies in 2019 was 13,771 or 12.3% more [6].

Table 2. Bee colonies by statistical regions in Bulgaria, in 2018 and 2019 (Number)

Bee colonies by statistical regions, in 2018 and 2019 Statistical areas (NUTS1) and statistical regions (NUTS2)	**Bee colonies by 01/10/2018**	**Bee colonies by 01/10/2019**	**Change 2019/2018**	**Bee colonies from which honey was harvested in 2018**	**Bee colonies from which honey was harvested in 2019**	**Change 2019/2018**
Bulgaria	783,348	867,561	10.8%	613,946	702,851	14.5%
Northern and South Eastern Bulgaria	*654,103*	*728,569*	11.4%	*520,865*	*597,551*	14.7%
North-Western	154,228	158,721	2.9%	117,934	125,561	6.5%
Northern Central	187,035	210,830	12.7%	158,096	172,910	9.4%
North-Eastern	172,637	190,417	10.3%	140,261	166,253	18.5%
South-Eastern	140,203	168,601	20.3%	104,574	132,827	27.0%
South-Western and Southern Central Bulgaria	*129,245*	*138,992*	7.5%	*93,081*	*105,300*	13.1%
South-Western	47,329	48,740	3.0%	31,889	35,657	11.8%
Southern Central	81,916	90,252	10.2%	61,192	69,643	13.8%

Source: MAFF, Agrostatistics Department, surveys 'Beekeeping in Bulgaria', No. 368, February, 2020 [6].

When choosing a place for beekeeping, it is necessary to choose the most suitable area or region and to choose a place where to put your apiary [1]. An important condition for a bee farm to obtain high yields of honey is the availability of good honey plants in the area around the apiary, the blooming periods to overlap and thus the vegetation to ensure continuous harvesting throughout the season. It is necessary to create an individual calendar, the so-called "phenological calendar", for each locality in the area, with a radius of 2 km. The choice of a place for the apiary, where the hives are placed, should meet the following important conditions:

-To be in the center of an area with rich flora and a variety of honey plants, blooming at different periods, so that bees could collect nectar and pollen for longer periods during the year.

-To be well protected from prevailing strong and cold winds – bee colonies exposed to adverse wind conditions develop slowly, the bees get easily exhausted and a significant part of them dies.

-To be away from chemical plants and facilities, major railway stations, landfill sites, candy shops or sweet factories, etc.

-To be dry and sunny – in lower, humid and shady places bee colonies develop slowly and get sick more often, the bees work less and for shorter hours.

Adequate support of bee colonies requires the beekeeper to be aware of the condition of the colony at all times, and this is achieved through inspections. Inspections of bee colonies can be carried out throughout the year, except for the winter season.

When starting an organic production, each producer develops and submits to the relevant control authority a plan which necessarily complies with all the requirements for organic production, a logbook of farming activities, plant protection measures, preparations

purchased, quantities and directions of the realized production. Cooperation between more producers of organic bee products can significantly ease the costs of entering and maintaining new markets [3].

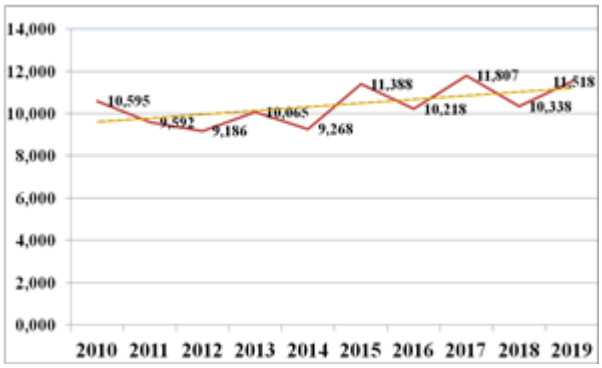

Fig.1. Production of honey in Bulgaria
Source: MAFF, Agrostatistics Department, surveys 'Beekeeping in Bulgaria', No. 368, February, 2020 [6].

The organic market in Bulgaria is relatively new and still too small, but at the same time it is fast-growing. Over the past few years there has been a boom in the market for organic products in Bulgaria. The number of specialized shops is increasing, as well as the number of large retail chains involved in the distribution of organic food. Most of the Bulgarian organic food and products are bound for foreign markets. Bulgaria is a traditional producer of different types of organically certified honey with excellent quality indicators and a large part of the production is exported to the world market. Bulgarian organic fresh fruits and vegetables, milk and dairy products, jams, dried fruits and nuts, have excellent taste qualities and are highly valued both in the European and world market [4].

CONCLUSIONS

There is a need for research, analysis and evaluation of the status of ecological beekeeping in Bulgaria. The internal and external market of bee products in Bulgaria is insufficiently developed [4].
In terms of organic beekeeping in Bulgaria, the stimulation of quality and competitive production in accordance with the requirements of European markets and consumers, as well as the provision of opportunities for sustainable development of organic production should be a priority of Bulgarian agricultural policy [10].
Bulgaria will continue to work towards ensuring the control of organic production and its compliance with the requirements of the European and national legislation in this field, as well as towards promoting the benefits of organic food and products to human health and the benefits of organic production methods, as being more environmentally friendly and more sparing in their use of natural resources [5].

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IMPACT OF COUPLED SUPPORT ON SURFACES AND PRODUCTIONS OF MAIN CROPS THAT BENEFIT FROM THIS TYPE OF SUPPORT

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Abstract

Direct payments granted in agriculture play an extremely important role for the incomes of Romanian farmers. This type of payments are funds from the European Union budget, more precisely from the European Agricultural Guarantee Fund (EAGF), and in Romania these payments are granted through various schemes such as: Single area payment scheme, Redistributive payment, Young farmers payment, payment for agricultural practices beneficial for climate and environment, but also Coupled support. In relation to the amounts granted per hectare, on the one hand, the most targeted by farmers, is coupled support, which is granted to sectors considered economically, socially and environmentally important and which are affected by certain difficulties. The aim of this paper is to identify the progress made in certain cultures that have been encouraged through this form of support. The analyzed data comes from the Agency for Payments and Intervention for Agriculture. The conclusion is that this support plays an important role for agricultural practices related to climate change and the environment protection, having the role of crop diversification.

Key words**:** *direct payments, coupled support, European funds*

INTRODUCTION

The European Agricultural Grant Fund (EAGF) is a fund set up at European Union level to support Member States' agriculture. At the Romanian level, these funds are managed by the Agency for Payments and Intervention for Agriculture (APIA) [7, 3]. These funds also aim to finance the following expenses:

- measures to regulate or support agricultural markets;
- direct payments to farmers in the context of the common agricultural policy;
- the Union's financial contribution to measures to inform and promote agricultural products on the Union's internal market
- the Union's financial contribution to the program to encourage the consumption of fruit and vegetables in schools.

Coupled support scheme - can be granted to the sectors and productions provided in art. 52 para. (2) of Regulation (EU) no. 1307/2013, considered important for economic, social and environmental reasons and which are affected by certain difficulties [10].

According to Order 619/2015 on coupled support in the plant sector, those wishing to receive this type of support must meet a number of specific conditions depending on each crop they grow. Thus for [9]:

Coupled support for **soybean** cultivation:

- maximum annual production of 1,300 kg of soybeans/ha,
- capitalizes on a minimum production of 1,300 kg of soybeans/ha,
- uses officially certified seed.

Coupled support for alfalfa:

- have achieved a minimum annual production of 15 tonnes/ha of green mass or 3.75 tonnes/ha of dry mass,
- have marketed at least the minimum production envisaged,
- have consumed with the animals they own, registered in the RNE, and/or have stored for consumption with them at least the minimum expected production obtained on the farm,
- uses officially certified seed.

Coupled support for peas for industrialization

- concluded an annual contract with a registered industrialization unit for food safety,
- delivers a minimum quantity of 1.9 tonnes/ha of peas to a registered processing unit,
- uses officially certified seed.

Coupled support for grain beans for industrialization

- concluded an annual contract with a registered industrialization unit for food safety,
- deliver the minimum quantity of 0.85 tonnes/ha of beans to a registered industrial unit for food safety,
- uses officially certified seed.

Coupled support for rice

- marketing of a minimum production of 4,500 kg/ha of rice,
- uses officially certified seed.

Coupled support for hops

- concluded a contract with a brewery or processing units for pharmaceutical purposes
- prove the minimum production of 490 kg of dried hop cones/ha.

Coupled support for sugar beet

- have a contract for the production of sugar beet with a sugar factory,
- prove the marketing of a minimum production of 26,400 kg/ha,
- uses officially certified seed.

Coupled support for early, semi-early and summer potato cultivation:

- demonstrate the marketing of a minimum production of 12.5 tonnes/ha,
- uses officially certified seed.

The paper analyzes the changes that have occurred in the vegetable sector on the area and yields obtained from crops like: hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes, as well as in the case of alfalfa, as a result of granting coupled support for these types of crops.

MATERIALS AND METHODS

The data used in this study are from the Payments and Intervention Agency for Agriculture (number of beneficiaries, amount granted, amount) and were correlated with data on area and production of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes, as well as in the case of alfalfa, analyzing the data from a quantitative and qualitative point of view. The main statistical indicators were also determined, such as: arithmetic mean, standard deviation, coefficient of variation, minimum period and maximum period. At the same time, the correlation coefficient was determined, using the Excel program to determine the values, using the equation [11]:

$$Correl(X,Y)=\frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}$$

The arithmetic mean or mean value of a series of values is the ratio of the sum of the values of the series to their number.

$$\overline{X}=\frac{x_1+x_2+\ldots\ldots x_n}{n}=m$$

The standard deviation is expressed using the same unit of measurement as the values in the series under consideration and is a very accurate indicator of the spread of the series.

$$\sigma=\sqrt{D}\ \text{sau}\ \sigma=\sqrt{\frac{(x_1-\overline{X})^2+(x_2-\overline{X})^2+\ldots\ldots+(x_n-\overline{X})^2}{n-1}}$$

The coefficient of variation represents the ratio between the standard deviation and the average, when the average is different from 0, and the expression is made in percentages.

$$C.V.=\frac{\sigma}{\overline{X}}$$

RESULTS AND DISCUSSIONS

Analyzing the area cultivated with hops in the period 2014-2019, an oscillating trend is found, with a minimum value of the period of 225 ha and a maximum value of 257 ha. The annual rate has a positive value of 0.7%. The calculated standard deviation is 14.1 ha, and the coefficient of variation is 5.8% (Table 1).

In the case of rice cultivation, there is a downward trend in terms of cultivated area, with a minimum of the analyzed period of 7,427 ha and a maximum of 12,719 ha. The rate has negative values of 10.2%, and the coefficient of variation has a value of 20%, indicating a relative degree of heterogeneity of the analyzed data (Table 1).

Table 1. Analysis of the main statistical indicators on the area under hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and lucerne in the period 2014-2019 (ha)

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	243	225	257	227	255	252
Rice	12,719	11,106	9,435	9,125	8,251	7,427
Pease	27,364	31,702	43,218	106,562	120,247	104,448
Beans	12,071	12,561	14,918	11,170	11,391	11,007
Soy beans	79,910	128,156	127,266	165,143	169,422	158,149
Sugar beet	31,280	26,596	24,924	28,204	25,723	22,729
Early, semi-early and summer potatoes	27,984	28,887	28,359	27,114	27,968	28,020
Lucerne	361,571	364,540	380,248	391,114	408,678	412,861
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	ha	**Ha**	**ha**	**%**	**ha**	**%**
	225.0	257.0	243.2	0.7	14.1	5.8
	7,427.0	12,719.0	9,677.2	-10.2	1,936.8	20.0
	27,364.0	120,247.0	72,256.8	30.7	42,472.3	58.8
	11,007.0	14,918.0	12,186.3	-1.8	1,461.0	12.0
	79,910.0	169,422.0	138,007.7	14.6	33,813.1	24.5
	22,729.0	31,280.0	26,576.0	-6.2	2,933.8	11.0
	27,114.0	28,887.0	28,055.3	0.0	580.3	2.1
	361,571.0	412,861.0	386,502.0	2.7	21,683.4	5.6

Source: data processed INS, Accessed on 22.09.2020 [8].

In the case of the area cultivated with peas, there is a significant increase, so that if in 2014, the cultivated area was 27.4 thousand hectares, in 2019 the area was over 120 thousand hectares. Thus, it was possible to determine an annual growth rate of 30.7% and a coefficient of variation of 58.8%, indicating a high degree of heterogeneity of the analyzed data. This impressive increase can be attributed to aid in agriculture, through coupled support, but especially to support agricultural practices that are beneficial to the climate and the environment, with the role of crop diversification (Table 1).

As in the case of pea cultivation, the area cultivated with soybeans registered a significant increase, as in 2014 the cultivated area was 79.9 thousand hectares, in 2019 the cultivated area was over 158 thousand hectares. The annual growth rate has positive values of 14.6%, and the coefficient of variation has a value of 24.5% indicating a relative degree of heterogeneity of the analyzed data. This sharp increase in soybean acreage is largely due to increased market demand (being a high-protein food), but also to support in agriculture, such as support for climate-friendly and environmentally friendly agricultural practices, with the role of diversifying cultures. Leguminous crops also play an extremely important role in crop rotation, enriching the soil with nitrogen. (Table 1) [1, 2, 6].

Regarding the area cultivated with sugar beet, there is a sharp decrease, from 31.3 thousand hectares cultivated in 2014 to a cultivated area of 22.7 thousand hectares. The annual rate has a negative value of 6.2%, and the coefficient of variation was calculated at 11%. The reduction of areas can be attributed to the elimination of quotas, but especially to the lack of processing units, so that in order to receive coupled support, the producer must prove the processing of a minimum production of 26.4 t/ha. (Table 1) [4, 5].

In the case of alfalfa, there is also an increase in the cultivated area, registering a minimum of the period of 361.6 thousand hectares and a maximum of the period of 412.8 thousand hectares, with an annual growth rate of 2.7%. and a coefficient of variation of 5.6% indicating that the string of data analyzed is homogeneous (Table 1).

In the case of total soybean production, there is an upward trend, except for the last year analyzed when the production obtained was lower by 10.7% compared to 2018. Also the annual rate shows an increase of 15.4% in the analyzed period, and the coefficient of variation has a value of 31.4% which indicates the heterogeneity of the analyzed data series. It should be noted that in this case, the production obtained is largely influenced by the cultivated area (Table 2).

Table 2. Analysis of the main statistical indicators on production obtained from hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	268	224	208	124	219	218
Rice	45,159	49,773	43,635	43,311	43,355	39,991
Pease	51,017	55,302	78,808	282,245	172,512	221,572
Beans	19,748	19,966	19,087	16,125	17,298	14,095
Soy beans	202,892	262,061	263,380	393,495	465,609	415,942
Sugar beet	1,398,570	1,040,827	1,012,186	1,174,502	978,266	917,163
Early, semi-early and summer potatoes	431,329	420,222	401,935	449,459	431,175	401,373
Lucerne	6,071,232	5,730,897	5,505,202	5,915,928	6,971,521	6,222,965
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	t	**T**	**t**	**%**	**t**	**%**
	124.0	268.0	210.2	-4.0	47.1	22.4
	39,991.0	49,773.0	44,204.0	-2.4	3,209.9	7.3
	51,017.0	282,245.0	143,576.0	34.1	96,647.9	67.3
	14,095.0	19,966.0	17,719.8	-6.5	2,319.0	13.1
	202,892.0	465,609.0	333,896.5	15.4	104,811.0	31.4
	917,163.0	1,398,570.0	1,086,919.0	-8.1	175,002.4	16.1
	401,373.0	449,459.0	422,582.2	-1.4	18,731.9	4.4
	5,505,202.0	6,971,521.0	6,069,624.2	0.5	508,697.3	8.4

Source: data processed INS, Accessed on 22.09.2020 [8].

As regards the production of sugar beet, there is a declining trend due in large part to the reduction in the area under sugar beet. Thus, the maximum of the period was recorded a production of 1.4 million tons (2014), and the lowest production was obtained in 2019, when it was 917 thousand tons. The annual rate has a negative value of 8.1%, and the coefficient of variation has a value of 16.1% (relatively homogeneous data) (Table 2).

Table 3. Analysis of the main statistical indicators on the average production obtained from hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	1,103	996	809	546	860	866
Rice	3,551	4,482	4,625	4,746	5,254	5,384
Pease	1,864	1,744	1,823	2,649	1,435	2,121
Beans	1,252	1,287	1,250	1,402	1,477	1,238
Soy beans	2,539	2,045	2,070	2,383	2,748	2,630
Sugar beet	44,711	39,135	40,611	41,643	38,031	40,351
Early, semi-early and summer potatoes	15,328	14,470	14,100	16,503	15,343	14,267
Lucerne	16,786	15,706	14,475	15,124	17,057	15,067
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	t	**T**	**t**	**%**	**t**	**%**
	546.0	1,103.0	863.3	-4.7	189.1	21.9
	3,551.0	5,384.0	4,673.7	8.7	655.1	14.0
	1,435.0	2,649.0	1,939.3	2.6	411.9	21.2
	1,238.0	1,477.0	1,317.7	-0.2	98.7	7.5
	2,045.0	2,748.0	2,402.5	0.7	292.7	12.2
	38,031.0	44,711.0	40,747.0	-2.0	2,309.4	5.7
	14,100.0	16,503.0	15,001.8	-1.4	906.9	6.0
	14,475.0	17,057.0	15,702.5	-2.1	1,025.1	6.5

Source: data processed INS, Accessed on 22.09.2020 [8].

The average rice production registers an upward trend in the analyzed period, so that the yield shows an increase of about 51% in 2019, compared to the average production recorded in 2014. The annual rate is 8.7% and the coefficient of variation records a value of 14% (Table 3). In the case of hop cultivation, it is noted that the average production obtained in 2017 (minimum period) was of 546 kg/ha, compared to the production recorded in 2014, when it was 1.1 t/ha, aspect due to the unfavorable meteorological conditions that determined variations of the average registered productions (Table 3).

Table 4. Analysis of the main statistical indicators on the number of farmers who accessed coupled support for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years				
	2015	2016	2017	2018	2019
Hop	3	3	3	3	3
Rice	7	8	10	10	11
Pulses	35	108	663	681	317
Soy beans	1,766	2,915	3,792	3,290	3,880
Sugar beet	894	823	891	860	689
Early, semi-early and summer potatoes	59	66	90	93	101
Lucerne	6,156	10,627	21,702	29,979	35,963
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
no.	**no.**	**no.**	**%**	**no.**	**%**
3.0	3.0	3.0	0.0	0.0	0.0
7.0	11.0	9.2	12.0	1.6	17.9
35.0	681.0	360.8	73.5	302.4	83.8
1766.0	3,880.0	3,128.6	21.7	856.3	27.4
689.0	894.0	831.4	-6.3	84.6	10.2
59.0	101.0	81.8	14.4	18.2	22.3
6156.0	35,963.0	20,885.4	55.5	12,578.6	60.2

Source: data processed APIA, Accessed on 22.09.2020 [8].
* 2015, 2016 pea and bean crops were allocated separate funds for each crop.

It can be noted that in the period 2015-2019 3 farmers received a granted coupled support for growing hops, which this culture in our country is a niche crop, with certain peculiarities in terms of cultivation conditions (Table 4).

In the case of farmers who have grown soybeans, there is an increase in their number from 1,766 in 2015 to 3,880 in 2019, representing an increase of about 120%. This may be due to the need for farmers to diversify crops, thus enriching the soil with nitrogen, but also as a result of meeting the conditions to obtain payments for agricultural practices beneficial to the climate and the environment (Table 4).

Table 5. Analysis of the main statistical indicators on the area for which coupled support was granted for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years				
	2015	2016	2017	2018	2019
Hop	207.4	231.9	239.3	246.7	245.6
Rice	8,738.7	6,959.0	6,903.8	7,630.8	7,705.4
Pulses	1,083.9	2,211.1	6,367.7	2,795.2	2,948.7
Soy beans	107,812.8	119,506.6	149,098.8	130,303.3	138,073.0
Sugar beet	22,133.9	21,843.6	24,633.5	22,364.6	21,625.3
Early, semi-early and summer potatoes	1,399.2	1,781.8	2,245.9	2,425.4	2,421.5
Lucerne	35,352.1	63,242.2	116,073.0	138,291.6	153,106.3
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
ha	**ha**	**ha**	**%**	**ha**	**%**
207	247	234	4.3	16.1	6.9
6,904	8,739	7,588	-3.1	742.2	9.8
1,084	6,368	3,081	28.4	1,977.8	64.2
107,813	149,099	128,959	6.4	16,023.4	12
21,625	24,634	22,520	-0.6	1,214.3	5.4
1,399	2,425	2,055	14.7	450.8	21.9
35,352	153,106	101,213	44.3	50,169.7	49.6

Source: data processed APIA, Accessed on 22.09.2020 [8].

In the case of hop cultivation, it is observed that in 2019, out of the total of 252 hectares cultivated, 97.4% of this area was granted coupled support. There is also a positive annual rate of 4.3% and a coefficient of variation of 6.9% (Table 5).

In the case of soybean cultivation, in 2019, approximately 87% of the area cultivated with soybeans at national level, benefited from subsidies through coupled support. One of the reasons why the percentage is lower is due to the weather conditions that made it difficult to obtain a mandatory minimum production of 1.3 t/ha, but also to the sale the production (Table 5).

And in the case of alfalfa it can be seen that only 37% of the total cultivated area met the conditions for granting coupled support. This was hampered by the conditions for granting as required by the minimum production of 15 t/ha green mass (or 3.75 t/dry mass) and the sale or use it on the farm of its own feed (Table 5).

Table 6. Analysis of the main statistical indicators on the average area for which coupled support was granted for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	**Years**				
	2015	**2016**	**2017**	**2018**	**2019**
Hop	69.1	77.3	79.8	82.2	81.9
Rice	1,248.4	869.9	690.4	763.1	700.5
Pulses	24.5	15.2	9.6	4.1	9.3
Soy beans	61.0	41.0	39.3	39.6	35.6
Sugar beet	24.8	26.5	27.6	26.0	31.4
Early, semi-early and summer potatoes	23.7	27.0	25.0	26.1	24.0
Lucerne	5.7	6.0	5.3	4.6	4.3
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
ha	**ha**	**ha**	**%**	**ha**	**%**
69	82	78	4.3	5.4	6.9
690	1,248	854	-13.5	231.5	27.1
4	24	13	-21.5	7.7	61.8
36	61	43	-12.6	10.1	23
25	31	27	6.1	2.5	9.3
24	27	25	0.3	1.4	5.5
4	6	5	-7.2	0.7	14.0

Source: data processed APIA, Accessed on 22.09.2020 [8].

In the case of hop and rice crops whose number of beneficiaries is low, compared to the cultivated area for which coupled support was granted, it is noted at the level of 2019, the average area that accessed coupled support for hops was 81.9 ha, respectively 700.5 ha for rice (Table 6).

On the other hand, in the case of legumes or alfalfa crops, whose high number of beneficiaries determined an average area of 9.3 ha in the case of legumes, respectively 4.3 ha in the case of alfalfa growers (Table 6).

Table 7. Analysis of the correlation coefficient between different variables in the case of soybean cultivation

	Area (ha)	*Total production (t)*	*Average production (t/ha)*	*No. Farmers*	*Sum (total/culture)*	*Quantum (euro/ha)*	*Coupled support surface*	*Average area*
Area (ha)	1							
Total production (t)	0.97	1						
Average production (t/ha)	0.91	0.98	1					
No. Farmers	0.77	0.74	0.71	1				
Sum (total/culture)	-0.36	-0.51	-0.58	0.14	1			
Quantum (euro/ha)	-0.98	-0.95	-0.89	-0.89	0.22	1		
Area for which the subsidy was granted	0.83	0.73	0.63	0.93	0.21	-0.90	1	
Average area	-0.64	-0.66	-0.66	-0.94	-0.08	0.79	-0.79	1

Source: data processed APIA, Accessed on 22.09.2020 [8].

Analyzing the correlation coefficient between the total production and the surface, a direct correlation is found, so that the two variables vary in the same direction. Also, the value of the coefficient of variation of 0.97 indicates a very close level of correlation between the two variables (Table 7).

Analyzing the coefficient of variation between the quantum and the surface, an inverse correlation is found, so that the two correlated variables vary in the opposite direction. Also, the value of the coefficient of variation of 0.98 indicates a very close level of correlation between the two variables. In practice, if the area under soybeans tends to increase, the amount of coupled support tends to decrease, as the amount allocated to the measure is related to the area (Table 7).

Analyzing the correlation coefficient between the total production and the surface, a direct correlation is found, so that the two variables vary in the same direction. Also, the value of the coefficient of variation of 0.75 indicates a level of close correlation between the two variables (Table 8).

Analyzing the coefficient of variation between the quantum and the surface, an inverse correlation is found, so that the two correlated variables vary in the opposite direction. Also, the value of the coefficient of variation of 0.92 indicates a very close level of correlation between the two variables. In practice, if the area cultivated with alfalfa tends to increase, the amount of coupled support tends to decrease, as the the amount allocated to this measure is related to the area (Table 8).

Table 8. Analysis of the correlation coefficient between different variables in the case of alfalfa culture

	Area (ha)	*Total production (t)*	*Average production (t/ha)*	*No. farmers*	*Sum (total/culture)*	*Quantum (euro/ha)*	*Coupled support surface*	*Average area*
Area (ha)	1							
Total production (t)	0.75	1						
Average production (t/ha)	0.30	0.85	1					
No. Farmers	0.98	0.74	0.30	1				
Sum (total/culture)	-0.63	-0.65	-0.46	-0.70	1			
Quantum (euro/ha)	-0.92	-0.64	-0.21	-0.90	0.78	1		
Area for which the subsidy was granted	0.98	0.73	0.28	0.99	-0.75	-0.96	1	
Average area	-0.92	-0.79	-0.43	-0.96	0.66	0.76	-0.91	1

Source: data processed APIA, Accessed on 22.09.2020.

CONCLUSIONS

These financial aids to farmers play an extremely important role both for their income and for supporting and growing of this crops at the national level. The restrictive conditions imposed for the granting of coupled support are relevant, but this support should complement another measure to finance investments in processing units. This should not be done only through the European funds available through the National Rural Development Program [11].

Also, Romania's agriculture must focus mainly on crops suitable for us in the country, but in close connection with the needs of the market.

It should be noted that the decrease in the area cultivated with rice may be due mainly to unfavorable cultivation conditions for our country, the production obtained causing high production costs, not being able to compete with the rice imported from Asian countries.

At the same time, it can be noted that this support plays an important role and is closely related to the support for agricultural practices beneficial to climate and the environment, having the role of crop diversification. Legumes also play an extremely important

role in crop rotation, enriching the soil with nitrogen.

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STUDY ON A BETTER MANAGEMENT IN A MODERN FARM USING DIFFERENT FUELS FOR TRACTOR ENGINES

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Abstract

In a modern agricultural farm, efficient management of power used in the farm is fully as important as efficient management of machinery. This paper studied the importance of using one or other type of fuels in the final result, which is the efficiency of the engine used by a tractor or other machinery used in the farm. The fuels considered are diesel oil, hydrogen, liquified petroleum gas, premium gasoline, propane, methanol and ethanol. The manager decision of using one or another fuel is based on each fuel energy value, combustion characteristics and economy. The farm manager also must consider the adjustments that must be made to tractor engine if using one or another fuel.

Key words**:** *machinery management****,*** *fuels, tractor engine*

INTRODUCTION

A farm manager must take into consideration many aspects in order to have a performant and competitive farm. One of these aspects is to minimize the cost of machines energy, while maximizing the returns from the farm enterprise. It is known that the 3 components of economic performance are: machine performance, power performance and operator performance [4]. From these 3 components, in this paper we shall refer especially to machines performance. From this point of view, another aspect of a modern and competitive agriculture is that of using the most recent technology by the farmers [7] and also increasing the efficiency of the activity through human resources [9]. When we refer to machines in an agricultural farm, we refer first to tractors, which are indispensable to any farm and then to agricultural machines. Today, all field power comes from internal combustion engines, and most of these engines are mounted in tractors. In this paper, we analyse the tractor engine principles and mechanism, but also we want to show the importance of using different fuels for tractors and agricultural machines. In the beginning, we will present some principles of engine which influence the use of one or another fuel.

The profitability is a fundamental factor in every domain of activity all over the world. The debate regarding optimum capital structure also establishes the link of capital structure with profitability and wealth of shareholders [1].

In this respect, an important factor of profitability in agriculture is the fuel we use for tractors and other agricultural machines. It is well known that old fuels are more and more expensive as the time goes by, that is why the quest for other alternative fuels is a major issue for all researchers. These alternative fuels which are most wanted are especially renewable fuels.

Hydrogen is one of the most promising renewable fuels because it can generate from resources like biomass and water. Hydrogen gas energy carrier is growing fast with the development of fuel cells and its application such as the fuel cell, and hydrogen usage as transportation fuel in the form of a compressed gas. The hydrogen supply options include hydrogen production via electrolysis process, using renewable and carbon dioxide-free electricity sources such as solar, wind or wave powered electrolysis, gasification of coal, petroleum coke and biomass with carbon dioxide capture and storage technology [6].

Labour productivity in Romanian agriculture is one of the most important indicators of economic efficiency. For this reason, it is appropriate to increase this indicator because the ways of increasing labour productivity are means of intensifying the positive action of the various factors that influence it [2].

We consider that studying the engine components and functioning is important if we want to find alternative fuels to feed the tractor engine, as it is well known, high pressure due to the combustion of fuel are brought to bear on the piston head. The connecting rod transmits this force into a torque on the crankshaft (Fig.1).

The number of cylinders used in an engine is a compromise between expense and smoothness of operation. Farm tractors are built with engines having 3 to 8 cylinders. In Fig. 2 is presented an engine with 6 cylinders.

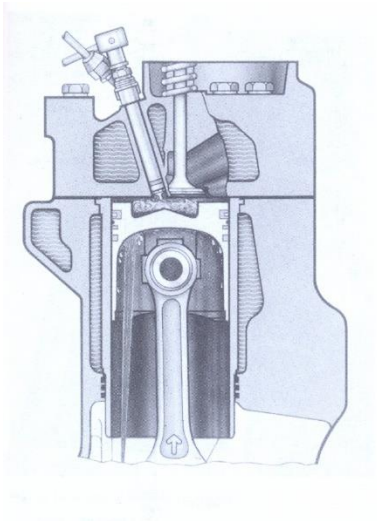

Fig. 1. Basic engine mechanism
Source: [8].

The types of tractors are chosen according to the technological process of the works and the biological properties of crops, following such indicators as ground clearance, gauge, outline dimensions, plot dimensions, energy consumption of machines, soil humidity, and the manoeuvrability of the aggregate.

The choice of aggregates is also based on direct operating expenditures. If two aggregates, after the cost of the works, require the same production costs, choose the one that satisfies the requirements of the machine system. The technical, technological and economic performance of agricultural aggregates is appreciated by the following techniques, also called indices of use or exploitation [3].

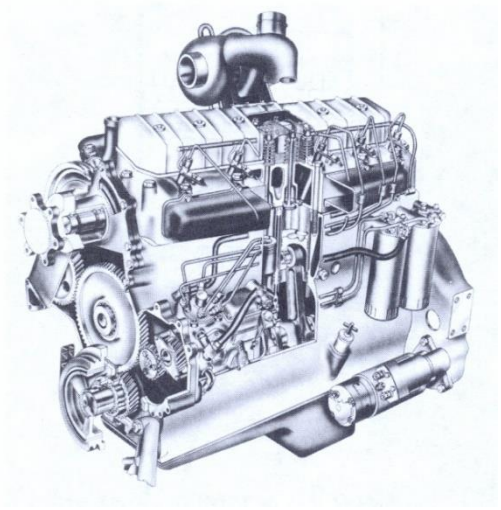

Fig. 2. Six-cylinder diesel tractor engine
Source: [8].

The way in which agricultural land is used by farmers could led to economic efficiency or not. The value of agricultural output is determined by two factors: gross value added and intermediate consumption. Both gross value added and intermediate consumption have a positive influence, meaning that the higher their levels, the higher the agricultural output [10].

MATERIALS AND METHODS

The materials used for this study consist in a tractor engine and different types of fuels with which it has been fed.

Beside the general construction of the engine, another aspect which must be taken in consideration is the valves functioning. Good valves action is essential to proper engine operation. Valves must sat tightly to seal off the combustion chamber during the power stroke. The valve actuating linkage begins at the camshaft with the cam followed or tapped. The tapped lifts the rod, which operates the rocker arm that bears on the valve stem.As the engine temperature rises, this linkage parts expand and would hold the valve open except fot the planned gap or valve train clearance between the rocker arm and the valve stem.this clearance values for farm tractors

range from 0.2 mm to 0.5 mm with the exhaust valve clearance often greater than the intake.

An important role in the best function of tractor engine is played by the fuels used for it [5]. Thus, the availability, energy value, combustion characteristics and economy of the fuel are of prime importance to the machinery manager. Burning of fuels is a chemical oxidation of carbon and hydrogen. Since air is about 23.2 % oxygen by mass, the correct air-fuel ratio is 3,448 units air to 228 units gasoline or 15:1. Other elements enter into the actual combustion equation: large quantities of nitrogen are carried through and elemetar carbon, carbon monoxide and hydrogen.

In Table 1 are presented some of the most important properties of different fuels which the engine can use.

Table 1. Typical properties of fuels

Fuel	Energy per mass [MJ/kg]	Energy per volume [MJ/m]	Octane number	Practical compress ratio
Propane	50.31	25.72	100	10:1
Premium gasoline	47.15	34.33	91	8.5:1
Regular gasoline	47.06	34.63	87	8:1
Diesel fuel	45.46	38.67	40	20:1
Methanol	19.95	15.89	119	12.5:1
Ethanol	26.69	21.18	115	12:1

Source: Own determination and technical data.

RESULTS AND DISCUSSIONS

As it can be observed from Table 1, different fuels have different characteristcs. So, if we want to obtain a good energy per mass, we shall use propane or premium gasoline, but the Diesel fuel numbers are very close to the formers, so we can use Diesel fuel with good results. In what concerns the octane number. It is obvious that the best choice is Methanol or Ethanol, while the Diesel fuel has the worst octane number. But if we analyse the compress ratio of the fuel, we can observe that Diesel fuel has the best compression ratio. In conclusion, the farm manager must make a decision, considering which is the most important characteristic of the fuel he uses at a certain moment.

For carburated engines, volatility, the ability to vaporize is an important fuel property because liquids will not burn. Since refined petroleum fuels are not homogenoeus, the percent of the fuel vaporized at any time depends on the temperature of the fuel at that time. The distilation curves (Fig. 3) show the boiling points of several fuels. The highly volatile liquified petroleum gases, propane and butane are not shown in the chart, these fuels are more homogenoeus because of their simpler molecular structure and they tend to have constant boiling points that depend only on pressure. At atmosphere pressure, propane boils at -42 ^{0} C and butane at 0^0 C.

The low volatility fuels cannot be used conveniently in a carburated engine, but they are commonly used in mechanical fuel injection engines.

Octane rating is the second important fuel property for carburated engines and is related to the ability of a fuel to burn in an engine. Mechanical damage to the engine can result if severe detonation occurs. Detonation is detected as a noise aring from combustion pressure vibrations. These occur when the unburned fuel and air experience spontaneous combustion.

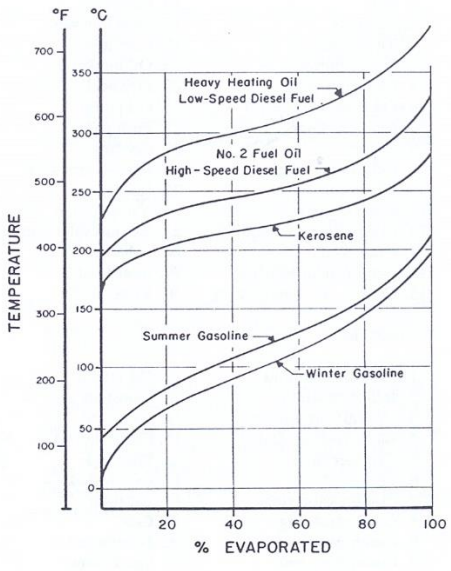

Fig. 3. Distillation curves
Source: Own determination.

Spontaneous combustion temperature may be reached as a result of: engine deposits, overloading and overheating and if the engine compression ratio is too high for the used fuel.

The liquified petroleum gas fuels are natutally highly resistant to detonation, while the heavy fuels are very likely to detonate. Natural gasoline has a moderate octane rating that may be raised greatly with additons of tetraethyl lea, alcohols or other organic compounds.

Diesel engines are subject of detonation also, but an a different way than carburated engines. Diesel fuels detonate because they do not burn fast enough. An ignition delay occurs on injection because the fuel needs to absorb heat and mix with oxygen. The accumulated fuel explodes rather than burns as it is injected.

CONCLUSIONS

In this paper we researched one of the possibilities of increasing productivity in an agricultural farm: using different types of fuels for feeding tractors motor. We presented the most important fuels properties which determines a farm manager to consider a type of fuel used for tractors engines. In the researched we have made, we explained which is fuel characteristic we want to obtain, related to the fuel we use. The main fuels which can be used for tractor engines, depending on these characteristics are: Diesel fuel, hydrogen, propane or premium gasoline.

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ANALYSIS AND EVALUATION OF THE RURAL LABOUR MARKET AND EMPLOYMENT OF THE RURAL POPULATION: A CASE STUDY OF VOLYN REGION, UKRAINE

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Abstract

An evaluation of the rural labour market development in terms of districts of Volyn region of Ukraine was conducted, identified and characterized trends in the rural population employment through the State Employment Service of Ukraine, the rural population unemployment scale in the study region of Ukraine and identify key areas for optimizing the labour market. forces taking into account the revealed tendencies. In order to highlight the local rural labour markets features and further development of individualized recommendations, the detailed assessment of them in terms of districts of Volyn region of Ukraine, in particular, based on the results of the registered rural labour market study developed a map to visualize the relevant regional groups. It is established that family-labour farms, functioning in the form of peasant farms, in the current economic situation provide the necessary conditions for the institutional foundation's formation for private management in rural areas of Ukraine. The necessity of forming preconditions for strengthening the effectiveness of employment policy in rural areas of Ukraine is substantiated. The article outlines proposals for improving and optimizing the functioning of the rural labour market. Based on the results of research and trends in the work, the need to develop measures to intensify the activities of advisory services and specialized staffing agencies to take into account the specifics of the rural labour market rationalization and the peculiarities of rural employment in the economic realities of Ukraine.

Key words**:** *registered unemployment rate, rural labor market, employment, rural population, cartogram*

INTRODUCTION

The deep crisis of the agricultural sector of the economy, the destruction of the rural social infrastructure, the negative demographic trends characterized by aging, and the extinction of the rural population necessitate a systematic analysis and identification of ways to effectively regulate the rural labour market. At the present stage of economic development, the importance and relevance of these issues are difficult to overestimate.

Certain aspects of the labour market functioning in today's realities are the subject of research by many scholars studying the economics of labour and social relations, among them: D. Bohynia [3], A. Boiar [4], O. Grishnova [9], M. Dolishnii [5], E. Libanova [11] , V. Lyshylenko [12], G. Kupalova [10], V. Onykienko [13], T. Petrova [14], A. Popescu [15-24], T. Shmatkovska [7, 26, 28], V. Yakubiv [29-31], Ya. Yanyshyn [32], I. Zhurakovska [34] and many others. However, due to the complexity and multifaceted nature of the formation of an optimal and efficient labour market in rural areas, it is necessary to deepen and expand the scientific study of the features of rural employment in the regional context.

The purpose of the article is to assess the rural labour market development in terms of districts of Volyn region of Ukraine, identify

trends in the employment of the rural population through the State Employment Service of Ukraine, the scale of long-term unemployment in rural areas of Ukraine and identify key areas for optimizing labour market, rural labour force, taking into account the identified trends.

MATERIALS AND METHODS

The data used for conducting analytical research in the work were obtained from the official materials of the Main Department of Statistics in Volyn Oblast, the State Statistical Service of Ukraine and the Volyn Regional Employment Centre.

The dynamics of a set of indicators characterizing the formation of the labour market for the rural population of Ukraine are studied in the work. The analysis of the system of corresponding indicators in dynamics is given.

The registered unemployment rate is the ratio (as a percentage) of the number of unemployed registered with the State Employment Service of Ukraine to the average annual working-age population. In order to make comparisons with the data of the sample survey, the calculation of the average number of registered unemployed for the period (I quarter, I half-year, 9 months, year). The corresponding unemployment rate is determined in relation to the economically active population of working age for the relevant period.

Registered unemployed under the current legislation of Ukraine are citizens of working age who due to lack of work have no earnings or other income provided by law, registered with the State Employment Service of Ukraine as job seekers, ready and able to start suitable work. Disabled people who have not reached retirement age, do not work, and are registered as job seekers are also recognized as unemployed.

Quantitative and qualitative characteristics of this category of unemployed, as well as information on the need for workers, employment of the unemployed, etc., prepared on the basis of administrative data of the State Employment Service of Ukraine in the Volyn region.

The level of employment is determined according to the administrative data of the State Employment Service of Ukraine as the ratio (as a percentage) of the number of employed persons to the number of unemployed who were registered with the State Employment Service of Ukraine during a certain period.

The rural population, desperate to find work, was unemployed, ready to start work, but stopped looking for work during the last month because they could not find it for a long time and had exhausted all possibilities for obtaining it.

The level of registered unemployment in terms of district labour markets in this study was analysed on the basis of a system of "traditional" statistical indicators, one of which is the “average standard” (Δx_i) [33], which is the value of the deviation of the indicator that characterizes the studied feature (x_i), from the average for this feature ($\bar{x}$) in the form of the difference:

$$\Delta x_i = x_i - \bar{x},$$

where:

x_i – the magnitude of the indicator deviation that characterizes the studied feature;

$\bar{x}$ – the average value of the indicator on this basis.

RESULTS AND DISCUSSIONS

One of the dominant-negative social consequences of unemployment, especially its long-term form, is professional disqualification, which causes a decrease in competitive opportunities and causes a decline in the labour force quality in rural areas. Therefore, one of the most important tools for the formation of sound and successful socio-economic policy should be considered constant monitoring of the labour market, the basic task of which is to prevent and identify negative trends in its development.

One of the necessary conditions for effective coordination of employment is the assessment

of current trends in its regional development. Thus, analysing the dynamics of balancing the unemployed in the rural labour market of the Volyn region of Ukraine with the assistance of the state employment service, we can say about the annual increase in the number of registered unemployed, only in 2019 revealed a partial improvement of the negative trend.

According to the results of our labour market monitoring based on the assessment of the level of registered unemployment of the rural population in the Volyn region of Ukraine, a set of systemic trends was identified. In particular, in 2016-2018, a clear trend to reduce the level of registered unemployment in rural areas can be observed in Kivertsi (3.6% - in 2018 compared to 5.4% - in 2016), Rozhysche (4.9% - in 2018 compared to 6.1% - in 2016) and 2.1 times in Volodymyr-Volynkyi districts (4.8% - in 2018 compared to 10% - in 2016) of Volyn region of Ukraine.

However, the decrease in the registered unemployment rate is not always an indication of an improvement in the labour market situation. There is no reason to believe that in some districts of Volyn region this situation is due to the inefficient functioning of state employment services in rural areas, which encourages the unemployed rural population not to register at employment centres at all, in particular, due to low unemployment benefits. According to the results of our study, the negative trends in increasing the number of registered unemployed in Ratnivsky (from 4.3% in 2016 to 7.4% in 2018) and Turiysky districts of the Volyn region, where the unemployment rate increased by 0.8%, are quite obvious. Although in Kamin-Kashyrskyi and Lyubeshivskyi districts of the Volyn region this indicator remains at a rather low level, in the studied period it also deteriorated by 0.6% and 0.4%, respectively (Fig. 1).

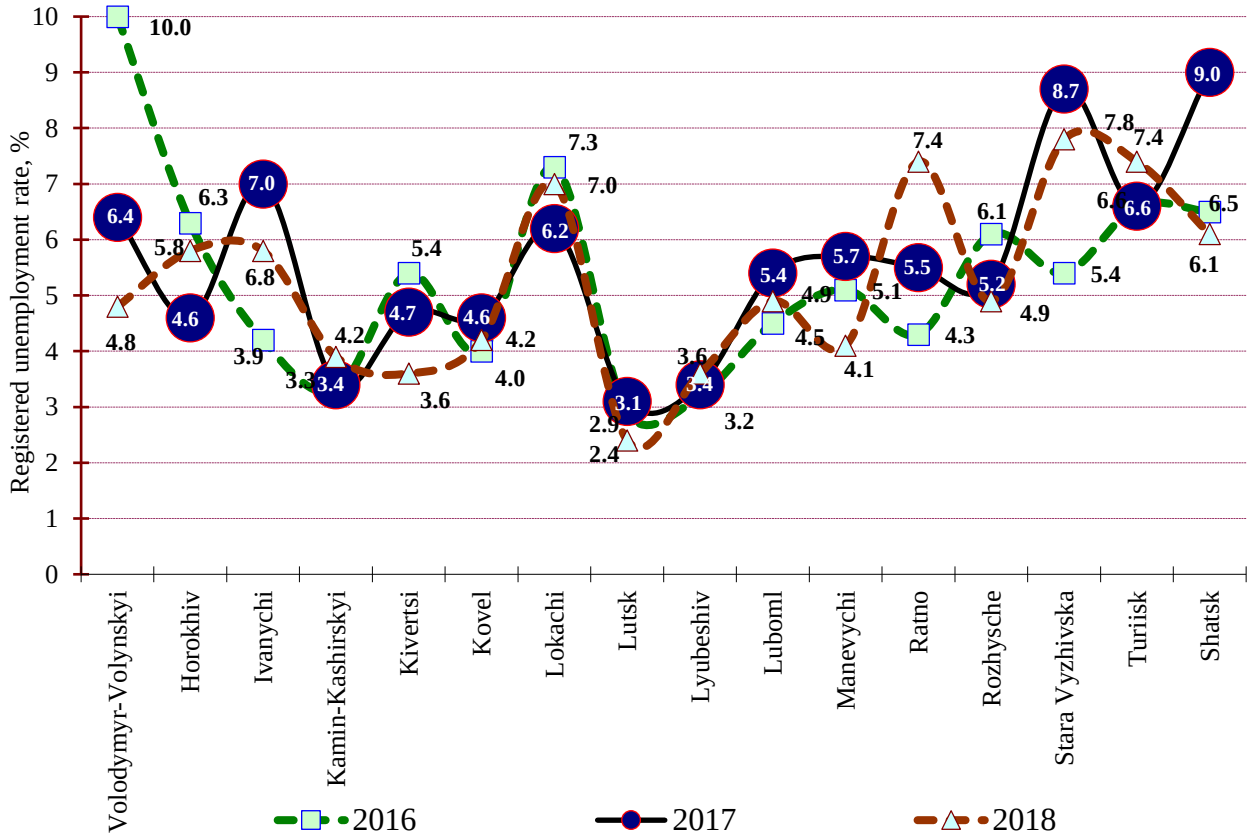

Fig. 1. Dynamics of the registered unemployment level of the rural population by districts of Volyn region of Ukraine, 2016 – 2018

Source: Own research and calculations based on the data from: [1, 2, 27].

Note that the number of rural populations employed with the assistance of the State Employment Service in Volyn region is growing every year. However, the growth of

employment through the employment centre of the studied region has not become systematic and optimal for the Volyn region of Ukraine, which requires the development of a set of relevant proposals and recommendations to improve the situation.

In order to highlight the features of the development of local rural labour markets and further development of individualized recommendations, we conducted a detailed assessment of them in terms of districts of the Volyn region of Ukraine. Thus, according to the results of the study of the registered rural labour market of Volyn region to assess the level of employment, we identified conditional regional groups (Fig. 2), of which: 1st - covers areas of Volyn region, where employment (compared to the regional average) is stable high but does not increase significantly in dynamics. These are the Volodymyr-Volynskyi district of the Volyn region of Ukraine, where the level of employment in 2015 – 2019 increased by 2.3 percentage points (p.p.) and amounted to 28.4% and Kovel district - by 5.9 percentage points and amounted to 32.2%.

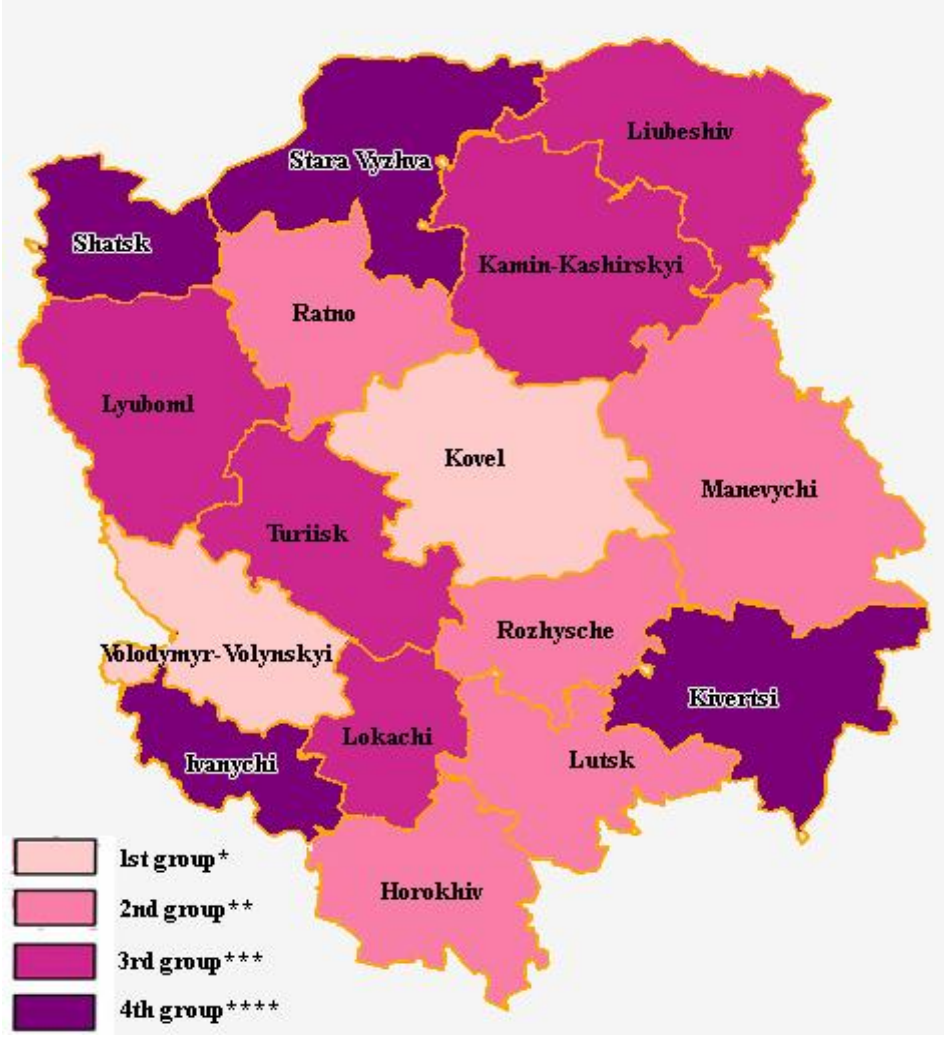

Fig. 2. Map of the districts of the Volyn region of Ukraine grouping to assess the employment trends of the rural population with the assistance of the State Employment Service for 2015 – 2019

Source: Own research.

**1st group – covers areas where the employment rate (compared to the regional average) is consistently high, but the dynamics do not increase significantly;*

***2nd group – covers areas with a significant increase in the level of employment of the rural population in 2015-2019, as a result of which this indicator from medium or low is close to high (compared to the regional average);*

****3rd group – includes areas in which during the study period there is also an increase in the level of employment of the rural population, but in an amount insufficient to exceed the regional average;*

*****4th group – covers the areas of the study area with a slight increase or decrease in the level of employment in the registered rural labour market during 2015-2019.*

The 2nd group covers the districts of the Volyn region of Ukraine with a significant increase in the level of employment of the rural population in 2015 – 2019, as a result of which this indicator from medium or low is close to high (compared to its regional average). In particular, these are: Horokhiv district, where the level of employment increased by 15.2 percentage points or 2.2 times; Lutsk district – 1.5 times; Rozhysche district - by 33.4 percentage points or 14.4 times and reached the maximum in the Volyn region in 2019. value - 35.9%. This group also included the Manevychi district, where the level of employment in the study period increased 1.5 times and Stara Vyzhva district of the Volyn region of Ukraine, where the level of employment increased 1.7 times.

Note that the first two groups are characterized by a clear positive trend in establishing a relative balance of supply and demand in the rural labour market, in which the employment rate of the unemployed rural population with the assistance of the state employment service exceeds the regional average.

The third group includes areas in which during the study period there is also an increase in the level of employment of the rural population, but to an extent insufficient to exceed the regional average value of this indicator. This group includes Kamin-Kashyrsk district, where the level of employment increased 1.7 times and amounted to 2019. 20.4%; Lokachi district - 1.7 times and amounted to 18.7%; Liubeshiv district - 1.5 times; Lyuboml district - 1.8 times and Turiisk district - 1.6 times. Group IV covers areas with a slight increase or decrease in the level of employment in the registered rural labour market in 2015 – 2019. According to the results of the study, this includes Ratno district, where the employment rate decreased by 8.5 percentage points; Shatsk district, where the level of employment increased by only 2.5 percentage points and amounted to 2019. 21.3%, as well as Kivertsi and Ivanychi districts. It should be concluded that this group is characterized by the worst dynamics of employment of the rural population in the period under study, which, in our opinion, is due to a significant imbalance of labour supply and demand in rural labour markets in selected areas of the Volyn region of Ukraine.

Since employment opportunities with the assistance of relevant government agencies are quite problematic (and in some areas - especially, Fig. 2), we believe that it is peasant farms in the form of family self-organization of agriculture, based on personal labour - take the place of compensation for rural employment people.

According to the results of assessing the dynamics of employment in the areas of employment in terms of the size of rural settlements in the Volyn region of Ukraine, we found clear trends and interdependencies, namely: in 2014 – 2018 the share of agricultural employment decreased rapidly in small villages to 199 people - by 32.1 percentage points and a population of 200-499 people - by 25.6 percentage points.

As a result of the outlined transformations in the Volyn region of Ukraine, we found that the largest number of employed rural residents in agricultural enterprises at the beginning of 2018 there were in the villages with a population of 200-499 people - 15.3%, and in the villages with a population of 500-999 people - 14.2% of the total employed rural population. In addition, the share of workers in peasant farms continued to grow significantly in all villages, regardless of their population and population, in particular in 2014-2018 - it increased by 12.9 percentage points. The most significant share of workers in farms is the population of up to 199 people (56.6%), as the scope of employment there is quite limited, in most of them (namely, 72.3% of the total) there are no what facilities.

In our opinion, the small number of people employed in agricultural production in large villages with a population of over 1,000 people and the internal motivation to work on the land causes a high share of those engaged in personal farms and in rural settlements with a relatively high rural population.

Thus, it can be argued that family-labour farms, functioning in the form of peasant farms, in today's realities provide the necessary conditions for the formation of the institutional foundations of private management in rural areas of Ukraine.

According to the analysis results of the dynamics of the registered unemployment level of the rural population in the districts of the Volyn region of Ukraine, it is quite difficult to identify a general trend that would be characteristic of the region as a whole. Therefore, we assessed the level of registered unemployment in terms of district labour markets of the studied region of Ukraine on the basis of a system of «traditional» statistical indicators, one of which is the average standard (Δx_i).

Analyzing the results of the study, it should be noted that in a quarter of districts of the Volyn region of Ukraine during 2016 – 2018 the values of the studied indicators are lower than the regional average by 1.0-2.8% (Table 1). Regarding the comparison with the all-Ukrainian indicators, in 2016-2018 only in the Lutsk district of the Volyn region and in 2016-2017 – in Liubeshiv and Kamin-Kashyrsk districts the registered unemployment rate among the rural population is lower than in Ukraine as a whole. This indicates a better situation in the rural labour markets of these districts compared to the average in the region and nationwide.

The tendency towards deterioration in relation to the average and national values in the studied period was characteristic of Lokachi, Turiisk, and especially Stara Vyzhva, Shatsk districts, which can be attributed to the areas with a problematic situation in the rural labour market. In addition, using the indicator of the average linear deviation, we note that on average in 2016 – 2018. the level of registered unemployment deviates by 1.38, 1.31 and 1.34%, respectively, from the average level of this indicator for the rural population in the study period.

Table 1. Average standards of the registered unemployment level of the rural population by districts of the Volyn region of Ukraine in 2016 – 2018

Regions districts	According to the average value			According to the value of Ukraine as a whole		
	2016	2017	2018	2016	2017	2018
Volodymyr-Volynskyi	4.7	0.8	-0.4	6.5	2.9	1.7
Horokhiv	1.0	-1.0	0.6	2.8	1.1	2.7
Ivanychi	-1.1	1.4	0.6	0.7	3.5	2.7
Kamin-Kashirskyi	-2.0	-2.2	-1.3	-0.2	-0.1	0.8
Kivertsi	0.1	-0.9	-1.6	1.9	1.2	0.5
Kovel	-1.3	-1.0	-1.0	0.5	1.1	1.1
Lokachi	2.0	0.6	1.8	3.8	2.7	3.9
Lutsk	-2.4	-2.5	-2.8	-0.6	-0.4	-0.7
Liubeshiv	-2.1	-2.2	-1.6	-0.3	-0.1	0.5
Lyuboml	-0.8	-0.2	-0.3	1.0	1.9	1.8
Manevychi	-0.2	0.1	-1.1	1.6	2.2	1.0
Ratno	-1.0	-0.1	2.2	0.8	2.0	4.3
Rozhysche	0.8	-0.4	-0.3	2.6	1.7	1.8
Stara Vyzhva	0.1	3.1	2.6	1.9	5.2	4.7
Turiisk	1.3	1.0	2.2	3.1	3.1	4.3
Shatsk	1.2	3.4	0.9	3.0	5.5	3.0

Source: Own calculations based on the data from: [1, 2].

Determining the economic essence of unemployment of the rural population in the system of labour use allows to identify certain categories of unemployment by its duration, namely: from 1 to 3 months - short-term; from 3 to 6 months - medium-term; from 6 months to 1 year - long-term; more than 1 year - chronic (stagnant) unemployment [1, 2, 6, 8]. In the outlined classification, long-term unemployment deserves special attention, which, in our opinion, covers the last two categories. After more than nine months of searching for a job, the activity of such a search decreases significantly, in particular, the desire to work for employment in the field of formal employment decreases. This phenomenon is associated not only with disbelief in the possibility of employment but

also with the habit of free disposal of their own time, formed during the period of unemployment. Therefore, the need to employ people who do not work or are looking for work for more than six months has become particularly acute and relevant.

Regarding the analysis of the share of the unemployed rural population in the Volyn region who have been looking for work for more than 6 months, it should be noted that in 2018. Compared to the previous year, it decreased by 28.9% or 11.6 thousand people and amounted to 32.6% (or 6.0 thousand people) of the total registered unemployed rural population looking for work. However, the average duration of a job search in 2018. Although it decreased by 3 months compared to 2017, it still remains quite high - 5 months, which, in our opinion, is an unacceptably long period.

We will take into account that the newly formed category of the rural population during the years of market transformations is desperate to find a job, although it is slowly but steadily replenishing its ranks; in 2017, among the rural population there were 195 thousand people. Their share in the number of the unemployed able-bodied rural population is 11% [25]. Desperate are people who did not have a job, and ready to start it, but during the last month stopped looking for a job because they could not find it for a long time and exhausted all opportunities to get it.

The growth of desperate people is quite large-scale, in particular in 2017 in the Volyn region of Ukraine the share of such persons in the economically inactive population in rural areas was 3.0% (3.4 thousand people), and in the city - 0.8% (1.3 thousand people). Thus, of the total number of the desperate rural population, persons who previously had a job amounted to 1.5 thousand people or 44.1%, of which the duration of unemployment 67.5% - did not work for more than three years, 26.3% - from one to three years, and only 6.2% - up to one year, which causes the loss of accumulated professional skills, knowledge and skills, and as a result - a significant «moral devaluation» of previously accumulated human capital of the rural population. Moreover, compared to the previous year in 2018, the number of unemployed people who stopped looking for work because they lost hope of finding it, in rural areas decreased by 0.3 thousand and amounted to 2.8% of the economically inactive population, and in the city - increased by 1.2 thousand people and was respectively 1.5% of the economically inactive. We believe that the decrease in the rural population of this category is due to a much greater increase in labour migration abroad, as an alternative to employment in the face of inability to find work at home, than the introduction of effective employment measures by government agencies at the appropriate level and direction. In particular, it is necessary to increase the efficiency of the State Employment Service, the main functional purpose of which is to implement a set of measures aimed at optimizing employment, including those living in rural settlements.

In addition, one of the reasons for this situation can be considered a significant problem of young professionals' employment after graduation from institutions with different accreditation levels due to lack of practical experience. For example, as noted by O. A. Grishnova, «today almost half of young people under the age of 28 do not work in the acquired specialty, and about a third of those who have full and basic higher education work on positions that do not require such a level of education» [9]. In particular, in the Volyn region of Ukraine, 23.8 % of the rural economically inactive population, which has despaired of work search, are dissatisfied after graduation.

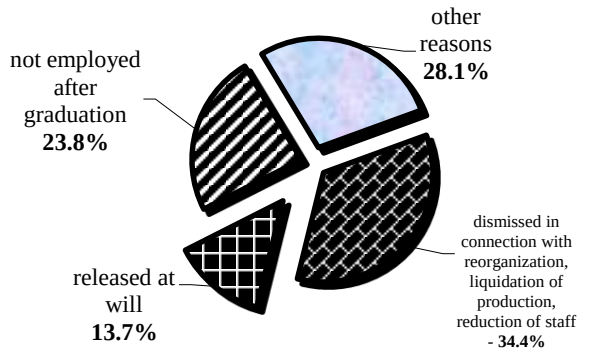

Fig. 3. The structure of the desperate in work search by the rural population of the Volyn region of Ukraine for reasons of unemployment, 2018.
Source: Own resource based on the data from: [2, 27].

Among other causes of unemployment, the share of which in the total is the largest, are dismissal due to reorganization, liquidation of production and reduction of staff – 34.4% of desperate or 1.1 thousand people; voluntary dismissal – 13.7% of desperate people (Fig. 3).

Based on the research results and identified trends, we consider it appropriate to develop measures to intensify the advisory services activities and specialized staffing agencies to take into account the rural labour market rationalization specifics and rural employment features in the economic realities of Ukraine (Fig. 4).

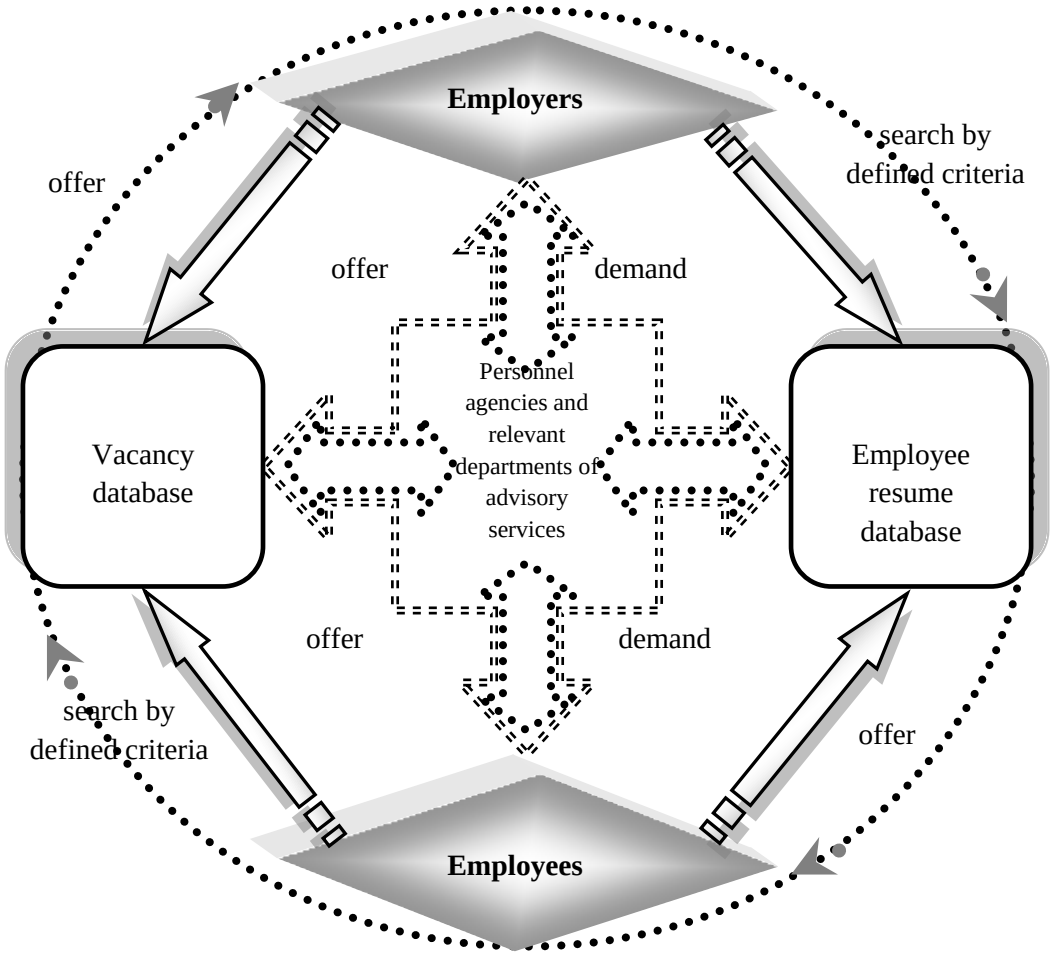

Fig. 4. Visualization scheme for rural labour force balancing in the rural labour market of Ukraine with the assistance of staffing agencies and advisory services
Source: Own research.

CONCLUSIONS

Thus, the identified trends and changes should be the basis for improving the efficiency and validity of employment programs priority areas at the regional and national levels, improving mechanisms for regulating supply and demand in rural labour markets to minimize socio-economic tensions of the rural population.

We believe that the increase in employment and, accordingly, the growth of the income level of the rural population will be facilitated by the development and implementation of an effective mechanism for motivating work; restoration and development of social infrastructure facilities in rural settlements as one of the alternative ways of employment; legalization of informal employment in order to prevent the possible participation of certain categories of unemployed in this illegal segment; establishing in-depth, active and multi-vector cooperation with staffing agencies and relevant sub-components of advisory services, as with effective

participants in the rural labour market in rural settlements of Ukraine.

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SOIL BULK DENSITY AS IMPORTANT MANAGEMENT FACTOR AND ECOSYSTEM SERVICES WELL FUNCTION

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Abstract

The decisions for a good soil management need many points of support to substantiate the management strategy. These support points must reflect as accurately as possible the field reality. In the present paper, these support points are the physico-chemical characteristics of two Luvisols: one, the crop soil (P1) and other under pasture (P2). The two soils had been analyzed to pointed out how soil bulk density is an important key of soil fertility and consequently of the agriculture management and how influence the well function of an important ecosystem services as the „maintenance of soil structure". Bulk density (BD) being considered as a referential parameter, it was compared with: packing density (PD), restricting bulk density (BDr), hydraulic conductivity (HC), and organic matter (OM) as parameters used to monitoring the structure quality. The results showed low differences between PD and BD values of both profiles, while the values of BDr drop drastically into the clayey horizons, matching perfectly with the higher clay content, and showed the stressed conditions for the roots in both soils. The HC depends not only on the poral space design, but also on the quality and quantity of the clay coatings that coated the pore walls. The illuvial constituents partially clog the pores, reducing the values of the poral space (as part of BD), and hence the HC. The BD, being one of the physical quantifying characteristics (that assessing quantitatively the water and air in soil) represent an important key of soil fertility and strongly influenced „maintenance of soil structure"ecosystem service, and consequently emphasized the quality of the agriculture management. The paper management recommendations place it on a direct path that meets the problems faced by the farmers, related to the Luvisols physical and mechanical properties (unfavorable aero-hydric conditions and high energy consumption and relatively short working period) on the general background of the increasingly severe climate changes.

Key words**:** *management, bulk density, ecosystem services*

INTRODUCTION

„Bulk density is defined as the mass of solids per unit volume of the soil" [4]. It „is a simple soil attribute widely assessed by ecologists, engineers, and soil scientists" [14].

„The bulk density of soil is a function not only of the soil composition but also of management factors such as compaction by machinery, tillage and cropping" [5].

In soils with large contents of organic carbon, such as pasture soils, complexed organic matter is proportional to the clay content, which could explain why the bulk density is significantly correlated with organic carbon in the arable studied soils.

[4] showed that „bulk density is significantly correlated with organic carbon in the arable studied soils, while in the pasture soils it is significantly correlated with the clay content".

The soil physic behavior is controlled by the amount of complexed organic carbon (with clay). According to [4], this complex is formed by the association of unit mass (i.e. 1 g) of organic matter with 10 g of clay (for their studied soils).

„Soil quality is usually considered to have three main aspects: physical, chemical, and

biological; and it is considered to be important for the assessment of the extent of land degradation or amelioration, and for identifying management practices for sustainable land use". [1]

„Similar to other soil properties (e.g. texture, infiltration rate and bulk density), soil organic carbon concentration and stock are highly variable over space (horizontally and vertically) and time" ([6]; [15]; [9]).

[10] concluded in their work that „there are no values below which the soil structure suddenly collapses".

„Nevertheless, there is a huge amount of literature that shows that decreases in organic matter content are associated with increasingly adverse soil physical conditions". [1]

The objective of the present paper is to show how soil bulk density is an important key of soil fertility and consequently of the agriculture management and how influence the well function of an important ecosystem services as the „maintenance of soil structure".

MATERIALS AND METHODS

Two Luvisols (Stagnic Albeluvisol – according to WRB-SR-2014; and Luvosol Albic Stagnic – according to SRTS-2012 respectively) had been studied.

The first soil (P1) is located in Neamţului Subcarphians, middle terrace of Moldova River. On plane relief at absolute altitude of 352 m, formed in loamy clayey deposits. The climate is characterized by a mean annual temperature of 7.8^{o}C and a mean annual precipitation of 635 mm. The evapotranspiration is 608 mm. The natural global drainage is good and the groundwater is at 7 – 9 m. The bioclimatic zone is forested with mixed forest: *Picea excelsa, Abies alba şi Fagus silvatica* cu *Dentaria glandulosa, Salvia glutinosa, Oxalis acetosela)*. The soil moisture regime is udic, while the temperature regime is mesic. The land use is arable (rye – *Secale cereale* – in the year of soil sampling).

The second soil (P2) formed in loamy clayey deposits, is located on the upper terrace of Agapia River, on flat relief at absolute altitude of 470 m. The mean annual temperature is 8.2^{o}C and the mean annual precipitation 672 mm. The evapotranspiration is 621 mm. The natural global drainage is good, while the groundwater is at 6 – 8 m. The zone is forested with mixed forest: *Fagus silvatica, Abies alba, Picea abies).* The land use is pasture (*Agrostis tenuis, Lolium perenne, Trifolium sp., Poa annua, Medicago lupulina, Polytrichum communae, Juncus effusus*). The soil moisture regime is udic and the temperature regime is mesic.

The soil was sampling from each pedogenetic horizon and further analyzed (granulometry, bulk density, hydraulic conductivity, total porosity, aeration porosity, and organic carbon) according to ICPA Methodology.

RESULTS AND DISCUSSIONS

Luvisols are soils formed on the terraces, in stratified parent material. Therefore, their main physical characteristics depend mainly on the texture (inherited from the parent material).

The two soils (P1 and P2) have variable texture: from loamy (into the upper 53 cm corresponding to the Ap-EB horizon sequence, in crop soil; and 0 – 24 cm, Aț-Ao horizons respectively, in pasture) to loamy clayey (in the deeper Btw horizons of both soils).

The crop soil (P1) is deeper (comparing to the pasture), the eluvial Ea horizon is thicker (from 24 cm to 43 cm), and the clayey Btw horizon started at 65 cm.

Under pasture, the eluvial Ea horizon is thinner (from 24 cm to 37 cm), while the finer textured Btw layer appears at 45 cm depth.

In addition to these differences, there are notable differences between the two profiles related to the clay content.

In P1 (crop soil) the clay content is 24.9 – 29.1% in the tilled layer (Ap-Apt horizons) increasing to 47.0 – 48.7 in the clayey Btw horizons (Fig. 1).

Bulk density (BD). Taking into account that BD depends on the clay content, the two parameters positively correlated (Fig. 1 and 2) and had the same tendency to increased with depth.

Nevertheless the BD showed a higher sinuosity, as a result of a higher value in the coarser Ea horizon, and, consequently, a higher porosity, followed by a lower value (1.45 g/cm^3) in the underlined transition horizon (EBw), where the clay increased with 1%.

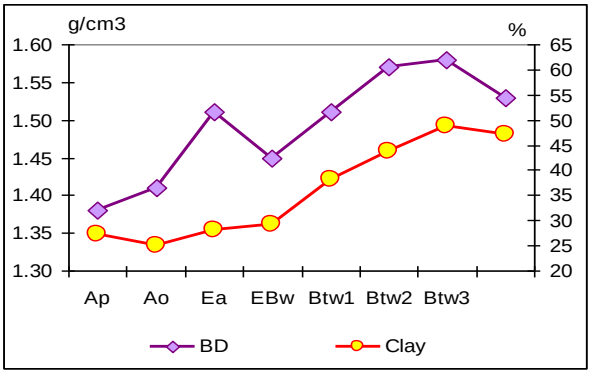

Fig. 1. The correlation between BD (bulk density – g/cm^3) and clay content in P1.
Source: Own determination.

In the P2, the clay quantity is higher (than in P1): 29.3 – 30.1% in the upper horizons (Aț-Ao horizons), increasing to 54.4 – 58.2 % in Btw horizon (Fig. 2).

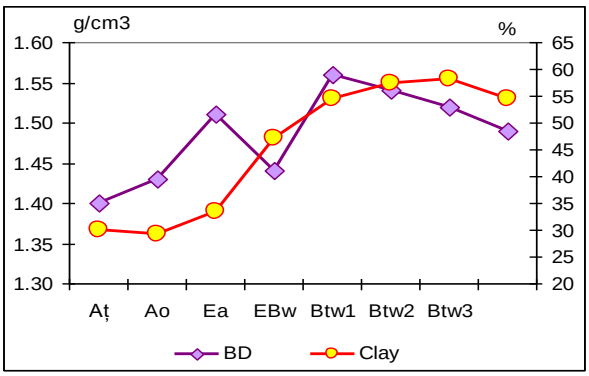

Fig. 2. The correlation between BD (bulk density – g/cm^3) and clay content in P2.
Source: Own determination.

Comparing both soil profiles (Fig. 1 and 2), the BD showed relatively the same sinuosity, while the differences between the values of the two soils ranging between 0.02 – 0.06.
In both profiles, the BD is lower in the top soil and high in Ea horizon (with coarser texture and lower organic matter content) and increased with dept.
In P1 the BD values are ranging in the limits of 1.38 – 1.58 g/cm^3 (Fig. 1). The low value (1.38 g/cm^3) in the upper horizons are a consequence of tillage, while in the deeper horizons, the higher values (1.51 – 1.58 g/cm^3) are due to clay content.
In P2 the values are more randomly distributed (Fig. 2) in the pedogenetic horizons, but maintaining the same tendency (increasing with depth) from 1.40 to 1.56 g/cm^3.
Between the two profiles, the differences in the clay content are 2.7 until 18 times, while the BD differences are smaller, and even negatively (-0.04 to 0.02).
This pointed out that, despite the lower clay content in P1, the spatial fabric of the soil matrix is more stuff, more packing, with a higher compaction (inherited, more probably, from the parent material), to which added the clay illuviation (as a result of pedogenesis).
Showing the volumetric characteristics of the soil, BD emphasizes the balance between aggregates and poral space.
The presence of the clayey horizons in the soil profile induce shallow rooting, but shallow means to develop into the eluvial horizon (Ea) which has favorable physical characteristics, but hostile environment (low: OM, nutrients, clay, etc.).
Penetrating the unfriendly environment of the eluvial horizon, the roots intersect the Btw horizon, both clayey compacted and affected by water stagnation.
The values of BD showed the restrictive conditions for the root growing through Btw.
A higher value of the BD results in slowly-poor infiltration of water through the soil dawn the rizosphere. Taking into account the presence of the clayey Btw horizon, it hinders the water stagnation in the upper part of the soil profile.
All these aspects showed precarious balance between bulk soil and voids (air respectively).
Packing density (PD). „The soil physical state can be synthetically described by bulk density, packing density and compaction degree“ [11].
Instead of BD, or together with the BD, the soil physicists also prefer the packing density (PD), as a physical parameter to describe the soil status, and being calculated with the formula [1]:

$$PD = BD + (0.009 * C)$$

where: PD = packing density (g/cm^3); BD = bulk density (g/cm^3); C = clay content (%).

The type of particle packing strongly influenced the size and the shape of the pores. [7] showed that the „concept of particle have generally been developed assuming the particles to be spherical". Or, in the studied soils the Ea horizons have also platy structure, and both transition and Btw horizons have manly angular aggregates, or massive structure with fissures.

The data showed low differences between both PD and BD values of both profile, however between PD and BD the differences are important.

The PD values of both soils are higher then BD data, and are drawing a less sinuous curves (Fig. 3).

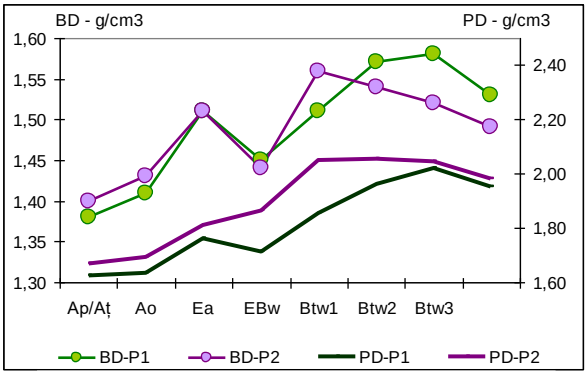

Fig. 3. The data of BD (bulk density – g/cm^3) and PD (packing density – g/cm^3) in both soils (P1 and P2).
Source: Own determination.

In the crop soil (P1), PD values show moderately loosened soil in the tilled layer (Ap-Apt horizons) and slightly compacted into the transition horizons. In the clayey ones (Btw) the soil is compacted.

Under the pasture (P2) the soil is moderately loosened in the upper 24 cm (Aț-Ao horizons) and compacted in the underlined horizons.

The PD emphasizes „the arrangement of the solid in a given volume"[7]. In this respect, PD is strongly influenced not only by the type of packing (loose or densely), but also by the shape and the size of the aggregates, as well as by the roughness of their surfaces.

PD is also considered one of the soil properties useful for monitoring soil quality.

Both physical parameter (BD and PD respectively) help to an accurate evaluation of the bulk soil matrix quality.

In this respect, it could also be considered the bulk density which restricting rooting: „*restricting bulk density*".

Restricting bulk density (BDr). This type of density is calculated with the formula [1]:

$$BDr = 1.52 - (0.00646 * C)$$

where: BDr = restricting bulk density (g/cm^3); C = clay content (%).

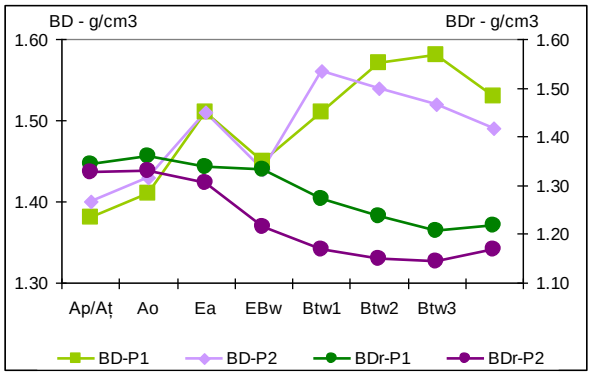

Fig. 4. The correlation between BD (bulk density – g/cm^3) and BDr (restricting bulk density– g/cm^3) in both soils (P1 and P2).
Source: Own determination.

The values of the BDr are lower and their graphic (Fig. 4) expressed the negative relationship with the BD. The values drop drastically into the clayey horizons, showing the stressed conditions for the roots in both soils. In P2 the values are lower, BDr matching perfectly with the higher clay content.

Hydraulic conductivity (HD). If soils have the same degree of compaction, the same correlations between physical characteristics should appear.

„Soil hydraulic conductivity describes water-soil relations and affects soil water balance and, by extension, plant growth"[13].

„The hydraulic properties of soils with identical texture depend on bulk density and structure, and the increasing bulk density not only induces changes in the pore-size distribution but also affects the ability of soil to shrink and to conduct water under unsaturated conditions"[3].

HD being a parameter that depends on the soil permeability, and consequently on the poral space, it varies with BD.
Therefore the HC data showed the same evolution (with depth) in both profiles, and mainly into the more compacted horizons (Fig. 5).

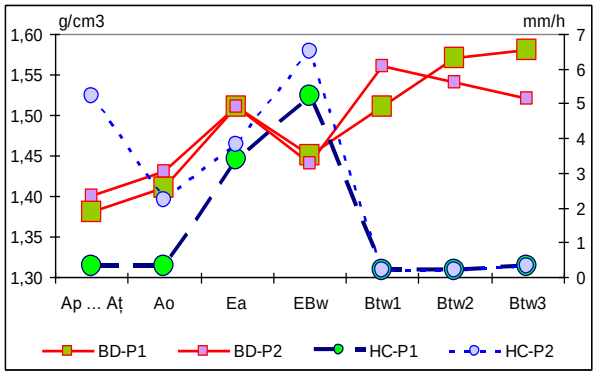

Fig. 5. The correlation between BD (bulk density – g/cm^3) and HC (hydraulic conductivity – mm/h) in P1 and P2.
Source: Own determination.

Comparing the studied soils, the analytical data of HC showed very small values in the crop soil (P1), except Ea-EBw horizons (24 – 46 cm), where the values are medium.
But the soil under the pasture (P2) is more compacted, comparing to the P1: two times in the upper part of the profile, till four times into the transitional EBw horizon. Into the more clayey Btw horizons, the degree of compaction is emphasized by the same values.
Consequently, the HC vary in the upper part of the soil profile, but had the same values (as crop soil) in the Btw horizons.
The HC depends not only on the poral space design, but also on the quality and quantity of the clay coatings that coated the pore walls.
In Luvisols, many pores are covered with a high diversity of discontinuous clay coatings (Fig. 6): from impure clay coatings (composed of clay±Fe±humus) to pure clay coatings and clay±Fe coatings. Each type influenced differently the permeability, depending on their composition and extension on the pore walls.
The impure clay coatings retain a high quantity of soil solution on the pore walls even after drainage.

In the studied Luvisols also the illuvial constituents (clay±Fe±humus) partially clog the pores, reducing the values of the poral space (as part of BD), and hence the HC, and accordingly the correlation between BD and HC.

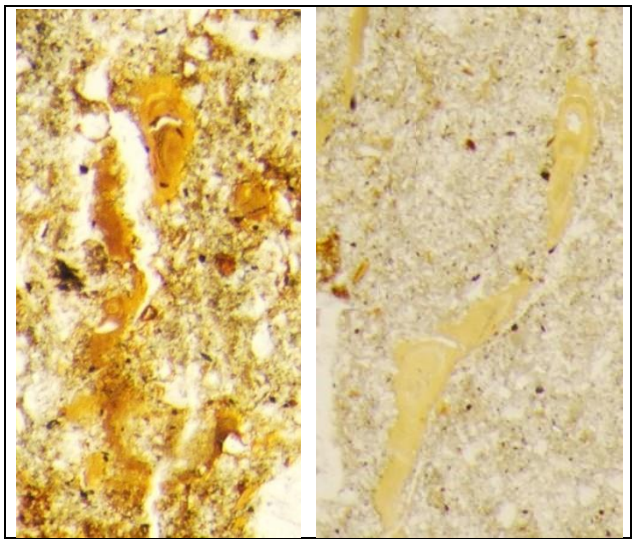

Fig. 6. The impure clay coating (composed of clay±Fe±humus) and pure clay coating (composed of clay±Fe) on the pore walls and clogging the voids.
Source: Own determination.

In these conditions, even if soil fauna is active, building poral space, the illuvial process is also active and induced the pores clogging (partially or totally).
Consequently, the HD values drastically decreased.
Therefore, the measured porosity is smaller then the real structural porosity formed in the bulk soil.
In this order, it could be statute that HD is directly proportional with the biological activity intensity and inversely proportional with the illuvial process (and clay coatings amount respectively).
For an accurate image of the soil physics, the correlation between BD and: HC, AP (aeration porosity – %v/v) and TP (total porosity – %v/v) had been approached for both soils (Fig. 7 and 8).
TP of the crop soil (P1) showed high to medium values in the upper part of the soil profile, ranging in the limits of 45.8 – 48.6 %v/v (Fig. 7). Accordingly, the AP values gradually decreased with depth from low (13.60 – 14.10 %v/v) in the tilled layer to

extremely low (0.13 – 5.10 %v/v) in the Btw horizon.

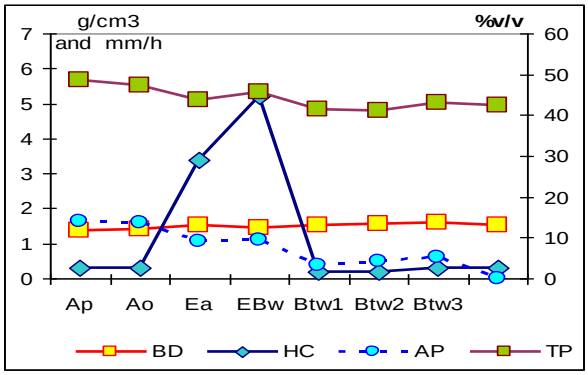

Fig. 7. The correlation between BD (bulk density – g/cm^3) and: HC (hydraulic conductivity – mm/h), AP (aeration porosity – %v/v) and TP (total porosity – %v/v) in P1.
Source: Own determination.

Under pasture (P2), TP is medium (46.7 – 48.2 %v/v) in the bioaccumulation layer, to low (43.5 – 46.3 %v/v – Fig. 8) in the deeper horizons. Accordingly the AP values are low (13.20 – 14.10 %v/v) in the bioaccumulation layer, to extremely low (4.20 – 5.20 %v/v) in the Btw horizon.

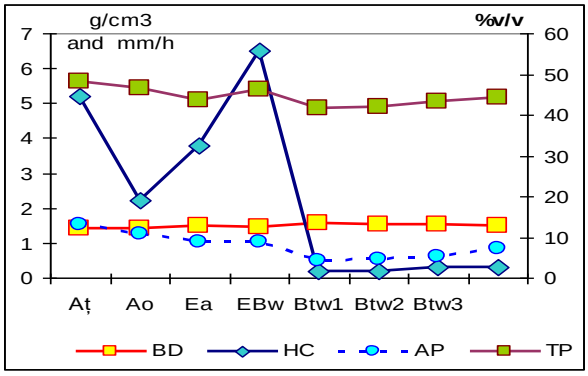

Fig. 8. The correlation between BD (bulk density – g/cm^3) and: HC (hydraulic conductivity – mm/h), AP (aeration porosity – %v/v) and TP (total porosity – %v/v) in P1 and P2.
Source: Own determination.

In this respect, the two graphics (Fig. 7 and 8) showed that BD is low correlated to the AP and TP for both soils.
Comparing the two graphics, even if BD curves are featuring relatively the same allure for both soils, the HC curves are highly different in the upper part of the soil profiles. Into the clayey Btw horizons, HC clearly correlated to all the physical parameters.

Although the physical-mechanical characteristics of the studied soils are relatively favorable in the upper horizons (tilled layer and bioaccumulation layer respectively), they became unfavorable into the deeper transition and Btw horizons, which give the soil profiles, as a hole, unfavorable conditions (concerning the moisture/aeration balance).
During the maximum period of humidity which creates moisture excess on soil surface, anaerobic conditions prevailing even in the top A horizon.
Organic matter (OM). If the physical characteristics are basically inherited from the parent material, the differences between the two soils should be given by the land use and, consequently, by the organic matter content.
Taking into account that BD could be estimated from the soil organic matter, it appears to be a correlation between BD and OC (organic carbon) (Fig. 9 and 10).
In the crop soil (P1) the organic carbon content is low to extremely low (Fig. 8).

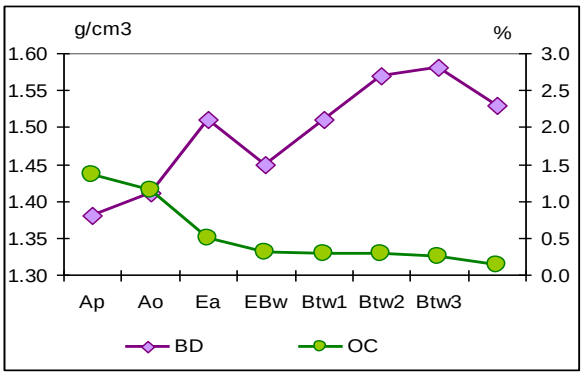

Fig. 9. The correlation between BD (bulk density – g/cm3) and OC (organic carbon - %) in P1
Source: Own determination.

Under pasture (P2) the higher content of the humic substances (4.20 – 2.34%) in the upper two horizons drops drastically to extremely low (0.96 – 0.52%) in the deeper clayey horizons (Fig. 10).
High BD mirrors the low values of OC (Fig. 10) which exhibit low retention of water in soil.

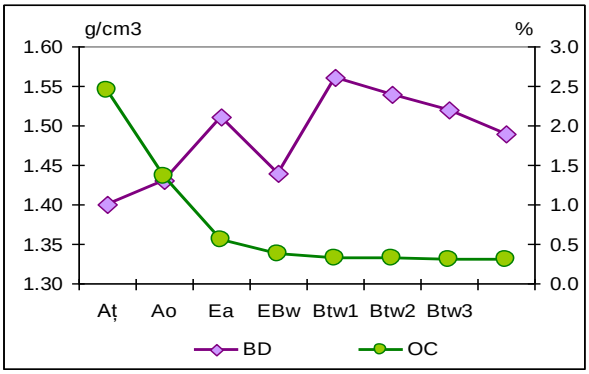

Fig. 10. The correlation between BD (bulk density – g/cm^3) and OC (organic carbon - %) in P2.
Source: Own determination.

The higher content of humus in P2 is a consequence of an important rooting which further influenced the porosity (by nourishing soil fauna that generated biogenic channels). [8] found „highly significant negative relationships between percentage clay or silt+clay and the bulk density at which rooting was at a maximum or the bulk density at which rooting was 0.2 of that maximum".

The upper part of the Luvisols with low organic matter and silty – to silty clayey texture inherited a dense arrangement of the soil particles that restrict root growth, and further compaction processes that increased bulk density and limiting root growth passes to the subsidiary

Since root penetration is affected by soil strength and aeration conditions, and both are related to BD, then root penetration should be a function of BD.

The differences between the land use (crop and pasture) and vegetal cover respectively are emphasized not only by the quantity, but also by the quality of the OM, the important brick of the soil architecture and a good „maintenance of soil structure".

In what concerning the correlation between OC and BD, the two parameters are negatively correlated (Fig. 8 and 9) in both studied soils.

[12] reports „relationships between soil organic carbon (SOC), soil organic matter (SOM), and bulk density (BD), in acidic loamy to sandy loam fine fractions of forest soils".

The organic matter being complexed by clay, it results a double influence on BD of the bulk soil.

The management. This study was carried out as a result of the signals received from the farmers who face problems caused by the physico-mechanical properties specific to Luvisols and which imprint unfavorable aero-hydric conditions on soil profiles and high energy consumption and relatively short working period.

According to the yearly management and plant rotation respectively, the „land use" changed every year (and even seasonally), and consequently the soil biodiversity specific (more or less) to every crop. Further, the soil architecture also changed according to the crop roots characteristics, emphasized by the bulk soil and the adjacent poral system.

The prediction of the evolution of BD could be drawing according to the intensity of soil biodiversity activity.

In the two Luvisols the fauna activity is relatively high, building and hardly renewing the poral space into the bulk soil.

In this respect, the good management of the Luvisols (both pasture and crop) should include the increasing of the OM content as supply for soil biodiversity. Thus because a good management favored a *crescendo* improvement of soil characteristics that potentiate each other, i.e.: the increase of OM stimulates the biological activity which burrowing intensely the soil and consequently decreased BD and BDr and increased HC and AP.

Table 1. The physico-chemical status of the crop soil (P1).

Horizons	BD/TP	PD	AP	HC	OM
Ap	loosened	moderately loosened	low	very low	low
Ao	slightly compacted		very low		
Ea		slightly compacted		medium	very low
EB					
BE	moderately compacted	compacted	extremely low	very low	extremely low
Btw_1					
Btw_2	compacted		very low		
Btw_3					

Source: Own determination.

According to the data of the studied physical parameters the soil in the crop (P1) is loosened (Tab. 1) into the top horizon and

from slightly compacted to compacted in the deeper horizons, while the soil under pasture (P2) is compacted on a higher depth (Tab. 2).

Table 2. The physico-chemical status of the pasture soil (P2).

Horizons	BD/TP	PD	AP	HC	OM
At	slightly compacted	moderately loosened	low	medium	medium
Ao			very low		low
Ea	moderately compacted	compacted			extremely low
EBw					
Btw_1	compacted		extremely low	very low	
Btw_2					
Btw_3					

Source: Own determination.

The compaction directly influences water retention capacity of the soil, as well as the permeability, which inevitably lead to a bad water and air regime of the soil. Directly increased both penetration resistance and plough resistance, with further negatively effects on the root life.
The low content of the organic matter could also favor the crusting process in the top layer and negatively affect the „maintenance of soil structure" ecosystem service.
Inappropriate management could strongly affect on long term, the ecosystem services well function, as maintenance of soil structure. Furthermore, it affects physical status and inevitably soil fertility and soil life.
In this respect the following management practices are recommended for the studied Luvisols.
Elimination of temporary excess rain moisture through agro-pedo-amelioration works and surface drainage works.
To improve the aerohydric and soil nutrition regime, organic fertilization with 30 – 40 t / ha manure is required (once at every 3 – 4 years).
The correction of the soil reaction with the help of calcareous amendments (around 5 t $CaCO_3$) is strictly necessary.
Re-amendment works must be done on time (at every 5-6 years) to ensure the effectiveness of chemical fertilizers, and the doses must be rigorously determined according to soil acidity indices.
The application of the complex NPK fertilizers must be in accordance with the agrochemical condition of the soil.
The management required for the pasture (P2) also includes the animal grazing control and reseeding with a mixture of forage plants with different type of roots and rooting able to breaking down the higher structural elements in the compacted layers.
Consequently, the biodiversity activity is stimulated at different depth of the soil, and mainly earthworms burrowing, which means highly porosity, lower bulk density and compaction respectively.
Inappropriate management could strongly affect on long term, the ecosystem services well function, as maintenance of soil structure. Furthermore, it affects physical status and inevitably soil fertility and soil life.
Good management practices reclaim the decrease of the bulk density. Thus, „many soil management decisions can be made from measured dry bulk density of the soil" [5].
„The delivery of ecosystem goods and services depends on the structure and functioning of ecosystems, which are affected by (global) environmental change and land management effects on the soil biota" [2].
The BD, being one of the physical quantifying characteristic (that assessing quantitatively the water and air in soil) represent an important key of soil fertility and strongly influenced „maintenance of soil structure" ecosystem service, and consequently emphasized the quality of the agriculture management.
The paper, through the management recommendations, is a point of support for agricultural technologies that require important adjustments in the conditions of the increasingly severe climate changes.

CONCLUSIONS

The correlation between the important physical parameter with BD, as an important manager factor and ecosystem services well function, concluded:
The values of BD showed the restrictive conditions for the root growing through the Btw clayey horizons. The presence of the Btw in both profiles induced shallow rooting, what means forcing them to develop into the eluvial horizon with relatively favorable physical

characteristics, but hostile environment (low: OM, nutrients, clay, etc.).
The analytical data showed low differences between both PD and BD of both profile, these two parameters helping to an accurate evaluation of the bulk soil matrix quality.
The values of BDr drop drastically into the clayey horizons, showing the stressed conditions for the roots in both soils; moreover, in P2 the values are lower, BDr matching perfectly with the higher clay content.
The HC depends not only on the poral space design, but also on the quality and quantity of the clay coatings that coated the pore walls. The illuvial constituents (clay±humus±Fe) partially clog the pores, reducing the values of the poral space (as part of BD), and hence the HC, and accordingly the correlation between BD and HC.
In the crop soil (P1) the OC content is low to extremely low, as in the clayey horizons of P2, affecting the stability of the structural aggregates. The differences between the land use (crop and pasture) and vegetal cover respectively are emphasized not only by the quantity, but also by the quality of the OM, the important brick of the soil architecture and a good „maintenance of soil structure".
The BD is one of the physical quantifying characteristic (that assessing quantitatively the water and air in soil) represent an important support point for an efficient management to provide at a higher level possible the „maintenance of soil structure" ecosystem service, and consequently the quality of the soil life.
Throughout the management recommendations, the paper comes to the aid of farmers which tilled the Luvisols, soils with unfavorable aero-hydric conditions, high energy consumption and relatively short working period.

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EVALUATION OF SOME AGRONOMIC LAND-USE PRACTICES ON SOIL QUALITY INDICATORS AROUND AMALLA-NSUKKA AREA, SOUTHEAST NIGERIA

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Abstract

Information about effects of agricultural land uses on soil properties is essential for sustainable utilization of soil resources and conservation of the ecosystem. This study was carried out to assess the impact of agricultural land use types on selected quality indicators of some soils of Amalla in Nsukka, South-East Nigeria. A total of 15 composite soil samples were collected each from cassava farm, maize farm and oil-palm plantation farm at 0-15 cm soil depths in 5 different study locations. Three farms practicing each of the land use type at each location were taken as replicates. The analysis of variance (ANOVA) was done following the generalized linear model of Statistix 9.1 laid in a Completely Randomized Block Design. The results shows that the mean values of sand, silt and clay contents ranged from 74.60–80.80%, 11.00–14.00% and 7.39–11.40% in the farm locations, respectively. The mean soil bulk density ranged from 1.18–2.05 g/cm^3 and was significantly ($P<0.05$) different among the land use types, except at Ibagwa farm. The sand and silt contents of the soils did not differ significantly ($P<0.05$) among the land use types in most of the study locations. The clay content differed significantly across all land use types in all the sampled locations, and was significantly higher under the oil palm compared to both cassava and maize farming systems. The significantly ($P<0.05$) higher soil organic carbon (OC) content was found under the oil palm land use, while the lowest organic carbon of 0.34% was found in the cassava farm locations. Soil organic matter (OM) was significantly ($p \leq 0.05$) higher in the oil palm (2.1% – 2.9%) and lowest under the cassava farm (0.59%–1.3%). Generally, the OC content (0.34%–1.34%) recorded under the various land use types was well below the bench mark for most crop requirements, and soil's structural stability might fail. The soils are thus, predisposed to greater risk of low fertility and water erosion. More detailed studies on environmental and economic aspects of these land uses are strongly recommended.

Key words**:** *evaluation, agronomic land use, soil quality indicators, Amalla, Southeast Nigeria*

INTRODUCTION

Change in land use management from natural to managed ecosystems often attracts consequences that may be deleterious to soil structure and other inherent soil qualities. Over the years, soil quality and sustainable agricultural productivity have largely been depleted by inappropriate land use management systems [4]. Accordingly, agricultural management practices can largely influence the quality of soils which in turn affects sustainability of agro-ecosystem roles on crop productivity [9]. Land use change affects the dynamics of soil nature and is one of the main drivers of environmental change as well as important component in understanding the sequence of changes in the characteristics and interaction of human activities in the environment. These changes affect the basic nature of the land and several other natural processes in the soil. A successful agriculture thus, requires a sustainable use of soils, but poor land use practices could easily cause soil to lose its quality within a short period of time [20]. However, the success to preserving soil quality widely depends on the understanding of how the soil responds to agricultural practices over time [10]; and as such, agricultural practices requires basic knowledge of sustainable use of land [37].

According to [20], land use may be the most dominant factor that influences soil properties

under small catchment scales. Land use and soil management practices influence the soil nutrients and related soil processes such as erosion, oxidation, mineralization, and leaching, among other processes [6], [22]. The introduction of the sand to clay ratio was noted as the main soil physical factor controlling the aggregate stability against erosion [23], while increase in sand content in soils was reported to decrease their susceptibility to gully erosion [14]. But for heavy soils containing large amounts of clay and silt particles due to increase in the saturation water and water holding capacity, the formation of gully erosion and their frequency are more expected [14].

Most changes in land use affect the amount of carbon held in vegetation and soil. The soil organic matter (OM) and the organic carbon (OC) plays crucial roles in enhancing crop production [36], and in the mitigation of greenhouse gas emissions [15]. Furthermore, OC contents of soil aggregates influence aeration, water movement, and nutrition, while the soil OC contents of bulky soils affects water-holding capacity [7]. Thus, maintenance of soil OM is especially important due to its effect on soil nutrient status and soil structural stability [11].

The Southeastern ecological zone of Nigeria has a human population considered to be a factor in moderating human roles on land use patterns as well as per-capital consumption [26], [2]. The high population increase now poses a number of threats to provision of adequate food supplies, management of soils to support crop production, development of appropriate technologies for sustainable agricultural production and meeting the challenges of intensive agriculture. Despite the use of mineral fertilizer blends such as NPK and Urea fertilizers on soils of the region, the yields of crops are still in constant decline and has become a source of concern. At present, there is no information available to the people of Amalla area on the immediate and remote causes of low crop yields in recent times.

The sustainability of crop and soil management practices that could improve soil quality depends on understanding how soils respond to different site-specific cropping and land-use practices [29]. Consequently, there is need for adequate soil information to understand and appreciate the serious issue of sustaining soil productivity in the south-east region of Nigeria. The most prevalent land use patterns in communities of the south-east Nigeria, such as Amalla in Enugu State, include continuous cassava and maize cultivation, and several oil palm plantations. This research was, therefore, focused on assessing the effects of some of the practiced land use types on soil OC content, plus other soil physical properties and their potentials for continuous agriculture in the study area.

MATERIALS AND METHODS

The study area

The study was conducted in Amalla area located in Udenu Local Government Area (LGA), and forms part of the Nsukka Senatorial Zone of Enugu State. The area is located between Latitudes 6º 55" and 6º50" N and between Longitudes 7º30", and 7º35" E of the equator. The climate of the study area is sub-humid tropical, having distinct rainy and dry seasons, with a bi-modal rainfall distribution pattern with peaks in July and September. The month of March is the warmest with an average temperature of 27ºC, while the month of August is the coldest with an average temperature of 22.9ºC [28]. The mean annual minimum rainfall is 1,200 mm, while the mean annual maximum rainfall is 2,000 mm spread between April and early November.

The natural vegetation consists mainly of secondary forest due to prolonged human intervention through arable small scale farming methods. The predominant crops grown include cassava, maize, oil palm, banana, and cocoyam among others. Farming is the major socio-economic activity in the area. The farm area has a wide expanse of one square-mile of which about 85 hectares are being cultivated for arable crop production. Arable crops are mostly cultivated and are grown as rain-fed crops. Major crops grown are maize (*Zea-mays*), cassava (*Manihot spp*), and Oil Palm (*Elaeise guinnensis*).

Site selection and soil sampling procedure

Field reconnaissance survey was carried out during the 2019 cropping season in the study area to select farm stations with different land uses. Direct interviews were held with the farmers to gather information about the area over the past 5 years. The interview was done for each farm unit that was eventually selected for the study.

Three farms used for the cultivation of cassava (*Manihot spp*), Maize (*Zea mays*) and Oil palm (*Eleais guenensis*) were sampled in each of the 5 selected villages comprised of Ibagwa, Obodo-onitsha, Umua-gbadu, Umu-enachi and Ifuroka. Within each farm, 4 soil samples were collected randomly at a 0-15 cm depth using an Edelma soil auger, then homogenized thoroughly to give a composite soil samples as a representation of each farm. Thus, a total of 15 representative soil samples were collected for each land use type. Each soil sample was kept in a black polythene bag and properly labelled. The samples were subsequently transported to the laboratory, air dried, crushed and sieved using a 2 mm mesh sieve in preparatory for laboratory determination of the selected soil properties.

Determination of selected soil properties

The bulk density was measured following the core method as described by [43]. Particle size distribution was determined using Bouyoucous hydrometer method [17], while the soil OC was determined using the Walkley and Black wet oxidation method using a 1-normal potassium dichromate (1N $K_2Cr_2O_7$) as described by [25]. The soil OM content was then computed by multiplying the OC content by a factor of 1.724.

Statistical Analysis

The data generated was analysed in accordance with the generalized Linear model of Statistix 9.1 (2012) for the ANOVA in a completely randomized block design (CRD). The sample means were compared using a Standard error (SE) and then separated using the Least Significant Difference (LSD) in order to determine the influence of the land use types on the measured soil properties.

RESULTS AND DISCUSSIONS

Effects of land use types on selected soil properties in the study area

Particle size distribution

Results of the effects of land use types on some selected soil properties across the study locations are shown in Tables 1- 5. Tables 1-3 show the results of selected soil properties as influenced by the land use types at Ibagwa, Obodo-onitsha, and Umu-enachi locations, while Tables 4 and 5 show the results for Umu-agbadu and Ifuroka locations, respectively.

Table 1. Effects of land use types on selected soil properties at Ibagwa village farm location

Land use type	PSD (%)			Soil texture	BD (gcm^{-3})	PD (gcm^{-3})	OC (%)	OM (%)	OM rating*
	Sand	Silt	Clay						
Cassava farming	79.60[a]	12.50[a]	7.90[b]	Loamy sand	1.39[a]	1.12[a]	0.62[c]	1.0[b]	Medium
Maize farming	79.59[a]	13.00[a]	7.39[b]	Loamy sand	1.36[a]	1.12[a]	0.73[b]	1.26[b]	Medium
Oil Palm farming	76.59[a]	12.01[a]	11.40[a]	Loamy sand	1.47[a]	1.12[a]	1.34[a]	2.31[a]	Very high
SE (±) P<0.05	NS	NS	0.8165		NS	NS	0.0128	0.0134	

Means followed by different letters in the same column are significantly different at probability level (P<0.05).
*Murphy *et al.* (2012)
Key: PSD = Particle Size Distribution; BD = Bulk density; PD = Particle density; OC = Organic carbon; OM = Organic matter
Source: Authors' results.

Table 1 shows that the sand and silt contents did not differ significantly (P<0.05) among the land use types in Ibagwa location, except for clay content that differed significantly (P<0.05). The results also show that sand content (76.59-79.60%) predominated the soil

textures, followed by silt (12.01-12.50%) and clay contents (7.39-11.40%).

Table 2. Effects of land use types on selected soil properties at Obodo-onitsha village farm location

Land use type	PSD (%)			Soil texture	BD (gcm^{-3})	PD (gcm^{-3})	OC (%)	OM (%)	OM ratings
	Sand	Silt	Clay						
Cassava farming	74.60[a]	13.00[a]	7.40[a]	Loamy sand	1.48[b]	1.05[a]	0.78[c]	1.3[b]	Medium
Maize farming	79.59[a]	11.86[a]	8.40[a]	Loamy sand	1.69[a]	1.08[ab]	1.06[b]	1.8[b]	High
Oil Palm farming	80.60[a]	12.00[a]	7.40[a]	Loamy sand	1.26[c]	1.21[a]	1.23[a]	2.1[a]	Very high
SE (±) P<0.05	NS	NS	NS		0.0428	0.0519	9.03E-03	0.0152	

Source: Authors' results.

Results for Obodo-onitsha location shown in Table 2, reveals that sand, silt and clay contents did not differ significantly (P<0.05) among the land use types. Likewise, results for Umu-Enachi village is presented in Table 3, and it shows that sand, silt and clay contents differed significantly (P<0.05) among the land use types. However, sand content still dominated the textures, followed by silt and clay contents, respectively.

Table 3. Effects of land use types on selected soil properties at Umu-Enachi village farm location

Land use type	PSD (%)			Soil texture	BD (gcm^{-3})	PD (gcm^{-3})	OC (%)	OM (%)	OM ratings
	Sand	Silt	Clay						
Cassava farming	76.60[c]	14.00[as]	7.39[a]	Sandy loam	1.18[b]	1.16[a]	0.34[c]	0.59[c]	Very low
Maize farming	79.30[a]	11.00[b]	9.41[a]	Sandy loam	1.23[ab]	1.11[a]	0.62[b]	1.07[b]	Low
Oil Palm farming	78.76[b]	12.01[ab]	9.20[b]	Sandy loam	1.28[a]	1.09[a]	1.06[a]	1.83[a]	Medium
SE (±) P<0.05	0.0318	0.8166	0.0109		0.0288	NS	8.17E-03	0.0113	

Source: Authors' results.

Table 4. Effects of land use types on selected soil properties at Umu-Agbadu village farm location

Land use type	PSD (%)			Soil texture	BD (gcm^{-3})	PD (gcm^{-3})	OC (%)	OM (%)	OM ratings
	Sand	Silt	Clay						
Cassava farming	80.80[a]	10.97[a]	8.20[a]	Loamy sand	2.02[b]	1.06[a]	0.34[c]	0.59[c]	Low
Maize farming	80.30[a]	12.00[a]	7.70[a]	Loamy sand	1.24[c]	1.04[a]	0.73[b]	1.26[b]	Medium
Oil Palm farming	79.80[a]	12.00[a]	8.20[a]	Loamy sand	2.05[a]	1.07[a]	1.28[a]	2.22[a]	Very high
SE (±) P<0.05	NS	NS	NS		0.0100	NS	8.17E-03	0.0341	

Source: Authors' results.

The results of Umu-Agbadu location presented in Table 4 shows that sand, silt and clay contents did not differ significantly (P<0.05) among the land use types. The results also show that sand content (79.80-80.80%) still predominated the soil textures, followed by silt (10.97-12.00%) and clay contents (7.70-8.20%).

For Ifuroka location, the results presented in Table 5 shows that both sand and clay contents did not differ significantly (P<0.05) among the land use types, except under cassava farming system, which differed significantly from the other land use types.

Table 5. Effects of land use types on selected soil properties at Ifuroka village farm location

Land use type	PSD (%)			Soil texture	BD (gcm^{-3})	PD (gcm^{-3})	OC (%)	OM (%)	OM ratings*
	Sand	Silt	Clay						
Cassava farming	79.80[a]	11.70[ab]	8.50[a]	Loamy sand	1.38[b]	1.07[a]	0.45[b]	0.78[b]	Low
Maize farming	79.80[a]	12.00[a]	8.69[a]	Loamy sand	1.41[a]	1.08[a]	0.45[b]	0.78[b]	Low
Oil Palm farming	80.80[a]	10.50[a]	8.70[a]	Loamy sand	1.42[a]	1.05[b]	0.66[a]	2.90[a]	Very high
SE (±) P<0.05	NS	0.3392	NS		9.43E-03	4.3E-03	9.81E-03	0.0249	

Source: Authors' results.

The results also show that the soils of the study area are generally Loamy sand textured, except for Umu-enachi location (Table 3) which falls in the Sandy loam category. The sand and clay fractions did not differ significantly (P<0.05) among the land use types across all study locations, except for Umu-Echina location. Likewise, silt did not differ significantly (P<0.05) among the land use types in the study locations, except for Umu-Echina and Ifuroka.

Although there was no statistical disparity among the sand contents under most of the land use types in the study locations, there was, however, numerical variation among the land use types. Sand particles was found as the soil property that was slightly influenced by some of the cropping and land use systems, in addition to other activities such as soil erosion-deposition processes [38]. This present finding on soil texture was consistent with those of [35], who reported that there was no significant effect of land-use systems on soil particle size distributions. However, this report did not agree with some findings by [19], [41] and [1], who reported that continuous cropping and intensive land-use systems have significantly affected soil particle size distributions. Recently, it was highlighted that such discrepancy in the soil particles could be attributed to the duration of the cropping system for a given land use, variability in management practices, effects of weather conditions, plus the influence of variation in topography [38].

The high sand content recorded in soils of the study areas was perhaps, due to the intensive agricultural practices. The sand content ranged closely with those reported by [16], who found higher sand contents in the surface layers of cultivated lands. Clay content of the various soils, though generally low (7.39%-11.40%), still varied significantly among the land use types. The significantly (P<0.05) high differences in clay content especially between the oil palm farming system and those of both cassava and maize farming systems was perhaps, due to less pulverization of soils under oil palm farm, than for both maize and cassava farms. Similar finding was observed by [16], who reported that plantation farm recorded higher clay content than on arable farms. Clay material help to provide the needed cohesion among soil particles, resulting in the formation of more stable aggregates which makes them less susceptible to erosion [27]. The absence of clay fraction reduces the tendency of soil particles to bind together and form soil aggregates that are resistible to the shearing force of flowing water, thus making the soil more vulnerable to soil erosion. However, it was reported that soils with more sand and silt proportions than clay (as observed in this study) at the surface layer promotes runoff, and are hence, susceptible to water erosion [39].

Bulk density

Bulk density differed significantly (P<0.05) among the land use types across all locations, except for Ibagwa location, where bulk density of the soils did not differ significantly (P<0.05) among the land use types. Highest bulk density of 2.05 gcm^{-3} occurred under the oil palm farming system, while the lowest value of 1.18 gcm^{-3} occurred under the cassava farming system at Umu-Enachi location. In the locations, soil bulk density was significantly (P<0.05) higher under the oil palm land use type. Differences in the bulk density of the soils could be the result of

varying degree of soil disturbances experienced under the respective land use types. The relatively higher bulk density under the oil palm land use could be as a result of less tillage activity that left the soils undisturbed to have increased its compactions over time. The intensive cultivation of the cassava and maize farming systems and the attendant applications of fertilizer could have contributed to their lower bulk densities, since farming activities in the region are not done with heavy machineries that could trigger soil compaction over time. However, values of the bulk densities recorded across the study locations, with the exception of Umu-Agbadu, falls within the critical level described as an ideal soil condition for plant root growth and water holding capacity [3]. Bulk density is a combined result of soil structure, texture, OC and applied pressure on soil [42], [40], and is necessary for the estimation of some physical soil properties, including porosity, water retention, heat capacity, and compressibility [33].

Soil OC Content

The significantly ($P<0.05$) higher soil OC contents was both found under oil palm land use system at Ibagwa (1.34 %), followed by Umu-Agbadu (1.28 %), while the lowest OC of 0.34 % was found under the cassava land uses at Umu-Enachi and Umu-Agbadu locations. The soil OC content varied significantly ($P<0.05$) among the various land use systems across the study locations. The cassava land use system recorded the lowest OC content across the locations, followed by maize farming system. The relatively higher OC content observed under oil palm land use system could be the result of accumulation of litters in the topsoil surfaces and the slow uptake of mineralizable OM content. On the other hand, the relatively lower OC content under cassava and maize land use systems could be attributed to the continuous land cultivation that aggravates OM oxidation.

Soil OC had a significant ($P<0.05$) effect on the chemical and physical characteristics of the soils, and it is one of the most essential components for soil quality assessments. The OC content is accounted as an important indicator for determination of soil erodibility, which are often affected severely by land use change [12]. The impacts of land use change on soil OC, permeability and aggregate stability can trigger changes in the inherent soil erodibility statuses [18]. The OC content had positive effects on soil water holding capacity and soil porosity, leading to reduction in soil erodibility [13]. The OC content (0.34%-1.34%) recorded in soils under the various land use types was well below the 2% critical limit suggested as a bench mark below which soil structural stability will suffer a significant decline [27]. According to [31], intensive tillage under rain-fed farming systems may increase aeration rates, which induces the acceleration of OC oxidations. This explains why lower values of OM content were recorded under both cassava and maize farming systems, as against the oil palm farming system across the locations studied. Similar findings were reported by other researchers who claimed that continuous cultivation depletes soil OC and reduces soil quality, regardless of the cropping system practiced [30]. According to [38], agricultural intensification and repeated cultivation have resulted into a serious decrease in soil OC content under natural vegetation. According to the authors, cultivation enhances decomposition of soil OC. The present study is in agreement with previous reports, such as [5] and [34], where variability in soil nutrient stocks was said to be attributed to differences in soil and crop management practices under different land use patterns.

Soil OM Content

Figure 1 shows the variations in soil OM with land use types and across locations.

Significant differences ($p \leq 0.05$) in soil OM content were observed among the land use types. The OM content was significantly ($P<0.05$) higher under oil palm (2.1% - 2.29%) farming system, and was the lowest under cassava farming (0.59% - 1.3%).

There was, however, relatively lower OM content (1.83%) under oil palm at Umu-Enachi, which could be as a result of the sandy loam texture, compared to the loamy sand texture at the other locations.

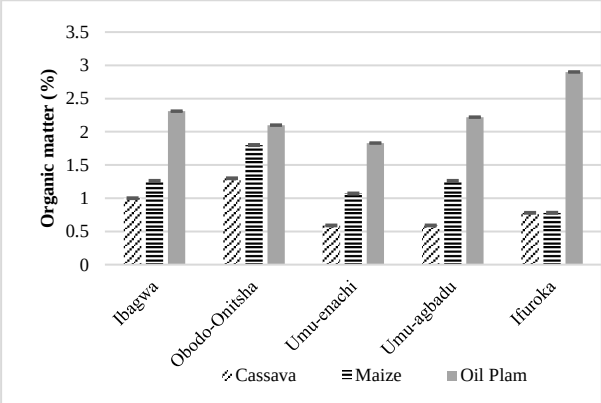

Fig. 1. Variation in OM with landuse types and across locations
Source: Authors' results.

The significantly low soil OM under cassava farming could be attributed to the effect of continuous cultivation of the soil, which promotes OM oxidation.

The higher OM content under the oil palm land use system could have been due to the shrub residues and litters, plus low utilization of OM content in the plantation. This result corroborate with the findings reported by [21], that cultivated soils generally contain relatively low OM content due to the action of soil aeration, which enhances decomposition of soil OM.

Following the ratings by [24], the soil OM were generally low to medium under the cassava farming, then low to high under the maize farm, and was medium to very high under the oil palm land use, respectively. Soil OM is recognized as a major component among soil quality indicators, and is linked to many other soil quality indicators that moderates crop productivity [30].

Soil OM plays an important role under long-term soil conservation and/or soil restoration towards sustaining soil fertility [8].

It is also credited to increasing structural stability of soils against rainfall erosive impacts, poor infiltration capacities, and in the activities of soil fauna [32].

CONCLUSIONS

This study evaluated some selected soil physical properties and OC content as affected by different land use types in 5 different locations in Amalla, Nsukka Senatorial District of Enugu State, South-East Nigeria. The soil textures of the study area was predominantly loamy sand, being largely of sand with low clay fraction. The sand and silt contents of the soils did not differ significantly ($P<0.05$) due to the land use types in most of the study locations, whereas clay differed among the land use types and across study locations. The soil bulk density was significantly ($P<0.05$) higher under oil palm land use type. Variation in soil qualities was influenced by the types of soil management practices studied. Soil OM content was significantly ($p \leq 0.05$) higher under the oil palm (2.1% – 2.9%) and lowesr under cassava farming (0.59% - 1.3%). Generally, the soils were low in OC (<2%) and clay (<12%) contents; a situation that can predispose the soils to greater risk of water erosion. While this work revealed changes in soil quality indicators under the land use types across study locations, a detailed study on environmental and economic aspects of these land uses is strongly recommended. Furthermore, measures to improve the soil OC content should be promoted to enhance resistance of the soils to water erosion and to overcome low soil fertility in the study area.

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DIRECTIONS OF DEVELOPMENT AND IMPLEMENTATION OF THE UKRAINIAN EXPORT POTENTIAL

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Abstract

In the article are researched the main trends of forming and realization of the agrarian enterprises' export potential. There is conducted an analysis of interdependance between the separate factors (in particular, investments into the agrarian sector) and the quantitative indicators of the export potential development. There are proposed the ways of the agrarian enterprises' export potential realization within the context of the eurointegrational processes, which harbour contemporary specificities of the agrarian enterprises development, tendencies of the agrarian enterprises' foreign economic activity and the analysis of the possible opportunities and main threats for Ukrainian enterprises when carrying out the export activity. There is produced a typical algorithm of the certification undergoing devoted to the agricultural commodities export in accordance to the European requirements under the GlobalGAP standards, that will facilitate the growth in production of the agricultural products, specially for the sale onto the European markets.

Key words*: export potential, agriculture, foreign economic activity, agricultural products certification*

INTRODUCTION

The export potential of the enterprise as an economic category and an object of analysis got the increased attention of scientists and practitioners in the international business. The experience of highly developed countries and countries that are rapidly developing convinced that the dynamism of the positive development of most national economies largely achieved through an effective export policy, depending on the level of excellence of the processes associated with the formation and using of the export potential of both the state and entities, as well as the selection of methods and tools that can provide a successful course of these processes. Nowadays, agriculture is a main sector of the Ukrainian economy that is why we chose the agrarian enterprises to research the export potential.

MATERIALS AND METHODS

The theoretical and methodological basis of the study is the dialectical method of cognition, a systematic approach to the study of economic phenomena and processes, the fundamental provisions of economics and scientific works of domestic and foreign scientists on the problems of export activities of agricultural enterprises.

RESULTS AND DISCUSSIONS

Agricultural enterprises are on the first and the lowest stage of the technological chain, which last stage is export of the agricultural products. For the agricultural enterprises the organization and provision of foreign-economic (export) operations is a difficult task. For its solving it is necessary to leave the boundaries of the material-resource, financial or marketing components of a business activity subject economic potential. For instance, the function of an export activity organization can be carried out outside the enterprises [1, 2, 7].

Thus, organization and carrying out of export operations with the agricultural products can become possible upon the condition of the participation of a big number of business subjects, specialized on different kinds of activities. The final export displays the efforts results not only of agricultural manufacturers, but also of processing enterprises and other

auxiliary productions. Additional it should be mentioned, that the ways of export stimulation, such as the return of the Value-Added Tax to the exporters, include states into the list of export subjects. Export subsidies make the products export operation to be efficient. Their production cost is a bit higher than the cost in the international market.

Undoubtedly, the further effective development of the agrarian sector enterprises and uprising of its export potential is connected with the increasing of the part of the agricultural products export with a high added value. The modern Ukrainian export is characterized by a meaningful relative weight of raw-material orientation products and a low level of an added value. It leads to exhaustion of a resource base of the country and increases the level of its economy perceptivity to different exogenous factors, as well as to the change of pricing environment [10, p. 57-58].

The diversity of the factors, which influence the export potential of agrarian enterprises of Ukraine, can be classified in different ways. For example, according to the way of influence the factors can be divided into the factors of direct and indirect influence. The factors, which make negative influence on the enterprise operations are the factors direct influence. As a rule, the factors of indirect influence do not influence the operations of an agrarian enterprise immediately, but they should be taken into account in management decisions. Indirect influence is more difficult than the direct influence. The factors of direct influence include the influence of business rivals and consumers, legal coverage, inflation, information provision, etc. The factors of indirect influence are the following: political stability; the state of the economy; scientific-technical progress; world market; social-cultural factors.

The international experience shows, that the countries with transitive economies can not leave the economic crisis without involving and effective use of foreign investments. Foreign investments, accumulating business, state and mixed capitals, help to form national investment markets, and they are the impulse for creation of internal services and goods markets.

During recent years, we observe increasing of national and foreign investments into agriculture, but the part of investments into this sphere in general volume of foreign investments is still small.

The main source of the direct foreign investments into the Ukrainian agrarian sector are the European countries. Besides, the volume of investments from China and Persian Gulf countries increases every year. Despite the fact that Ukraine rises in the rating of cleared conditions for making business, there are unused opportunities for further improvement in different directions, for instance in state regulation sphere.

Investors are attracted by a huge potential of the country agriculture, but they still meet great obstacles in the process of investment, in addition to economic downturn and tension in policy, which take place nowadays.

Ukraine has an open and clear legal order of foreign investment, which meets international standards.

Currently, according to the size of investments and capitalization the agrarian sector is a leading industry of the Ukrainian economy. It is also observable in compliance to the statistical data, despite the fact that in 2019 the volume of investments decreased. For instance, in accordance to the data of the Office for National Statistics of Ukraine, as a result of 2018, the sum of the capital investments in the national agrarian sector yielded to 578.8 million USD. This result was 76.4 million dollars more than the result of the corresponding period of the year 2016, but 7.8 less than in 2017 (Fig. 1). In spite of all economic challenges, large foreign transnational companies, such as Bunge and Cargill, etc. invest money into the sphere of national agriculture. Mostly, they are interested in the development of the sphere of infrastructure, since without its improvement it is not possible to increase the volumes of production, neither to increase its export [5].

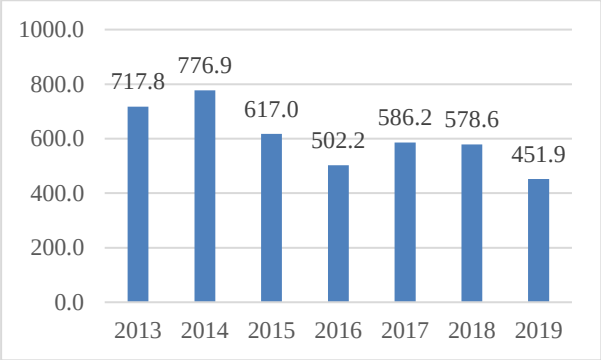

Fig. 1. Foreign direct investment, involved into the agrarian sector, million dollars during years 2013-2019. Source: Accounted by the author according to the data of the Office for National Statistics of Ukraine [5].

In agriculture there are different types of enterprises: corporate enterprises, farming enterprises, individual enterprises.

According to the experience of some European countries, the success on the way of transformation of their economies was partially achieved due to the activity of small and middle enterprises, which for 50 % supply gross national product, for 50% they supply export, and 60 % for import of the country.

In the countries of the European Union there are more cleared conditions for manufactures to carry out foreign-economic activities. First of all, it is stipulated by the work of institutions, analytical agencies, which quickly give the information, which can be used by small manufacturers for strategic planning. The system of state support of agriculture through the dotation system functions successfully [6, p. 38].

Nowadays, in spite of a very difficult economic situation in Ukraine, there is a big number of foreign investors, working in the country. There are some, who are interested to invest into our country. For instance, these are small and middle enterprises from such countries as Czech Republic, Poland, India, UAI.

Professor Onysko S.M. states in his work [12, p. 57], that the agrarian enterprises lack their own sources of capital investments. In these conditions the only way of their compensation should be the investment credits of banking establishments, which have passed the liquidity crisis and have their own corresponding index of capital.

By reason of the state support and limited access to financing, many small and middle business owners are often ready to sell their agrarian business, taking into account its popularity, and they expect having a chance to sell it to foreign investors.

In the nearest future the access to the credit resources for national agricultural manufacturers will also be limited, especially taking into account the financial state of the banking system in Ukraine during the previous three years. By the latest estimates, in Ukraine the part of the bank crediting is less than 20 % of the agrarian sector floating funds. At the same time in developed countries it is 70 %. Interest rate for agricultural enterprises was about 19.8 % in the end of February, 2016. It exceeds average interest rate in economics (16.4 %). Besides, it should be mentioned, that mostly these are short-term credits for current operation needs of the agrarian sector activity (the preparation for sowing with the purchase of fuel, fertilizers, seeds, planting material, forage reserve, etc.), but not long-term ones – for the development and purchase of basic assets, which was allowed by the special treatment of VAT [5].

In the countries of the European Union there acts common agricultural policy. The total volume of support of the agrarian sector in the countries of the European Union during 2017-2019 was almost 60 billion Euros per year, which is about 525 Euro/ha, or 20 % of gross production of an agricultural enterprise. Depending on the country, the state support of the industry is different. For instance, in the Netherlands and Belgium it is 500 Euro/ha, in Poland it is 345 Euro/ha. At the same time, in Ukraine this index is 10-20 Euro/ha (including the assets, which remained under the special treatment of VAT).

Diversification and increase of export of the Ukrainian agricultural production is a real task to be carried out. The output of products with a big part of added value is prospective. According to the analysis, the main export products are grain and oil crops. But in 2018-2019 more than 200 Ukrainian enterprises increased the volume of export of poultry and meat products, started exporting eggs, fish,

honey, flocks, raw leather, forage for pets, other byproducts, etc. to the countries-members of the EU. These facts prove that Ukrainian manufacturers can be not only the suppliers of raw materials in the world or European markets, but also can find their way in manufacturing of ready-made products.

Table 1. Commodity composition of trade in 2015-2019 -groups I-IV according to Ukrainian Commodity Coding System (UCCS)

Groups	2015		2016		2017		2018		2019		2019 to 2015, %/ item
	million dollars	*% in structure*	million dollars	*% in structure*	million dollars	*% in structure*	million dollars	*% in structure*	million dollars	*% in structure*	
Export											
Together groups I-IV according to UCCS	14,563.1	*100.0*	15,280.8	*100.0*	17,756.9	*100.0*	18,611.8	*100.0*	22,144.1	*100.0*	152.1
I. Alive animals; products of animal origin	823.4	*5.7*	775.0	*5.1*	1,108.8	*6.2*	1,210.6	*6.5*	1,277.0	*5.8*	155.1
II. products of plant origin	7,971.5	*54.7*	8,093.7	*53.0*	9,215.7	*51.9*	9,886.1	*53.1*	12,914.4	*58.3*	162.0
III. Fats and oils of animal or plant origin	3,299.8	*22.7*	3,962.0	*25.9*	4,605.7	*25.9*	4,496.5	*24.2*	4,732.2	*21.4*	143.4
IV. Ready-to-use food products	2,468.4	*16.9*	2,450.1	*16.0*	2,826.7	*15.9*	3,018.6	*16.2*	3,220.4	*14.5*	130.5
Import											
Together groups I-IV according to UCCS	3,484.4	*100.0*	3,891.1	*100.0*	4,301.1	*100.0*	5,055.5	*100.0*	5,736.0	100.0	164.6
I. Alive animals; products of animal origin	548.2	*15.7*	626.3	*16.1*	731.5	*17.0*	318.0	*18.2*	1,071.5	18.7	195.5
II. products of plant origin	1,146.2	*32.9*	1,284.8	*33.0*	1,368.0	*31.8*	1,529.2	*30.2*	1,794.6	31.3	156.6
III. Fats and oils of animal or plant origin	182.3	*5.2*	246.0	*6.3*	266.6	*6.2*	267.4	*5.3*	253.3	4.4	138.9
IV. Ready-to-use food products	1,607.7	*46.1*	1,734.0	*44.6*	1,935.0	*45.0*	2,340.9	*46.3*	2,616.6	45.6	162.8

Source: accounted by the author according to the data of the Office for National Statistics of Ukraine [5].

Researches show that the part of agricultural food products in the commodity composition of Ukrainian exports comprised 40-45 % in 2015-2019. It is the evidence of a high level of dependence of the national economy on the export of these commodities. Thus, taking into account the performance of export activity, we can make a conclusion, that the agricultural industry is rather prospective.

In the 21st century the sustained development of the national agrarian sphere can be supplied only by means of using new high-producing and drought resistant varieties of agricultural plants, application of innovative technologies and modern technical means, which demands remarkable capital investments into the industry [8].

According to estimates of the director of the International Bleyzer Fund O. Ustenko, Ukraine needs annual investments in the amount of 5 billion dollars during 10 years in order to reach a European level of agrarian enterprises development. He mentioned the following high priority measures for investment climate improving: coping with the corruption, creation of regulatory environment and administrative barriers liquidation [13, p. 104-110].

For the volumes of exports to grow, it is necessary to increase the production of the high-quality agricultural products and search for new sales markets or to increase the share of sales on the present ones.

The prospective sales markets definition and the agrarian enterprises factual export activity on these markets are the important aspects in predicting the export potential of the agrarian enterprises.

Proceeding from the results of the previous researches, it was found that the EU member-countries' markets are the most prospective foreign sales markets for the agricultural

products made by the L'viv region's agrarian enterprises.

It is worth noting that the exports to the EU countries had increased in more than two times during five years at the expense of the volumes of the crops exports growth, whereas, on the contrary, the volumes of the livestock breeding exports had decreased by 35%. There are two main reasons concerning the reduction of the livestock breeding products exports: shortage of its production volumes and the veterinary restrictions pertaining to its exports.

The partial removal of unequal trade conditions between the EU and Ukraine, which showed itself after Ukraine, had joined the WTO, is a main advantage of the free trade area for trading with the agricultural products. The removal of unequal conditions is being made real by means of the following:

-cancellation of the customs within the frame of the tariff quotas for the agricultural goods:

-cancellation of the export subsidies for the agricultural products to the EU entrepreneurs while exporting to Ukraine;

-granting the Ukrainian party with the right to use extra trade conditions and protective measures [3].

Implementation of zero-rate import duty quotas on the crops exports to the EU countries is a way to augment the exports volume on the crop products market. In spite of that, the Ukrainian agricultural products export expansion onto the EU countries' markets will be hindered, because of the little import tariff quotas volume for customs-free import of the national agricultural products into the EU countries and the insufficiency of the majority of the national agricultural producers, currently, to meet the technical, sanitary, phytosanitary conditions of the products export onto the EU markets.

There is a high possibility of the national meat and meat products, milk, vegetables and fruits producers' competitiveness weakening, as a result of the imports growth from the EU.

Generally, Ukraine and in particular the L'viv region has a vast export potential in the agricultural sector, but they cannot fully implement it. It is explained by the fact that the Ukrainian agricultural producers faced too tough level of competition on the international markets.

Keeping the tendency to the increase of the volume of the agricultural products exports to the EU countries is possible in case of implementation of three types of export-oriented enterprises development, which can provide a sustainable level of the agrarian enterprises exporting potential development within context of the European integration (Fig. 2).

The given options of the agrarian enterprises exporting potential development are aimed at defining the development vectors as for agrarian enterprises export activity and for their entrepreneurship development in general, as well.

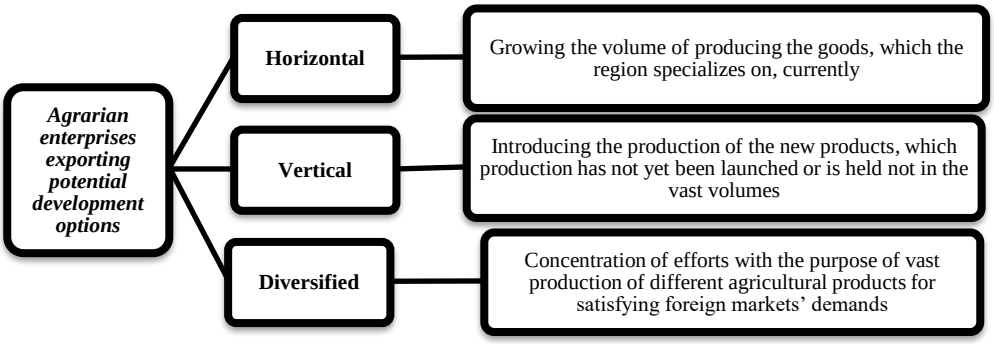

Fig. 2. The agrarian enterprises exporting potential development options within the context of the EU integration. Source: designed by authors [11].

There are opportunities for the agricultural development in Ukraine, nevertheless the main part of agricultural products are being made within the households. Horizontal option of development is aimed at deepening the region's specialization on the output of the products which production already, nowadays, has the necessary resources for. In particular,

such crops can be represented by fruits, berries and vegetables, which demand for is high enough on the national as well as foreign markets.

Vertical option of the agrarian enterprises exporting potential development involves the establishment of the new or consolidation of the existing technologically interconnected productions. This option may be implemented by the production of the, so-called niche crops, particularly the garlic and the sweetcorn, whose export quotas are not fulfilled. Currently, the corn export is being carried out for fodder and technical purposes. Changing the orientation onto the sweetcorn production may become a prospective way of the agricultural enterprises export activity development.

As to the garlic, it is worth noting that the demand for it is quite high and stable in the European countries. Today, large-scale production of the garlic is not conducted, that is why, the small and the middle agrarian goods-producers consolidation for the joint garlic planting is a prospective. Such a way of production arrangement will allow to conjoin the harvests into the large consignments for exporting.

The diversified exporting potential development option can be implemented by means of researching the foreign market's needs and consolidating the various types of productions into the common production system. We can include the production of the organic agricultural products to this option. This idea is followed in the works of I. Kostyrko, T. Hrom'yak [9, p. 4-5]. Such diversification of production will allow to conquer a stable share of foreign markets, since organic products are getting more and more popular.

The agrarian sector of the Ukraine's economy has to reach the high level of the agricultural production organization, which would correspond to modern world and European demands and which, at the same time, secures and strengthens one's own identity, for the comprehensive integration into the European area. Particularly, such scholars as N. Zalisko, V. Krupa [14, p. 50-53] highlight that it is necessary to proceed with the researches of the state governance mechanisms in the sphere of implementation of the European guarantying model of the nutrition quality and security in order to develop the Ukraine's Agricultural production complex foreign trade prospects.

Meanwhile, using the accomplishments, which can be gained, as a result of uniting a member-countries regional integrative grouping's agrarian potentials, their agrarian markets and thanks to the solidary responsibility for the final outcome at every stage of the agrarian cooperation and all integration process participants common financial interest, will guaranty the achievement of the best economic result, which is impossible to reach without integration, or it is economically unreasonable.

There is defined a priority of measures in the process of researching the conditions for the agrarian sector of economy adaptation to the European model of the agricultural development:

1)Conducting an estimate of one's own financial capacities and opportunities of access to the EU structural funds financial resources.

2)Classifying the rural territories types in conciliation to the EU standards.

3)Designing some alternative schemes of the rural development organization; specifying the criteria of rural territories depressiveness; overcoming the deficit of information among the peasants in the sphere of agricultural policy, etc.

After the European Union opened its markets to Ukrainian producers, the latter can compete with world producers without duties and on equal terms. However, due to the different supply of agricultural products in the EU, not all countries are promising to export products. In order to analyze which countries have higher prices for agricultural products and which markets are more promising, in our opinion, it is advisable to group them at the average selling price.

Table 2. Grouping of EU countries at the highest sales prices of agricultural products, 2019*

Product	Price range (Euro/100 kg)	Countries
Sugar beets	31.06–32.61	Finland, Bulgaria, Slovakia
Potato	31.2–47.89	Luxembourg, Malta, Greece
Barley	16.72–19.52	Greece, Romania, Portugal
Oat	18.47–23.64	Bulgaria, Romania, Czech Republic
Corn	17.1–21.03	Romania, Portugal, Greece
Wheat	17.01–19.4	Great Britain, Portugal, Greece
Eggs	13.74–18.5 Euro per 100 units	Austria, Luxembourg, Greece
Chicken	145.16–363.8	Greece, Denmark, Luxembourg
Veal	322.8–368.8	Malta, Austria, Luxembourg

* Source: calculated by the author according to Eurostat [4].

Agrarian enterprises of Ukraine has the capacities to increase the volumes of the their production, however an inappropriance of their products' quality to the international standards is an obstacle. Within the frame of the reasearch, are proposed the main stages for the implementation of the systems of the products quality management at the common agrarian enterprise as to the GMP+ and GlobalGAP standards. These standards encompass basic rules of ISO 9001 and ISO 22000 (HACCP). Standards GMP+ pertains to the feed production branch and are applicable for the enterprises, which produce the fodder for animal feeding.

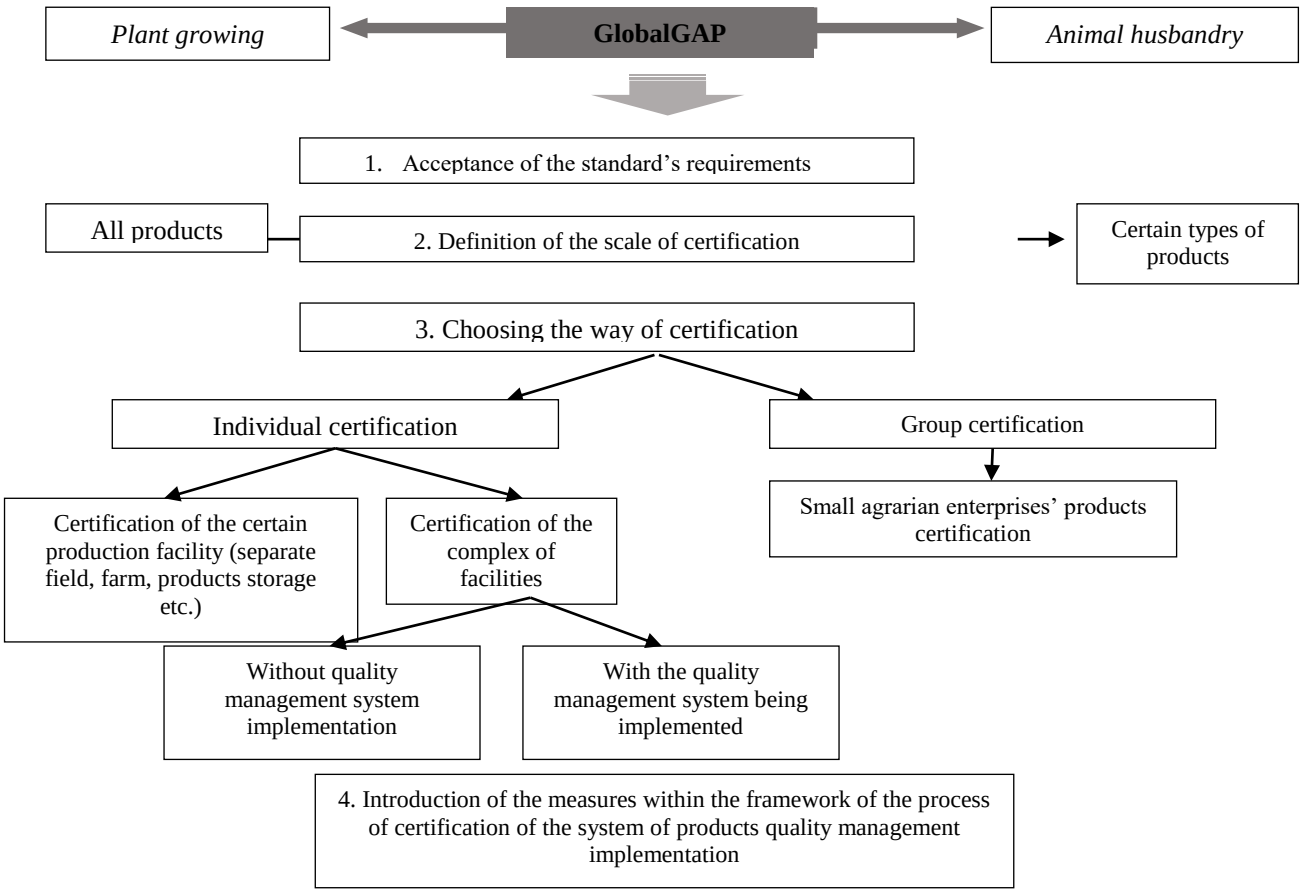

Fig. 3. Typical algorithm of the GlobalGAP standards implementation at the agrarian enterprise.
Source: designed by authors.

The scheme shows the typical algorithm of the standards Global GAP implementation at the agrarian enterprise.

Nowadays, GlobalGAP is a solemn integrated standard for the primary products with the possibility of its separate modules usage

concerning the different groups of goods and commodities production in plant growing and animal husbandry, and in compound feed industry.

The abovementioned algorithm is useful as for big agricultural enterprises and for small producers as well. Its application provides the agrarian enterprises with the possibility to sell the primary agracultural products on the European markets, securing a high level of compatitiveness of these products.

CONCLUSIONS

Finally, as a result of the conducted prediction of the export potential development, there have been defined the main development options, which must be oriented toward the adaptation to the European market. Meanwhile, the European standards attainment in the functioning of the agrarian sector of economy is possible only in conditions for defining the basic priorities, which will drive the European integration process in conformity with the strengthened agreement between Ukraine and the EU. These are:

1)improvement of the state mechanisms of providing the rural inhabitants with the societal goods as a factor for their welfare growth;

2)the fullest realization of the agricultural formations of all legally-organizational forms;

3)the agricultural products valid national standards harmonization with the European and world requirements;

4)making agrarian production more ecological due to introduction and usage of the environmentally friendly farming methods;

5)bioenergy development based on the national raw materials.

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ROMANIA AND THE COMMON AGRICULTURAL POLICY - PERSPECTIVES OF POST-2020

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Abstract

The reason of this study stems from the need to know how to shape the future common agricultural policy to be valid for the next seven years, between 2021 and 2027. The article examines the reform package of post-2020 Common Agricultural Policy, the proposed objectives, the directions of action, the financial support for the two pillars (agriculture and rural development), and the payment schemes that Member States will be able to implement starting with 2021. A comparative situation is also presented to EU Member States regarding the level of direct payments related to one hectare of utilized agricultural area during three financial years, the present one, the past and the future one, in order to draw conclusions regarding the level of support and its possible effects. The primary data used in the elaboration of this paper were taken from national and international statistics, communications of European Union Council, releases of the European Commission and the ministries of resort, various national and international publications in the field, on the basis of which the authors formulated conclusions and recommendations in the field. The main conclusions of the study relate to the need to simplify the CAP, to make it more efficient and to achieve convergence between Member States, so that the distribution of payments is made fairly without further distorting the market for agricultural products with public money.

Key words**:** *Common Agricultural Policy, direct payments, rural development, objectives, allocations*

INTRODUCTION

The European Union is the result of a process of cooperation and integration that was initiated for predominantly economic reasons in 1951, between six European countries (France, Belgium, Germany, Italy, Luxembourg and the Netherlands).

After seventy years and successive waves of accession, the European Union now comprises 27 Member States, including the exit of the United Kingdom on 31 January 2020.

The reasons for the establishment of the European Union are found both in the need for stability and order in the European space (ideas found in the works signed by Machiavelli, Hobbes, Locke, Kant and others) and in the expansion of nation-state notion since the mid-nineteenth century.

In the context of the evolution of the European Union, agriculture has gone through several stages of its development process: from the spectrum of food shortages and rural poverty, to the achievement of food self-sufficiency and today's living standard of farmers and the implementation of the decision to expand its borders to Central and Eastern Europe. In the mid-1950s, the agriculture in the six founding countries of the European Economic Communities (France, Germany, Italy, the Netherlands, Belgium and Luxembourg) provided 17.5 million jobs (representing 33% of Italy's active population, 25% of France's and 10% of Belgium's). About 85% of farms in Italy, 55% of farms in Germany and about 35% of farms in France were between 0.5 and 5 hectares in size. The contribution of agriculture to GDP formation ranged from 8.4% in Belgium to 23% in Italy.

Starting from these realities, in April 1956, after the **Messina Conference** "*Spaak Report*" it was concluded that agriculture is a basic component of the Common Market. Therefore, an important objective of the **European Economic Community** (1957, the Treaty of Rome) has constitute the elaboration and implementation of the Common Agricultural Policy, considered in fact the

"driver" of economic unification, thus becoming the first axis of community construction.
The concept of "common policy" faithfully reflects one of the defining features of the CAP. The first instrument of the CAP was the Common Market Organization (CMO) and nowadays, the Common Agricultural Policy comprises two pillars, namely Pillar I – Agriculture and market measures, and Pillar II - Rural Development.
The European Commission's proposals on the Multiannual Financial Framework (MFF) for 2021-2027 [4; 7; 8] sets out ”the budgetary framework and main guidelines for the post-2020 Common Agricultural Policy”. The main priorities set by the Commission for the future common agricultural policy refer to raise concerns about environmental protection and the fight against climate changes, a better targeting of the support for farmers and to increase the link between research, innovation and consultancy.

MATERIALS AND METHODS

The reason for the study that has been carried out in this article stems from the need to know how to shape the future common agricultural policy to be valid for the next seven years, between 2021 and 2027, the guidelines set at Community level, the mechanisms and the level of financial support allocated to Member States, including Romania. Romania's accession to the European Union meant the radical change of the country's development policies, the adaptation of national policies to community policies, including investment behaviours based on development projects.
The article examines the reform package of post-2020 Common Agricultural Policy, the proposed objectives, the directions of action, the financial support for the two pillars, and the payment schemes that Member States will be able to implement starting with 2021.
Based on the financial allocations proposed for each Member State, we calculated the level of direct payments related to one hectare of utilized agricultural area. In the analysis of this indicator we used the comparison method of the situation registered in Romania with that encountered in the other Member States, during three financial years, the present one, the past and the future one, in order to draw conclusions regarding the level of support and its possible effects. The unsatisfactory position occupied by Romania in the ranking of Member States is obvious.
An increased attention is also paid to the process of capping direct payments, a topic that reappears in the new proposal for a CAP regulation and could have serious consequences for large farms.
The primary data used in the elaboration of this paper were taken from national and international statistics, communications of European Union Council, releases of the European Commission and the ministries of resort, various national and international publications in the field.

RESULTS AND DISCUSSIONS

The reform package of post-2020 Common Agricultural Policy contains three legislative proposals [19]:
- a regulation on strategic plans of the CAP, which refers to direct payments, sectoral interventions and rural development) [4];
- a horizontal regulation regarding financing, management and monitoring of the CAP [8];
- a regulation which provides the single common market organization [9].
The post-2020 CAP focuses on nine objectives, which reflect its functionality on several levels: economic, environmental and socio-territorial (Figure 1).

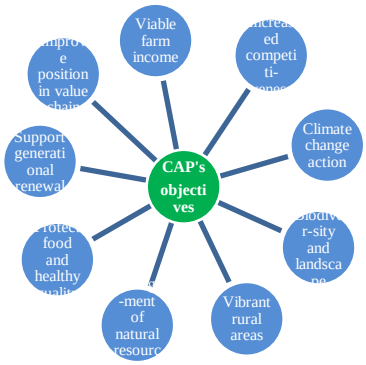

Fig. 1. The CAP's objectives for period 2021-2027
Source: Processing according to EC, COM/2018/392 [4].

The nine objectives of the CAP 2021-2027 (Figure 1) are accompanied by cross-cutting objectives which relate to the modernization of the agricultural sector through research and development, the promotion and application of innovation and digitalisation.

In order to achieve these objectives, the current structure of the CAP is maintained based on two pillars: Pillar I, which covers direct payments and market measures, and Pillar II, which covers rural development.

The European Commission is proposing the implementation of a new model to achieve results for the CAP in which Member States to have more flexibility to personalize their decisions and to adapt them to national needs. Thus, in order to draw up strategic plans, each Member State will have to carry out a comprehensive analysis of its specific needs and to draw up a plan to reflect how the Member State concerned uses the related funding for this policy to meet the needs [3; 23].

In order to achieve the objectives set for the Common Agricultural Policy for the period 2021-2027, the proposal of the European Commission for the Multiannual Financial Framework (MFF) of the CAP is 365 billion euros (Table 1). This amount represents about 28.5% of the overall EU budget for the next financial year.

Table 1. Financial allocations for the CAP 2021-2027 versus 2014-2020 (billion euros)

	MFF '21-'27	**MFF '14-'20**	**Difference**	**Variation %**
Pillar I	286	309	-23	-7
Pilar II	79	100	-21	-21
Total CAP	**365**	**409**	**-44**	**-11**

Source: Calculation based on Daianu et el., 2018 [3].

Compared to the current budget, the difference is 44 billion euros, but it should be noted that the budget for the period 2014-2020 included 28 Member States. During this period, the United Kingdom receives around 22 billion euros for Pillar I (the fifth largest allocation after France, Germany, Spain and Italy) and 3 billion euros for Pillar II. However, the difference in the amount allocated between the two MFFs is greater than the simple reduction in allocations due to the United Kingdom's exit from the Union. Due to Brexit, budget cuts are inevitable and obvious, as the United Kingdom has been one of the main net contributors to the European Union budget.

The proposal for the EU's Multiannual Financial Framework (MFF) 2021-2027 provides for substantial reductions for rural development programs (EAFRD) [6]. In its communication, the European Commission supported a reduction in CAP expenditure of around 5% [5]. However, after taking into account inflation, the late approval of Rural Development Programs 2014-2020 and the gradual introduction of direct payments in Croatia [16], it was concluded that the new MFF 2021-2027 proposes a reduction of direct payments in Pillar 1 of 12%, while rural development programs (Pillar 2) will be reduced by 28% [20] (Table 2).

Table 2. Comparison of the last year of the MFF 2014-20 and 2021-27

	MFF EU-27 ceilings (million euros)		**Change 2020-27 (%)**
	2020	**2027**	
Pillar I	39,468	34,606	-12.3%
Pillar II	13,050	9,421	-27.8%
Total CAP	52,518	44,027	-16.2%

Source: Pe'er et al., 2019 [20], Matthews, 2018b [17].

Given the new financial allocation with a lower focus on Pillar II, the share of market measures under Pillar I which is constant at around 5%, the volume of direct payments could increase to 73% [20]. The reduction of amounts destined for rural development in favour of direct payments is, in the opinion of many specialists [1; 20; 21] an inappropriate allocation given the fact that Pillar II represents the best way to improve the performance of the CAP in line with most socio-economic and environmental criteria.

Introduced as "transitional payments" in 1992, the original and main purpose of direct payments was to provide financial support to farmers to offset losses caused by prices fall in agricultural products during the MacSharry reform (1992), Agenda 2000 (1999) and the Fischler reform (2003). Today there is no clear justification for continuing this form of

support [21; 22; 24]. Moreover, many studies argue [14; 20] that there is no clear evidence to prove that providing flat-rate income in the form of direct payments would improve the overall income of farmers. A recent study [15] using panel regression and panel Vector Autoregression analysis, to take into account possible endogeneity issues, shows that agriculture income has been subdued due to negative shocks in direct payments and solvency, and it does not support the hypothesis that higher direct payments would increase agriculture income.

Table 3. CAP financial allocations for the period 2021-2027 by Member States (million euros)

	Member states	Direct payment (Pillar I)	Market measures (Pillar I)	Rural development (Pillar II)	TOTAL CAP
1.	**FR**	50,034.5	3,809.2	8,464.8	62,308.6
2.	**ES**	33,481.4	3,287.8	7,008.4	43,777.6
3.	**DE**	33,761.8	296.5	6,929.5	40,987.8
4.	**IT**	24,921.3	2,545.5	8,892.2	36,359.0
5.	**PL**	21,239.2	35.2	9,225.2	30,499.6
6.	**RO**	**13,371.8**	**363.5**	**6,758.5**	**20,493.8**
7.	**GR**	14,255.9	440.0	3,567.1	18,263.1
8.	**HU**	8,538.4	225.7	2,913.4	11,677.5
9.	**IE**	8,147.6	0.4	1,852.7	10,000.7
10.	**PT**	4,214.4	1,168.7	3,452.5	8,835.6
11.	**AT**	4,653.7	102.4	3,363.3	8,119.4
12.	**CZ**	5,871.9	49.5	1,811.4	7,732.9
13	**BG**	5,552.5	194.5	1,972.0	7,719.0
14.	**DK**	5,922.9	2.1	530.7	6,455.6
15.	**SE**	4,712.5	4.1	1,480.9	6,197.4
16.	**FI**	3,567.0	1.4	2,044.1	5,612.5
17.	**NL**	4,927.1	2.1	512.1	5,441.2
18.	**LT**	3,770.5	4.2	1,366.3	5,140.9
19.	**HR**	2,489.0	86.3	1,969.4	4,544.6
20.	**SK**	2,753.4	41.2	1,593.8	4,388.4
21.	**BE**	3,399.2	3.0	470.2	3,872.4
22.	**LV**	2,218.7	2.3	821.2	3,042.1
23.	**EE**	1,243.3	1.0	615.1	1,859.4
24.	**SI**	903.4	38.5	715.7	1,657.6
25.	**CY**	327.3	32.4	111.9	471.6
26.	**LU**	224.9	0.2	86.0	311.2
27.	**MT**	31.6	0.1	85.5	117.1

Source: EC, 2018c [6].

Michels et al., 2019 [18], following a survey regarding German farmers' perspectives on direct payments, showed the importance of these payments in their financial statements. However, the surveyed German farmers acknowledged that the current payment schemes do not meet society's expectations and that these should be better targeted, providing compensation for farmers who produce agri-environmental public goods and/or who clearly contribute to the well-being of animals.

In what concerns the financial allocation for the Common Agricultural Policy for the period of 2021-2027 for each Member State is shown in Table 3.

For the period 2021-2027 Romania will receive financial support for common agricultural policy in the amount around of 20.5 billion euros. This allocation ranking Romania sixth in the European Union.

Amounts higher than Romania will receive France (62.3 billion euros), Spain (43.73 billion euros), Germany (40.9 billion euros), Italy (36.3 billion euros) and Poland (30.5 billion euros), countries larger than Romania both in terms of agricultural area and the number of inhabitants in rural areas.

Comparing the national ceilings for direct payments to the usable agricultural area of each Member State, the magnitude of the differences (inequalities) is obvious. These differences are shown in the graphs below (Figures 2, 3 and 4).

Calculating the average of direct payments per hectare from the European Union budget, for the entire programming period 2007-2013, we find that Romania with 57 €/ha was on the last place in the EU-27, having allocated only 11.2% of the level granted to Greece (507 €/ha), 12.1% of the level granted to the Netherlands (469 €/ha) or 12.9% of the level granted to Belgium (443 €/ha).

In the period 2014-2020, a Romanian farmer receives subsidies per hectare also well below the European Union average (136 euro/ha), contrary to preamble statement of Regulation (EU) no. 1307 [9], which provided for the reduction of large gaps of the financial support distributed to farmers in the EU [13].

For the period 2021-2027, with all the changes occurred in the CAP, there is noticed still a big difference regarding the support per hectare due to each Member State which continues to generate major imbalances, unfair or discriminatory competition, with

negative effects, difficult to bear by the poorer states of the European Union, as it is Romania as well [2, 11].

For the current financial year, 2014-2020, Romania benefits from an allocation of approximately 20.4 billion euros for direct payments and rural development (increasing compared to the allocation in the financial year 2007-2013 in the amount of 13.8 billion euros).

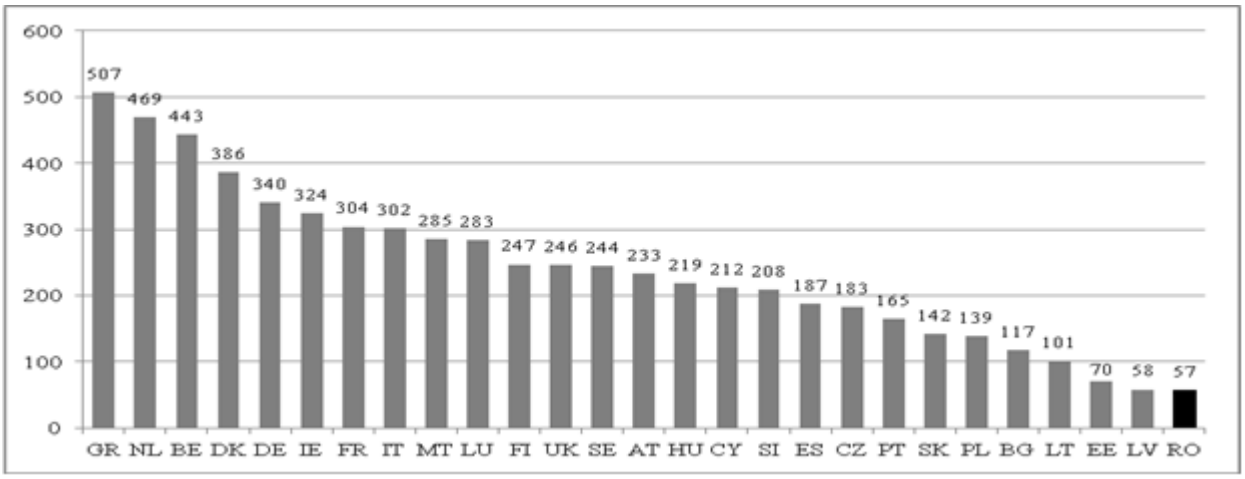

Fig. 2. Direct payments from the EU budget at 1 ha UAA (€/ha) in EU-27 countries, annual average 2007-2013
Source*:* Gosa & Feher, 2010 [12].

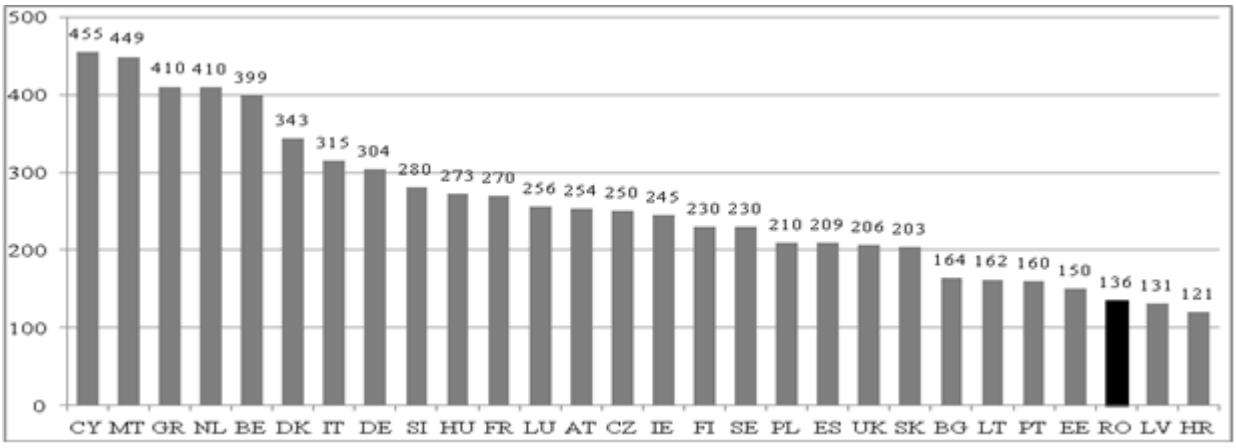

Fig. 3. Direct payments from the EU budget at 1 ha UAA (€/ha) in EU-28 countries, annual average 2014-2020
Source: Authors' calculation based on Regulation (UE) No 1307/2013 and Eurostat [ef_kvaareg] [10].

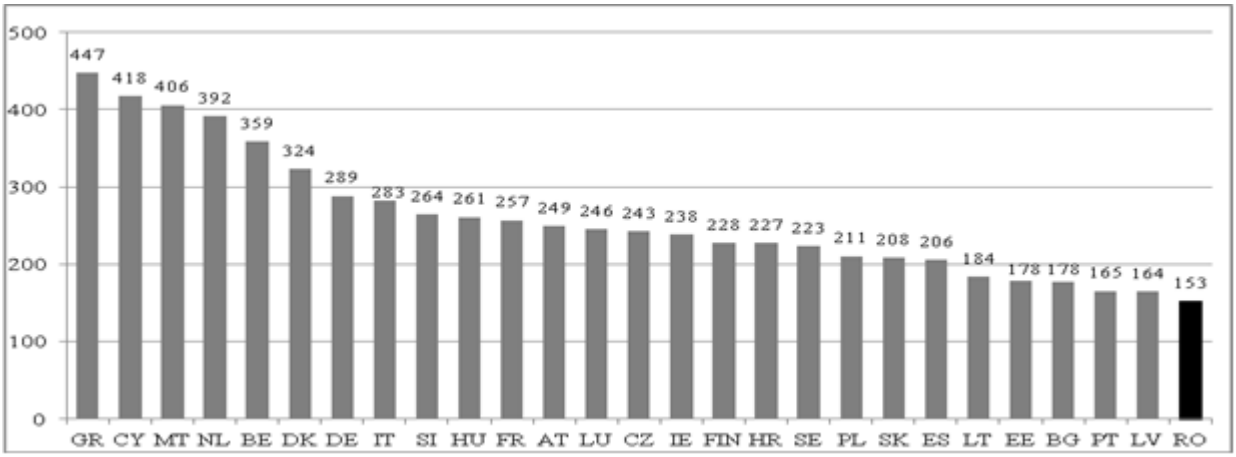

Fig. 4. Direct payments from the EU budget at 1 ha UAA (€/ha) in EU-27 countries, annual average 2021-2027
Source: Authors' calculation based on EC, 2018c and Eurostat [ef_kvaareg] [10].

Table 4. CAP financial allocations for Romania in the period 2021-2027 (million euros)

	2021	2022	2023	2024	2025	2026	2027	Total
Direct payments	1,856	1,883	1,910	1,937	1,964	1,991	1,991	13,533
Rural development	965	965	965	965	965	965	965	6 758
Total CAP	**2,821**	**2,848**	**2,875**	**2,902**	**2,929**	**2,956**	**2,956**	**20,292**

Source: MARD, 2019 [19].

In the next financial year (Table 4), Romania may benefit from an allocation of 20.3 billion euros to support the Common Agricultural Policy.

Farmers will be able to access direct payments through several types of payment schemes:

- basic direct payments, or single area payment scheme;
- green payments, which are in addition to the basic payment, but for which farmers are obliged to apply on all their eligible hectares agricultural practices beneficial to the climate and the environment. For this scheme, Member States must allocate 30% of the national financial package to direct payments;
- payments for young farmers (up to 2% of the national financial package of direct payments);
- complementary redistributive payments (up to 30%), through which additional aid can be granted for the first hectares of a farm;
- payments for rural areas with natural constraints (up to 5%);
- coupled support (up to 15%) representing an aid coupled with production in favour of certain areas or types of agricultural activities for economic or social reasons.

Within the new proposal to regulate the CAP [4] there is resumed the idea of reducing and capping direct payments.

The modulation of direct payments was introduced in the Health Check of the CAP in 2008, but capping as such was introduced for the first time in the CAP reform in 2013, voluntarily [13]. Therefore, payments of more than 150,000 euros can be reduced by at least 5%, with the possibility of increasing the amount up to 100%. Member States may decide to apply this reduction after deducting the wages paid by the farmer from the amount of the basic payment. At the same time, Member States that allocate at least 5% of their national package to redistributive payment should not reduce payments [9].

The regulation proposal for the period 2021-2027 [4] involves reducing direct payments from 60,000 euros and capping them at amounts of more than 100,000 euros per farm. Article 15 [4] provides for proposals in this regard and includes the amount of reductions by payment intervals, for a calendar year, as follows:

- payments between 60,000 to 75,000 euros to be reduced by at least 25%;
- payments between 75,000 to 90,000 euros to be reduced by at least 50%;
- payments between 90,000 to 100,000 euros to be reduced by at least 75%;
- payments over 100,000 euros should be reduced by 100% (ie payments should be capped at this maximum limit of 100,000 euros).

This stricter cap (starting from 60,000 euros per farm, instead of 150,000 euros per farm as it is now) comes as a response of European Commission to criticism regarding biased distribution of payments [20]. The savings thus obtained could be used for redistributive payments for the first hectares (Article 26) [4]. This fact comes to support farms with smaller areas of land. However, Article 15 states that wages related to agricultural activities (including taxes and social contributions) may be deducted. Within the works of several specialists [17; 20] we find the idea that this capping may be meaningless. The argument advocating is that the deduction of wages could create a gap, because of the fact that the increase in area is parallel to the increase in labour (and wages by default). Deduction of wages from direct payments could lead to distortions of land use but also of the labour market for large farms, with an incentive to adjust wages to avoid capping.

Another option regarding the capping of direct payments supported and voted especially by the Visegrad Countries (of which Romania is a part) in the Agriculture Committee of the old European Parliament proposes that the threshold for capping subsidies be increased to 100,000 euros and the capping not to be mandatory for the States applying a

redistributive payment in the amount of at least 10% of direct payments, the decision being up to each Member State.

Regarding the rural development side, a novelty in the European Commission's proposal for the Multiannual Financial Framework (MFF) for the period 2021-2027 provides for the increase of the co-financing rate of Member States for the budget allocated to rural development, from about 15% at present to a variation between 20 and 25%. Thus, together with the national contribution, the total budget for rural development could reach 9.3 billion euros, a level reached both in the current and in the previous financial year. It remains to be seen, however, whether Romania's budget will be able to cover this increased share of co-financing.

CONCLUSIONS

The negotiations concerning the Common Agricultural Policy for the period 2021-2027 are in full progress, and those presented above are subject to change.

The results of the public consultation on modernizing and simplifying the Common Agricultural Policy (CAP) have once again shown that there is a need to end excessive bureaucracy and that policy needs to be simpler and more efficient.

There can be noticed a constant downward trend in the allocation of the CAP from one financial framework to another.

An increased attention in the CAP 2021-2027 is being paid to climate change. Thus, at least 30% of Pillar II will be allocated to environmental policy interventions and 40% of the total CAP budget will be directed to measures dedicated to supporting the objectives of combating the effects of climate change.

The EU Member States need to carry out a careful analysis of their specific needs and to draw up a National Strategic Plan, which should reflect how they are going to use the related funding for this policy to meet the identified needs.

It has become increasingly difficult to justify substantial differences in the level of support per hectare provided to Member States by further distorting the market for agricultural products with public money. We believe that achieving the goal of full convergence, by distributing direct support equally across the EU, should be an absolute priority, in order to avoid imbalances resulting from disproportionate direct support between Member States.

The process of capping direct payments, unexplained until this date, we consider beneficial, contrary to the position of large farmers and even of the Ministry of Agriculture. However, the threshold from which the capping process could begin is debatable.

Approaching this issue only from the perspective of economic performances, we can state that large farms allow capital accumulation, implementation of high-performance technologies, obtaining high yields. At the same time, however, the impact of land consolidation in large agricultural holdings on the rural population is negative, emphasizing the degree of poverty, as demonstrated by the overlap of poor areas with the area of large agricultural holdings.

With regard to the proposals on the conditions for capping direct payments depending on wage costs, we believe that this criterion can again lead to very large discrepancies between Member States because the level of pay is different. At the same size of agricultural holdings, the higher wages in the old EU Member States make the effective level of capping in these countries much higher than in the poorer states, with a lower level of wages.

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GREEN ECONOMY PREREQUISITES OF WASTE MANAGEMENT

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Abstract

This article analyses the concepts, the purpose, the evolution and the present state of the waste management and recycling in EU. In view of a green or circular economy, there are several prerequisites for further development of the sector, since the analysis discovers issues of waste management and recycling in Romania compared with some other Member States. There will be also approached and highlighted some aspects regarding the management of the rural municipal waste in Romania. The analysis will lead to some conclusions in regard with chances of the member states to reach the ambitious recycling target of 50% adopted by EU. The revision of the legislative framework has the purpose of waste reduction and therefore sets up an ambitious plan in view of waste management and recycling. This plan consists of some challenging targets to be reached by 2030, such as: the recycling of 65 per cent of municipal waste and of 75 per cent of packaging waste (as common EU targets); reducing landfill to at most 10% of all the waste (binding target). The conclusions reflect recommendations for improving the waste management in Romania and topics of further research.

Key words**:** *waste management, hierarchy, green economy, recycling, member states*

INTRODUCTION

In view of a greener and circular economy, the general trend in European Union is to improve and enhance all activities related to waste management, starting with the quantities of waste generated and ending with the disposal of the waste.
This is an important component in making Member States more resource efficient. The resource-efficiency is a paradigm behind the green (and circular) economy [11].
Indeed, if a country finds ways to extract more value from resources taken from nature, it will generate greater economic returns at lower costs for the environment [20].
In the case of waste, the environmental burden produced by emissions and leftover must be reduced. The best way in achieving this is by changing/adopting measures for waste management according to the waste hierarchy. This should be done by a pro-active plan meant to reduce the waste disposal (especially landfilling). At the same time, there will be an increased activity for the promotion of the green and circular economy prerequisites: preventing, reusing, recycling and recovering waste will support closing the loop and increased resource-efficiency.
In recent years, some central objectives have been included in the environmental policies and strategies, such as: the European Commission's Roadmap on a resource efficient Europe [1]; the EU's Waste Framework Directive [7].
As for the case of Romania, it is important to mention that national efforts to shift up the waste hierarchy have been under way for longer, in large part driven by earlier EU legislation such as the Landfill Directive [6]. Together, these instruments established a range of waste management targets and broader goals for 2020 and beyond.
In the transition to a green economy with a high level of resource efficiency, the EU member states must comply with the Waste Framework Directive (WFD). One of the most significant target is to enable, by 2020,

an increase in the re-use and recycling of some household or similar origin waste materials (paper, metal, plastic and glass), to reach the minimum overall quota of 50% by weight [14].

MATERIALS AND METHODS

The objective of this paper is to draw attention on the necessity to improve the waste management in view of a green and circular economy. The secondary goal is to assess Romania`s position in achieving the 50% goal of waste recycling as well as the situation in other member states in this endeavor.
The methodology used was as follows:
-Analyzing data and information existing on paper and on internet;
-Extracting data from Eurostat database on waste;
-Processing the data extracted, creating tables and synthetic graphs;
-Analyzing and interpreting the processed data, tables and graphs;
-Drawing conclusions.

RESULTS AND DISCUSSIONS

Grounds, policies and dynamics of municipal waste management in the EU

The waste policy has evolved in the European Union in the last 20 years or more, especially due to the strategies dedicated to the sustainable development and transition towards a green economy, namely a low-carbon and resource-efficient economy.
Starting with the EU's Sixth Environment Action Programme (2002- 2012) the waste management has become a priority, with the main goal to ensure that economic growth does not lead to increased waste [2].
Thus a long-term strategy on waste has emerged, namely the Thematic Strategy on Waste Prevention and Recycling (COM 2005/666) resulted in the revision of Waste Framework Directive, as the main document of waste policy in the EU [2, 7].
As a step of transition towards the green and circular economy, the WFD introduces a modern view to waste management, considering waste no more a burden but a valuable resource.
The main innovation in the WFD is its focus on waste prevention and the new targets meant to direct the EU towards becoming a greener, recycling economy. It includes targets for EU Member States to recycle 50% of their municipal waste and 70% of construction waste by 2020.
The WFD 2006/12/EC introduces a five-step waste hierarchy where prevention is the best option, followed by re-use, recycling and other forms of recovery, with the release to the environment (such as landfill disposal) as the least desired solution (Figure 1).
The best methods to be used are, in a hierarchical succession:
(a)Avoidance of producing waste at the source (waste prevention);
(b)Reduction of waste at the source;
(c)Reuse of waste, recycle and recovery.
The least preferred are the methods situated at the bottom of the list: releasing/disposing into environment (landfilling) etc.

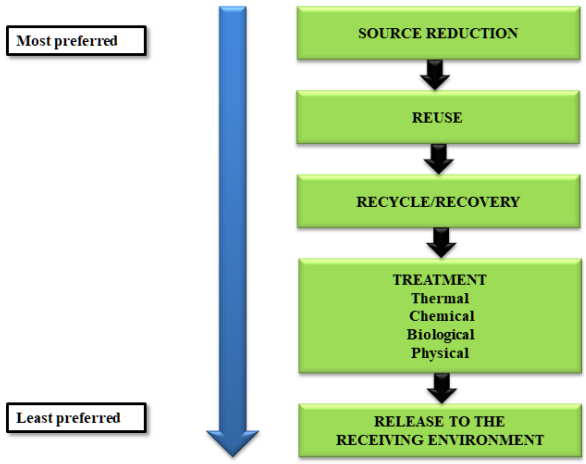


Fig. 1. Hierarchy of waste management practices
Source: [2].

In the following, there will be an analysis of the evolution of the municipal waste produced in the EU and in Romania.
According to the definition of OECD/Eurostat questionnaire, "municipal waste covers household waste and waste similar in nature and composition to household waste" [8].
Municipal waste consists to a large extent of waste generated by population, but may also

include similar wastes generated by small companies and public institutions and collected within the boundary of a municipality. In this paper we are aware that this latter part of municipal waste may vary from member state to member state and from municipality to municipality, depending on the local waste management system [4].

The quantity of generated waste is also estimated for the areas not served by a municipal waste collection system. The total amount of municipal waste generated and recycled yearly is reported to Eurostat by the EU member states [10].

During 1995-2014, the total quantity of municipal waste has increased in EU (28 countries) from 225.8 mil. Tonnes in 1995 to 239.25 mil. Tonnes in 2014, with a peak in 2008 (260 mil. tonnes of waste generated).

In Romania, in the same period, waste generated decreased from 7.75 mil. Tonnes of waste in 1995 to 5.1 tonnes in 2014 (a reduction of 2.27 mil. tonnes of waste in 20 years). The quantity of waste produced by Romania represented, on average, 2.8% of the total quantity generated in EU.

Other big countries like Germany, Italy, France or UK used to generate more waste with no visible trend of decreasing. For instance, during the period analyzed (1995-2014), Germany has reduced the quantity of waste generated from 50,894 mil tonnes to only 50,256 mil tonnes of waste. This reduction is similar, in absolute terms, with that of Romania, which is generating 7 times less waste [5]. For UK and Italy, it is recorded a small increase in the waste generated.

This overall evolution means that not all member states take actions in accordance with the waste hierarchy (reduction at the source).

In the analysis on the quantity of waste reduced during 1995-2014, it may be noticed that 12 countries have diminished their generated waste by 11.11 mil. Tonnes, out of which Germany contributed with 22.3%, Romania with 20.47%, Bulgaria with 17.7% and Poland with 11.6%. (Table 1).

When analyzing the relative quantity of waste generated in EU (waste calculated per capita), it results the diagram in Figure 2.

Table 1. Quantity of municipal waste reduced in the period 1995-2014

	Member State	Mil. Tonnes of waste reduced	Share
1	Germany	-2.480	22.32%
2	Romania	-2.275	20.47%
3	Bulgaria	-1.973	17.76%
4	Poland	-1.291	11.62%
5	Hungary	-1.039	9.35%
6	Spain	-908	8.17%
7	Norway	-586	5.27%
8	Slovenia	-283	2.55%
9	Lithuania	-175	1.57%
10	Estonia	-95	0.85%
11	Iceland	-5	0.04%
12	Latvia	-2	0.02%
	Total	**-11.11**	**100%**

Source: own calculation on Eurostat data [8].

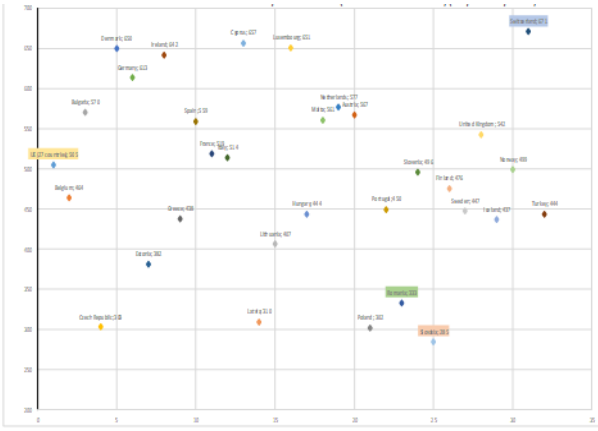


Fig. 2. Waste generated in EU member states (kg/inhabitant/year)
Source: own calculation on Eurostat data [8].

In the picture we could identify three areas. In the lower part there is a group of countries that have a low waste generation per head (less than 350 kg/inhabitant/year), such as: Czech Republic, Latvia, Romania (333 kg waste/inhabitant/year), Poland and Slovakia. In fact, Slovakia is the member state with the lowest value of this indicator (285 kg waste/inhabitant/year).

In the upper end there are European countries that generate large quantities of waste (more than 600 kg. waste/inhabitant/year). The group of heavy generators is comprised of six countries: Germany, Denmark, Cyprus, Luxemburg and Switzerland. On top of this group is Switzerland which has the biggest quantity of waste generated, 671 kg/inhabitant/year.

Between these two areas, there are other countries that generate municipal waste closer to the EU average (505 kg/inhabitant/year).

The data analyzed showed little evidence of increased waste prevention in the case of municipal waste. The prevention measures would create a consistent decreasing trend in waste generation [3].

Despite the fact that the definition of municipal waste is not the same across all EU countries, comparisons made in Figure 2 are relevant due to the fact that they were calculated as an average for 20 years.

Another issue of waste generation and management to be considered in Romania is the management of the municipal waste in the rural areas and localities.

The composition and the features of the rural household waste are different according to their corresponding origins in different types of households, villages, regions, and countries. However, there may be often noticed an issue of waste management that rural areas share: they are poorly or not sufficiently served by professional waste management companies. This is due to some adverse premises for a proper and sustainable development of rural infrastructure (low inhabitants densities, poor socioeconomic conditions, low willingness-to-pay, long distances from urban areas, etc.) [15].

The Romanian environmental protection agencies compute the amounts of municipal waste generated and uncollected by waste operators in rural areas using a waste generation rate of 0.4 kg/inhabitant/day−1, about 150 kg/inhabitant/year, so less than half the national average amount of municipal waste per inhabitant, but the waste management data is not usually available at the commune level [18].

In Romania, the rates of waste collection utility are not detailed at the local administration unit level (cities and communes). Accordingly, in environmental reports the waste statistics are conveyed as aggregate at the county level.

This factor makes it difficult to estimate the flow of uncollected household waste within the communes located in a geographical area.

As highlighted in previous research Romania has still some important socio-economic development gaps between urban and rural areas and this involves also the waste management infrastructure [13].

Although there are some waste management improvements since the EU adhesion (2007), the rural practices of waste dumping still remain a serious environmental threat in Romania, as documented by a recent study [16].

The material recycling of waste and prospects for reaching the 50% target

Since its fast development, industrial economy inevitably involved the production of a large quantity of waste the environment is not capable to naturally assimilate and transform. Therefore, one of the main green economy sectors is considered the waste retrieval and recycling, namely the waste management [21].

In the paper, it should be mentioned that the recycling rate was calculated by dividing recycled tonnage from municipal waste with the total municipal waste arising from municipal generators. The recycling activity includes several techniques as: material recycling, composting and anaerobic digestion, energy recovery.

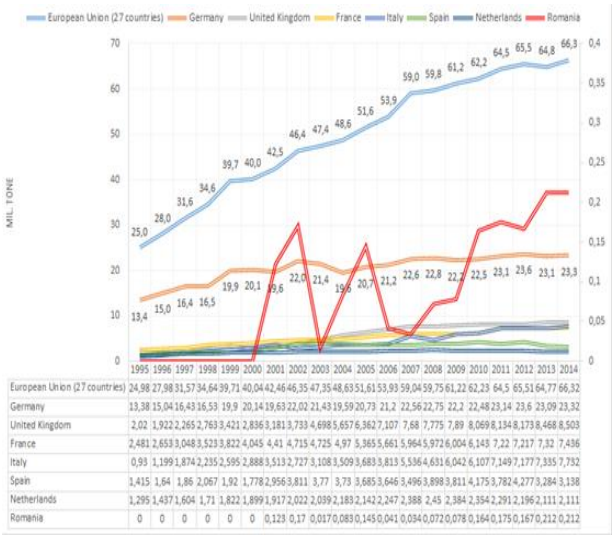
Material recycling is a process based mainly on separation, sorting, cleaning and mechanical treatment. Full recycling includes other activities as bio-digestion, fermentation and energy recovery.

Some authors argue that incineration should be not taken into account in recycling activity. Incineration is inconsistent with reduction, reuse and recycling because it relies on a steady large quantity of mixed waste. It is a superficial solution which does not solve the root of the problem – reducing the waste [17].

Figure 3 showed the clear tendency to increase the recycling quantities, in all EU member states.

At the EU level, during 1995-2014, the recycled waste quantities (material recycling) increased from 25 million tonnes in 1995 to 66, 3 million tonnes in 2014 (an increase of 266%). The biggest recycler in EU is Germany, with 23.3 million tonnes in 2014. Other significant recyclers were the United

Kingdom (8.5 mil. tonnes), France (7.4 mil. tonnes) and Italy (7.7 mil. tonnes).



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
European Union (27 countries)	24,98	27,98	31,57	34,64	39,71	40,04	42,46	46,46	35,47	35,48	63,51	61,53	59,04	59,75	61,22	62,23	64,5	65,51	64,77	66,32
Germany	13,38	15,04	16,43	16,53	19,9	20,14	19,63	22,02	21,43	19,59	20,73	21,2	22,56	22,75	22,2	22,48	23,14	23,6	23,09	23,32
United Kingdom	2,02	1,922	2,265	2,763	3,421	2,836	3,181	3,733	4,698	5,657	6,362	7,107	7,68	7,775	7,89	8,069	8,134	8,173	8,468	8,503
France	2,481	2,653	3,048	3,523	3,822	4,045	4,41	4,715	4,725	4,97	5,365	5,661	5,964	5,972	6,004	6,143	7,22	7,217	7,32	7,436
Italy	0,93	1,199	1,874	2,235	2,595	2,888	3,513	2,727	3,108	3,509	3,683	3,813	5,536	4,631	6,042	6,107	7,149	7,177	7,335	7,732
Spain	1,415	1,64	1,86	2,067	1,92	1,778	2,956	3,811	3,77	3,73	3,685	3,646	3,496	3,898	3,811	4,175	3,782	4,277	3,284	3,138
Netherlands	1,295	1,437	1,604	1,71	1,822	1,899	1,917	2,022	2,039	2,183	2,142	2,247	2,388	2,45	2,384	2,354	2,291	2,196	2,111	2,111
Romania	0	0	0	0	0	0	0,123	0,17	0,017	0,083	0,145	0,041	0,034	0,072	0,078	0,164	0,175	0,167	0,212	0,212

Fig. 3. Material recycling in EU (1994-2014) (mil. t)
Source: own calculation on Eurostat data [8].

As regarding Romania, Figure 3 shows that material recycling is reduced and oscillating, compared with other countries (this is why in the graph was plotted on the secondary axis). In 2014, the quantity of waste recycled in Romania was only 0.212 mil. Tonnes.
When analyzing the normalized indicator for 1995-2014 (waste recycled/capita), we see a similar trend as before: on the first place is Germany with an average of 250 kg/inhabitant/year recycled waste.

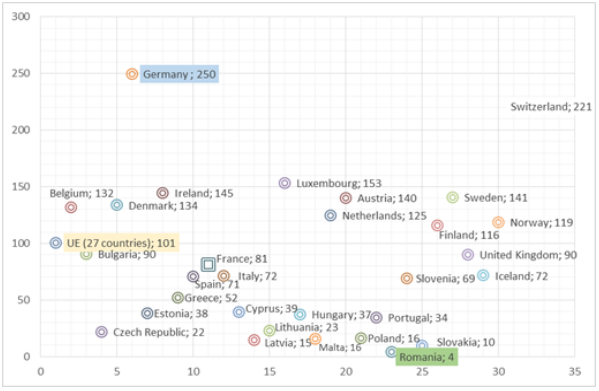


Fig. 4. Quantities of waste recycled in EU (1994-2014) (kg/inhabitant./year)
Source: own calculation on Eurostat data [8].

A consistent cluster of countries is positioned around the EU average (101 kg/inhabitant/year). Another cluster of countries is situated under the threshold of 50 kg/inhabitant/year (Portugal, Hungary, and Poland).
At the bottom of this group of countries is Romania with an average of 4 kg/inhabitant/year recycled waste. (Figure 4)
Consequently, an issue of concern is reaching the ambitious EU target mentioned at the beginning of this paper for the year 2020 of 50% municipal waste recycling (here including material recycling, reuse, energy recovery, bio digestion); this limit should be reached in 2020 by all member states [9].
In Figure 5 we could see the 50% limit as a red line and, in green, the recycling rate, as reported to Eurostat (data for 2014) for each country.

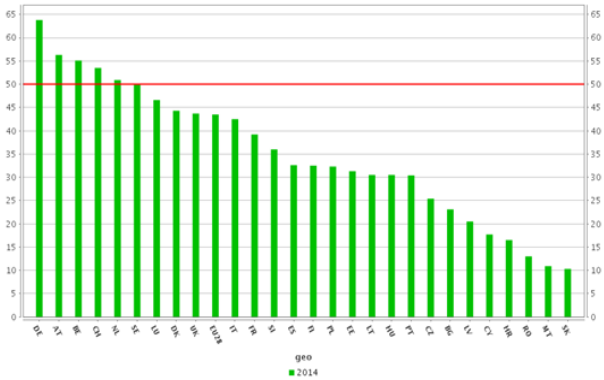


Fig. 5. Recycling rates of municipal waste, in EU (2014)
Source: Eurostat data [8].

Figure 5 reveals a complex situation. First, there are some member states that, in 2016, have surpassed the 50% recycling threshold. A number of five states have passed the threshold: Germany (63.8%), Austria (56.1%), Belgium (55.1%), Switzerland and Netherlands (50.9%). Second, there are six countries (Sweden, Luxembourg, Denmark, United Kingdom, Italy and Norway) which had a recycling rate in the interval [40%-50%]. These countries were near the EU recycling average rate in 2014 (43, 4%) and so they could easily reach the 50% target in 2020, without significant efforts.
In conclusion, there are 10 member states, out of 29 that are almost certain to surpass the 50% threshold.
After this group of countries, there are countries that may not reach the threshold. These countries are in the range of [25%-

40%] recycling rate. There were 12 countries in this situation (France, Slovenia, Spain, Finland, Poland, Estonia, Lithuania, Hungary, Portugal, Czech Republic and Latvia).

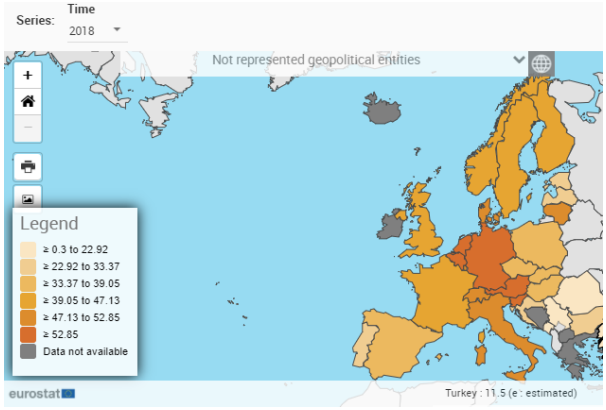


Fig. 6. Recycling rates of municipal waste, in EU (2018)
Source: Eurostat data map [8].

For the countries closer to the 40% recycling rate, there are chances to reach the target; however, those countries with a rate lower than 30%, are highly unlikely to reach the threshold. At the end, there is a group of countries with a recycling rate lower than 25%. These countries are: Bulgaria (23.1%), Latvia (20.5%), Cyprus (17.7%), Croatia (16.5%), Romania (13%), Malta (10.9%), and Slovakia (10.3%). The chances for this group of countries to pass the threshold of 50% are very remote. This outlook seems to be reaffirmed by the status on the recycling rate of municipal waste reached by the EU member states in 2018 (latest available data) displayed in figure 6. It should not be forgotten that recycling is a green business, and therefore a market for recyclables is very needed in order to develop this activity [19]. Regrettably, Romania remains among the least waste recycling countries in the European Union, although there are here some good opportunities offered by the implementing of circular economy or industrial synergy businesses in various economic sectors [12].

CONCLUSIONS

The analysis performed in this paper has led to several conclusions. There are no clear tendencies that waste management in EU is going in the direction of less waste, as the top priority in the hierarchy of waste management and a prerequisite for a resource-efficient, green economy.

The waste generated in Europe, in the last 20 years has a trend of stability. The biggest waste generator is Germany (both in absolute tonnes) and relative terms (tonnes/capita)); Romania has a modest contribution of 2.8% in total waste generated at EU level.

However, there is a clear trend for the waste recycling to increase its volume (2.66 times in 20 years); this trend is to be found in all member states.

The biggest waste recycler is again Germany, in absolute and relative terms. Other member states as UK, Italy, France and Spain have increased the quantities of waste recycled; Romania has still a very low contribution to the recycling activity, although this is another prerequisite for the waste management in a green economy.

As regarding the 50% recycling target, the situation is mixed. There are member states that have passed the threshold and some others that could do this until the end of 2020. The problem is within 13-14 countries which have such a low recycling rate that it is not reasonable to believe they could reach such a threshold by 2020 (Romania is part of this group of countries).

The fact that such a big number of countries cannot reach the target, may raise some questions about how this figure (50%) was determined and imposed to all member states.

In order to improve the situation and develop further and faster the sector of recycling in Romania, it is important to acknowledge some of the causes that put Romania in one of the last positions of green waste management and recycling in the EU.

There are many profound and inter-connected reasons for the state of underdevelopment of the recycling sector.

They are related to a whole area of issues such as the following:

(a)The lack of modern collection and treatment infrastructure;

(b)A sub-optimal use of funding available;

(c)The high share of biodegradable waste going to landfill;

(d)The poor enforcing of national strategies;
(e)The lack of separate collection;
(f)A poor use of economic instruments;
(g)The low taxes on landfilling (municipal) waste;
(h)The quite scarce application of pay-as-you-throw (PAYT) schemes.
The complexity and urgency of these issues call for some new topics and recommendations for future research.
It should now be taken into account that EU is further proposing several ambitious goals by 2030, as common EU or as binding targets:
(a)Recycling 65% of the municipal waste;
(b)Recycling 75% of the packaging waste;
(c)Reducing the landfilled disposed municipal waste to maximum10%;
(d)Interdiction of landfilling the separately collected waste;
(e)Using economic instruments in order to discourage landfilling;
(f)Simplifying and improving the definitions and harmonizing the calculation methods for waste recycling rates all over the EU;
(g)Applying practical measures promoting re-use and industrial symbiosis –by re-using one industry's by-product as raw material in another industry (a mechanism of circular economy);
(h)Implementing economic incentives so producers may launch greener products on the market, with supportive schemes of recovery and recycling (e.g. for packaging, batteries, electric and electronic equipment, vehicles).
It is therefore important to continue the research on waste management, in the urban as well as in the rural areas.
Such future research topics in Romania could be related to the best approaches able to:
(i)Impose taxes on the waste landfill and incineration to make recycling economically advantageous;
(ii)Rise the existing taxes on waste to enable incentives for recycling;
(iii)Better use of revenues from these taxes, to support waste prevention, re-use and recycling by facilitating separate collection, raising awareness and developing modern infrastructure;
(iv)Create/develop and monitor separate collection systems;
(v)Develop and perfect the controlling and transparency of the waste recycling schemes;
(vi)Amend the national strategies on bio-waste;
(vii)Enhance waste statistics;
(viii)Take advantage more of the EU funding to invest in the infrastructure and initiatives connected to the first stages of the waste hierarchy.

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SUSTAINABLE LAND MANAGEMENT AS AN INSTRUMENT TO IMPROVE ECOLOGICAL AND ECONOMIC EFFICIENCY OF AGRICULTURAL LAND USE

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Abstract

The goal of the research is to substantiate scientific and institutional fundamentals of sustainable land management as an instrument to improve economic efficiency of agricultural land use. The research methodology is presented as a model of the system of measures, which should be performed while adapting to the sustainable development of agricultural land management being the instrument to improve ecological and economic efficiency of land resources use. The research progress included implementation of several stages: 1) analysis of the goals of sustainable development, adapted for Ukraine for the period of 2015-2030; 2) determination of the specificity of use of the region's land and resource potential; 3) assessment of the impact of agro-technical and natural-climatic factors on the value of yield by the dispersion analysis method;4) modeling of the current and expected levels of yield of grain and soil-exhausting crops in conditions of the studied territory. To supply automation of the dispersion analysis calculations, the researchers used the computer program "Regre". The described methodology was tested on the territory of Mykolaiv region. The research defined the impact of agro-technical and natural-climatic factors on the value of yield capacity of the main agricultural crops of the region and their distinction by applying the dispersion analysis method. The research results are used to make forecasts of the level of yield of grain crops and sunflower in the future (2025). The increased yields of the main crops will provide the possibility to reduce the area of agricultural plowing, as well as expand the area of lands used for nature protection. The economic balance for the security of sustainable land management of the examined region needs crucial improvements. First, it concerns revival of land-owners' careful attitude to land. Therefore, labour and financial efforts should be focused on active application of the tools of the mechanism of land resources reproduction.

Key words*: land resources, agricultural land, sustainable development, dispersion analysis.*

INTRODUCTION

At the beginning of the 21st century, the world economy experiences principally new concepts on the ways of agrarian sphere development. The situation is forced by the growth of the world population and limited resources for satisfaction of the humanity's needs for food. According to the forecasts, made by numerous scientists, the global population will intensively increase.

Natural resources can potentially be used in a sustainable way if appropriate land management technology, regional planning and the policy framework complement one another in a purposeful way, in accordance with the principles and concepts of sustainable land management (SLM) [3].

Current conditions and use of land resources in the sector of agrarian nature management of Ukraine are characterized by the low economic and ecological efficiency. The strategy of maximum turnover of agricultural lands, out-of-date technologies of soil treatment, unsatisfactory use of fertilizers and other violations of the system of scientific arable farming cause negative effects. They are revealed in the misbalanced land use, degradation of soil, loss of fertility potential [7]. In several years, ecologically non-argued, irrational technical and technological as well as organizational land management in the agrarian sphere is capable to destroy the fertile arable layer of soil, having been created by the nature for thousands of years. In Ukraine, only one of 10 hectares of agricultural lands is in satisfactory ecological

conditions, one third of lands is eroded and degraded. The annual humus loss reaches 600-700 kg per 1 ha of agricultural lands [6].
Sustainable management of agricultural lands is one of the necessary conditions to support balanced correlation of ecological, economic and social factors of society development considering the properties of land resources and their values. The FAO considers that spatial organization of land resources, approval of the strategies of sustainable land management and land organization are important aspects to achieve sustainability and economic prosperity of each region and country in total [2]. On the contrary, attempts of agricultural producers to get maximum profit have resulted in harmful ecological consequences. The ecological crisis in land management has become a real threat. Therefore, land organization should become a principal means to secure sustainable development of land management in Ukraine, because it is characterized by many-sided activities and expects land policy, organization of rational use and protection of land, reclamation, crop-technical and anti-erosion measures [4]. The instruments and methods of land use planning in the appropriate scales should motivate and assist different and often competing users of land resources to choose the variants of land use and management, which will improve their efficiency, support stability of agricultural and food systems, contribute to management of land and water resources [1].
The science and practice face the urgent need to reconsider the paradigm, theoretical and methodological fundamentals of land management and improve the mechanism of management of the rational use of land resources. Establishment of a new philosophy and methodology of sustainable land management in Ukraine provides opportunities for application of its results both for effective land relations regulation and for organization of protection and rational use of lands, determination and organization of the system of economic and organizational measures on their fertility recovery.

MATERIALS AND METHODS

The research progress included implementation of several stages: 1) analysis of the goals of sustainable development, adapted for Ukraine for the period of 2015-2030; 2) determination of the specificity of use of the region's land and resource potential; 3) assessment of the impact of agro-technical and natural-climatic factors on the value of yield by the dispersion analysis method; 4) modeling of the current and expected levels of yield of grain and soil-exhausting crops in conditions of the studied territory.
To obtain the immediate and relevant initial information on the specificity of land resources use, the researchers used data of statistical reports as an informational base to detect possible deterioration of land quality.
To straighten the dynamic line of the yield of main agricultural crops, the straight-line equation was used [7]:

$$\bar{y}_t = a + bt, \quad (1)$$

where:
$\bar{y}_t$ – yield of crops for the period t;
a – an absolute term (equal to the theoretical value of the index in the period t = 0);
b – annual average growth (fall) of the crop yield;
t – ordinal number of the year.
Application of the method of dispersion analysis expects the following stages, i.e. logistic analysis; analysis and choice of factors to the model; composition of a multiple model and check of its significance; economic interpretation of the obtained results. To supply automation of the dispersion analysis calculations, the researchers used the computer program "Regre".
The work presents forecasts of the levels of yield of the region's agricultural crops for the period until 2025, which is composed by applying the method of analytical alignment of the yield dynamics.

RESULTS AND DISCUSSIONS

According to the internationally approved definition, sustainable development should

satisfy the needs of today's world by making no threat for the quality of future generations' life. It means that sustainable social and economic development is particular for the situation of balance between solution of social and economic problems and environmental protection, satisfaction of the necessities of life of the present generation and supply for the demands of future generations [5, 10].

Sustainable development of the sphere of agrarian land management should be considered as such conditions of the branch, which secure the best possible correlation between its economic growth, character of agricultural lands reclamation, increase of material and spiritual needs of population. Sustainable agrarian land management involves the methods of land resources use, which support the best possible ecological, social-economic parameters of agrarian landscapes functioning.

In September 2015, the Summit on sustainable development and approval of the Post 2015 Development Agenda was held within the framework of the 70th session of the UN General Assembly in New York. The Summit approved new goals of development. The Resolution of the Summit "Transforming our world: the 2030 Agenda for Sustainable Development" adopted 17 goals and 169 targets. Ukraine, along with other member-countries of the UNO, joined the global process on sustainable development security. One of the primary goals of sustainable development, adapted for Ukraine for the period of 2015-2030, is to end hunger and develop sustainable agriculture [9].

The main measures, which are necessary while adapting to the sustainable development of agricultural land management as an instrument to improve ecological and economic efficiency of land resources use, can be presented in the form of a model (Fig. 1).

The proposed model of the system of adaptive measures will help combining ecological requirements and economic interests. Therefore, it will contribute to a growth of the volume of agricultural products along with protection and improvement of the environment.

Achievement of the effect of sustainable land management, protection of the land fund integrity, and keeping to the principles of rational use of land resources are considered on the example of Mykolaiv region occupying the area of 2,458.5 thousand ha (4.1 % of the territory of Ukraine), which is the agrarian region of the country.

In the structure of agricultural lands of the studied territory, the largest share (above 69%) is occupied by arable land (Table 1). The area of agricultural lands in Mykolaiv region has recently demonstrated the tendency to reduction (in 2019, the area reduced by 118.12 thousand ha (4.8%) comparing to 2016). Such transformation of agricultural lands was partially implemented by reducing the area of arable land. In the agrarian sphere, the processes of implementation of environmental land management happen extremely slowly. Thus, a considerable share, i.e. 49.28 thousand ha (1.93%), needs conservation. Within the area of the research, 1.52% agricultural lands suffer from a combined water and wind erosion in 2019.

In terms of the main land users, the largest share of agricultural lands is used by agricultural enterprises. In the period of 2000-2019, the territory of Mykolaiv region was characterized by unstable conditions and a high level of anthropogenic burden. Ecological conditions of land resources are positively influenced by the structure of cropping area under agricultural crops, where the share of perennial herbs is relatively high (not less than one third of the total cropping area). In the studied region, the largest share in the structure of crops has been recently occupied by grain crops. Moreover, Mykolaiv region is among the top five leaders by the cropping area of soil-exhausting technical crops. Nevertheless, agricultural enterprises demonstrate the tendency to increase the level of land plowing.

A sustainable agrarian landscape is created by means of ecologically adapted organization of agricultural lands. Its main components include development and introduction of a system of crop rotations on arable lands and ways of formation of plant groups – on forage lands [1].

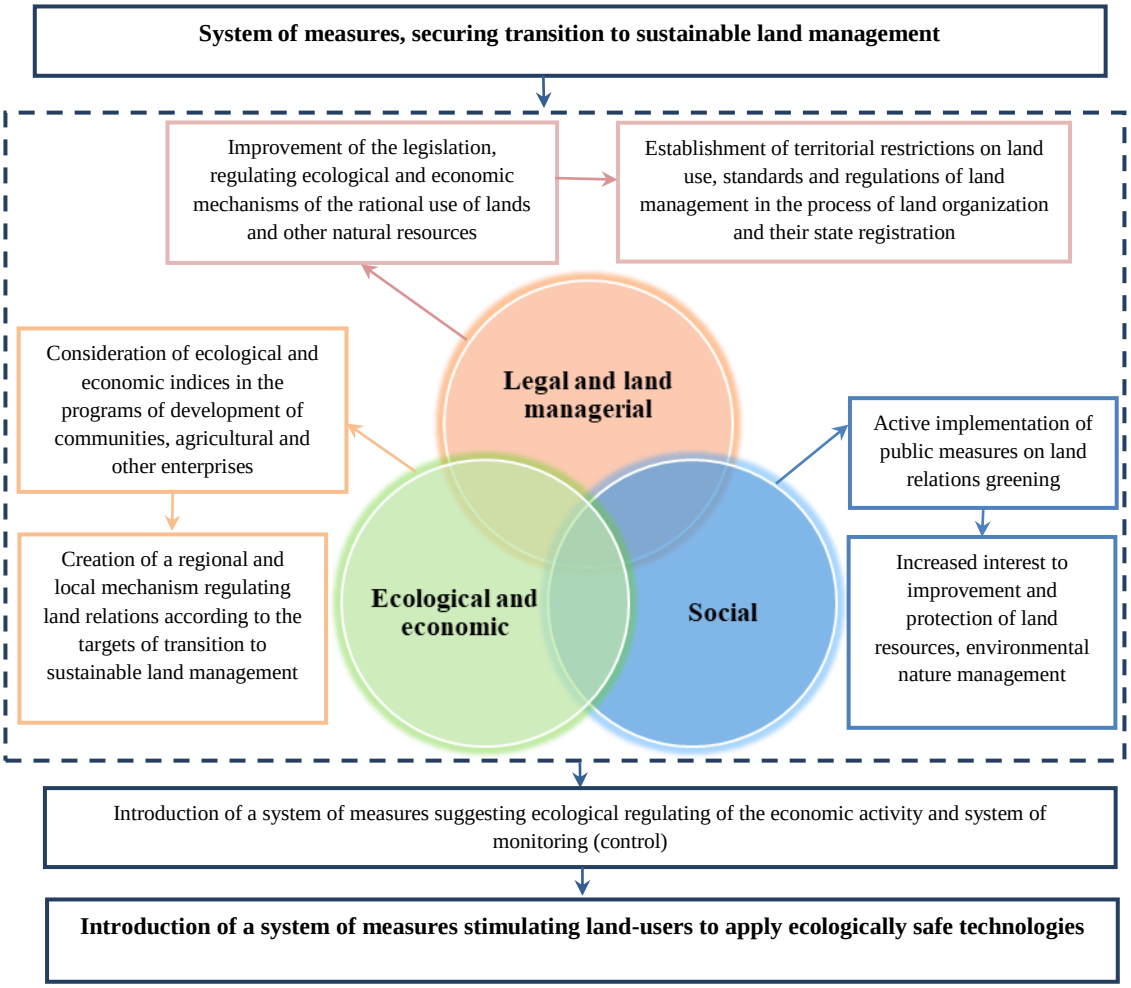

Fig. 1. Model of the system of adaptive measures on transition to sustainable land management*
*Source: Completed by the authors according to the data [9, 11].

Table 1. Structure of the land fund of the examined region (as of January 1)*

Main kinds of lands	2016		2017		2018		2019		Deviation, +,-	
	thous.ha	%	thous.ha	%	thous.ha	%	thous.ha	%	thous.ha	%
Total area	2,458.50	100.00	2,458.50	100.00	2,458.50	100.00	2,458.50	100.00	0.00	0.00
Including:										
1. Agricultural lands	2,006.20	81.60	2,006.20	81.60	2,006.20	81.60	1,888.08	76.80	-118.12	-4.80
including:										
arable land	1,699.20	69.12	1,699.20	69.12	1699.20	69.12	1,703.40	69.30	4.20	0.18
grasslands	3.10	0.12	3.10	0.12	3.10	0.12	3.57	0.10	0.47	-0.02
perennial plants	35.70	1.45	35.70	1.45	35.70	1.45	33.36	1.40	-2.34	-0.05
hayfields and pastures	268.20	10.91	268.20	10.91	267.90	10.90	255.70	10.40	-12.50	-0.51
2. Forests and other forested area, total	124.60	5.07	124.60	5.07	124.50	5.06	134.37	5.50	9.77	0.43
including the area covered by forest vegetation	101.20	4.12	101.20	4.12	101.30	4.12	121.49	4.90	20.29	0.78
3. Build-up lands	98.90	4.03	98.90	4.03	99.00	4.03	296.15	12.00	197.25	7.97
4. Open swamp lands	21.00	0.85	21.00	0.85	21.10	0.86	19.40	0.80	-1.60	-0.05
5. Open lands without or with poor vegetation	30.80	1.25	30.80	1.25	31.00	1.26	25.90	1.10	-4.90	-0.15
6. Other lands	177.00	7.20	177.00	7.20	48.10	1.96	94.65	3.80	-82.35	-3.40
Total area of lands (ground)	2,329.70	94.76	2,329.70	94.76	2,329.70	94.76	2,332.74	94.90	3.04	0.14
7. Territory, covered by surface waters	128.80	5.24	128.80	5.24	128.80	5.20	125.81	5.10	-2.99	-0.14

*Source: Completed by the authors according to the data [8].

The principal index of ecological and economic efficiency of agricultural land use is determined by the level of yield and productivity of agricultural crops and crop

rotation in total. Yield is an index of crop productivity. It is a derivative value of the factors and conditions of its formation. Therefore, variation of each factors definitely effects the ultimate value of the crop yield [7].

To identify the impact of agro-technical and natural-climatic factors on the value of yield of the principal agricultural crops in Mykolaiv region and their distinction, the dispersion analysis was used by the researchers (Table 2). The research results are used to make forecasts of the level of yields of grain crops and sunflower in the future (2025). It is expected that an increase of the yields of main crops will provide the possibility to reduce the area of agricultural plowing, as well as expand the area of lands used for nature protection.

To make calculations, the straight-line equation (1) is used. However, $\sum y = \sum \overline{y^2}$. To determine parameters a and b, the system of normal equations is composed:

$$\begin{cases} na + b\sum t = \sum y, \\ a\sum t + b\sum t^2 = \sum ty; \end{cases}$$

$$\begin{cases} 9a + 45b = 260.8, \ (\times 5) \\ 45a + 285b = 1{,}373.0; \end{cases}$$

$$\begin{cases} 45a + 225b = 1{,}304.0, \\ 45a + 285b = 1{,}373.0; \end{cases}$$

$60b = 69;$

$b = 1.15.$

The obtained value is inserted in:

$9a + 45 \times 1.15 = 260.8$. Then, $a = 23.23$.

$$\overline{y}_t = 23.23 + 1.15t.$$

For the period until 2015, yield of grain crops at the agricultural enterprises of Mykolaiv region will be determined as:

$y_{2025} = 23.23 + 1.15 \times 16 = 41.63$ centner/ha.

The dispersion characterizes the degree of absolute variation and serves for assessment of the factors' impact on the feature variation. Here is the calculation of the total dispersion, which manifests variation of yield due to the impact of agro-technical and natural-climatic factors:

$$\sigma^2_{general} = \overline{y^2} - \sum \overline{y^2} = 866.48 - 839.71 = 26.77.$$

The dispersion of the theoretical values of yield is calculated in the work. It characterizes the yield variation (change) under the impact of only agro-technical factors:

$$\sigma^2_{theoretical} = \frac{(\overline{y_t} - \sum y)^2}{n} = 79.4 \div 9 = 8.82.$$

Thus, it is obtained:

$$\frac{\sigma^2_{theoretical}}{\sigma^2_{general}} \times 100\% = \frac{8.82}{26.77} \times 100\% = 32.95\%.$$

Therefore, the impact of agro-technical measures on the change of grain crops yield at agricultural enterprises equals to 32.95%. The impact of natural-climatic factors on the yield of grain crops is 100% – 32.95% = 67.05%.

The same calculation is done for sunflower, which is a soil-exhausting technical crop (Table 3).

Table 2. Yields of grain crops at agricultural enterprises in Mykolaiv region*

Year, n	Year number, t	Yield, centner/ha, y	Calculated values		$\overline{y}_t$	Average square value of the feature, $\overline{y^2}$	$\overline{y^2}$	$(\overline{y}_t - \sum \overline{y})^2$
			t^2	t × y				
2010	1	24.5	1	24.5	24.4	600.3	-	21.1
2011	2	28.5	4	57.0	25.5	812.3	-	11.9
2012	3	16.4	9	49.2	26.7	269.0	-	5.3
2013	4	31.0	16	124	27.8	961.0	-	1.3
2014	5	32.3	25	161.5	29.0	1043.3	-	0.0
2015	6	32.1	36	192.6	30.1	1030.4	-	1.3
2016	7	34.6	49	242.2	31.3	1197.2	-	5.3
2017	8	30.6	64	244.8	32.4	936.4	-	11.9
2018	9	30.8	81	277.2	33.6	948.6	-	21.2
n = 9	$\sum t = 45$	$\sum y = 260.8$	$\sum t^2 = 285$	$\sum (t \times y) = 1{,}373.0$	$\sum \overline{y}_t = 260.8$	$\sum \overline{y^2} = 866.48$	839.71	79.4

*Source: Completed by the authors.

The calculations have provided the following results: a = 15.88, b = 0.52. Then,

$$\overline{y_t} = 15.88 + 0.52t.$$

Until 2025, the prospect of sunflower yield at agricultural enterprises in Mykolaiv region is determined as:

$y_{2025} = 15{,}88 + 0{,}52 \times 16 = 24{,}42$ centner/ha.

Thus, the impact of agro-technical measures on the change of sunflower yield at agricultural enterprises equals to 21.43%. The impact of natural-climatic factors on the yield of grain crops is 100% – 21.43% = 78.57%.

The performed calculations confirm that in Mykolaiv region, the 2025 prospects expect an increase of the yield of both grain and soil-exhausting crops. It will be equal to 41.63 centner/ha and 24.42 centner/ha respectively.

Table 3. Yield of soil-exhausting technical crops (sunflower) at agricultural enterprises in Mykolaiv region*

Year, n	Year number, t	Yield, centner/ha, y	Calculated values		$\bar{y}_t$	Average square value of the feature, $\overline{y^2}$	$\overline{y^2}$	$(\bar{y}_t - \sum \bar{y})^2$
			t^2	t × y				
2010	1	14.9	1	14.9	16.4	222.0	-	4.4
2011	2	16.6	4	33.2	16.9	275.6	-	2.5
2012	3	15.1	9	45.3	17.4	228.0	-	1.1
2013	4	22.5	16	90.0	18.0	506.3	-	0.3
2014	5	17.6	25	88.0	18.5	309.8	-	0.0
2015	6	21.3	36	127.8	19.0	453.7	-	0.3
2016	7	22.7	49	158.9	19.5	515.3	-	1.0
2017	8	16.4	64	131.2	20.0	269.0	-	2.4
2018	9	19.4	81	174.6	20.6	376.4	-	4.2
n = 9	$\sum t = 45$	$\sum y = 166.5$	$\sum t^2 = 285$	$\sum(t \times y) = 863.9$	$\sum \bar{y}_t = 166.5$	$\sum \overline{y^2} = 350.7$	342.3	16.2

*Source: Completed by the authors.

CONCLUSIONS

Results of the conducted research confirm the following suggestions:

1. The current deterioration of ecological conditions of lands, reduction of soil fertility and large-scale expansion of soil degradation processes require significant transformations in the human economic activity on agricultural lands. Protection and the most rational use of land resources, increase of land fertility can be achieved only under conditions of transition to agrarian land use referring to the model of sustainable development.

2. The impact of agro-technical and natural-climatic factors on the value of yields of main agricultural crops in Mykolaiv region and their distinction is studied by applying the dispersion analysis method. It is confirmed that the impact of agro-technical measures on the change of yield of the most common crops at agricultural enterprises variates by one third. Under such conditions, among agricultural practices, the optimal ones include non-exhausting practices of arable farming, reclamation of organic soils, economic activity on the base of climate focused methods of agricultural production.

3. The research results are used to make forecasts of the level of yields of grain crops and sunflower in the future (2025). An increase of the yields of main crops will provide the possibility to reduce the area of agricultural plowing, as well as expand the area of lands used for nature protection.

The economic balance for the security of sustainable land management of the examined region needs crucial improvements. First, it concerns revival of land-owners' careful attitude to land. Therefore, labour and financial efforts should be focused on active application of the tools of the mechanism of land resources reproduction.

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FEATURES IN THE DEVELOPMENT OF RURAL AREAS LOCATED IN THE SOUTH-CENTRAL PLANNING REGION IN BULGARIA

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Abstract

This article examines the state of rural areas in the South Central region of Bulgaria. A spatial assessment of the territorial and socio-economic development of the South Central region has been made. Based on statistical assessment, geographical analysis and socio-economic characteristics, the trends in the development of rural areas in the South Central Planning Region are derived. The article assesses the demographic condition of the population and the general condition of the settlements. Based on the presented overview of the rural areas in the South Central region, we can conclude that they lag behind in the pace of socio-economic development compared to the urban areas in the region. A more targeted regional policy is needed, including through the impact of European Union Funds to address regional disparities in rural areas in the South Central Planning Region.

Key words**:** *rural area, development, region, regional policy, local area, management, space*

INTRODUCTION

The spatial development of the separate territories in the modern states requires special attention and analysis. On the territory of countries like Bulgaria there are many separate rural areas. These rural areas need economic prosperity as well as modern development. The spatial view of the territory brings to the fore the natural conditions and resources, which together with the population are the basis of the socio-economic development of these territories. In Bulgaria, one of the most developed economic regions is the South Central Planning Region, but it also has a large share of rural areas that are experiencing difficulties in their socio-economic development. To a large extent, the rural areas of the South Central region in Bulgaria cover flat areas such as the Upper Thracian Plain, but also mountainous areas such as the Rhodopes, Sredna Gora and the Southern Ridge of the Balkan Mountains. The combination of different types of nature and different problems make the topic of rural areas in the South Central region very relevant and important in general for the regional development and management of the Bulgarian territory. The combination of urban and rural areas emphasizes the need to achieve balance and integration of regional policy. A number of program and strategic documents set out mechanisms aimed at improving the socio-economic development of rural areas. In practice, focusing on rural issues is an opportunity to promote integrated territorial governance at regional level and to develop relevant successful regional policies [1]. The socio-economic development of rural areas is a challenge for both the public sector and regional business. This is because local development presupposes the functioning of an effective regional economy, which combines the specifics and peculiarities of the territories of Bulgaria and reveals the opportunities for them. In this regard, we can assume that the rational use of natural resources and demographic potential are necessary conditions for the socio-economic development of rural areas in the South Central region. Our focus on rural areas will be based on the assessment and analysis of the natural resource potential and the characteristics of the population and settlements, as a factor for regional development. The focus of the exhibition will be on bringing out the strengths of rural areas [2]. This means that those sectoral and demographic characteristics that can bring out the strengths of rural areas and successfully

integrate them into the regional economy in the South Central Planning Region will be identified.

MATERIALS AND METHODS

The aim of the research is related to solving the problems of considering processes in the rural areas of the South Central Planning Region in Bulgaria. The socio-economic structuring of the population and settlements, as well as the branch problems in the rural areas are presented. For this purpose, statistical methods, comparative analysis, network approach and descriptive analysis were used for quantitative research of rural areas [3]. The study of statistics is the most used method in socio-economic research, which is the most popular and is sometimes identified with territorial development and the regional economy. Among the most important methods used for this purpose are: reference to expert assessment, systematic analysis and demographic analysis to fully assess the condition of the population and settlements, as well as to derive socio-economic patterns in the rural areas of the planning region.

RESULTS AND DISCUSSIONS

Geographical location of rural areas in the South Central region

The south central region is located in the southern part of the country, its astronomical position is between: 42°40´/41°14´N and 23°35´/26° 25´E. The northernmost point is the municipality of Karlovo - Troyan Pass 1,525 m above sea level. 42°40°N, the southernmost point is Veika Peak (Gyumordzhinski Snezhnik), the village of Gorno Kapinovo, Kirkovo Municipality, 41°14°N. The westernmost point is the village of Bozova municipality of Velingrad 23°35°E, the easternmost point of the rural areas in the South Central region is the municipality of Svilengrad, it is the place where the valley of the Tundzha River and the northern border of the Republic cross. Turkey - 26°25´´E. From a physical-geographical point of view to the north the region covers the ridge central parts of Stara Planina, to the south the Western and Eastern Rhodopes. To the west it borders the mountains Rila and Pirin, and to the east the border reaches the valley of the Tundzha River. The South Central region covers the territories of the districts of Plovdiv, Pazardzhik, Smolyan, Kardzhali and Haskovo and 57 municipalities. The region covers the western half of the Upper Thracian Lowland, the southern part of the Central Stara Planina, part of Sredna Gora, the sub-Balkan fields and a large part of the Rhodopes. The area of the region is 22,365.1 km² or 20.1% of the country's territory. Based on different atmospheric air circulation, which determines the different climatic zones of the continent of Europe, the territory of Bulgaria is located between two large climatic zones: Subtropical and Temperate. The South Central region and the rural areas within it fall within the boundaries of three continental climatic subregions: Temperate, Transitional and Continental Mediterranean climatic subregions. The rivers that are the basis for the formation of this catchment area are: Maritsa (21,084 km²), Tundzha (7,884 km²) and Arda (5,201 km²), occupying 31% of the territory of Bulgaria.

Fig.1. The map of South Central region, Bulgaria
Source: NSI, MRDPW.

Important for the height assessment of the planning region is the location of the settlements, the access to natural resources and especially the transport and infrastructural accessibility in spatial terms. There are different methodologies for selecting the indicators that should be applied in the economic assessment of the relief. Research in this direction shows that the use of a differentiated approach is necessary. Its application depends on the specifics of the

implemented implementation decisions. Usually the leading importance in the development of the territory in economic and economic terms is the vertical and horizontal division of the relief, the slopes of the slopes, the altitude [4]. From the point of view of the quantitative assessment of the predominant features of the relief on the territory of the South Central region, five main types of relief with regional significance can be distinguished: Lowland - Upper Thracian lowland; Plain-hilly, including the Karlovo valley, Sredna and Sarnena gora; Lowland with the mountains of the Eastern Rhodopes and Sakar; Mid-mountain - Western Rhodopes and High-mountain - Troyan-Kalofer part of the Central Stara Planina and the high parts of the Western Rhodopes.

The altitude in the rural areas by districts of the South Central region of 0 ÷ 1,600 m is indicated in tabular form. The study and analysis of the relief in vertical terms gives an idea of what economic activities can be developed in certain areas of rural areas related to altitude [5].

Table 1. Distribution of the territory by sq.km / percent and by meters above sea level in the Rural areas by districts of South-Central region

Region	Area in km^2		Measure	0-200	200-600	600-1,000	1,000-1,600	over 1,600
Rural areas in the South Central region	**18,219,54**	All	Sq. km.	4,235.68	9,738.63	3,318.21	4,203.89	868.58
			%	23.25%	53.45%	18.21%	23.07%	4.77%
		Urban regions	Sq. km	2,832.51	7,854.60	3,318.19	3,344.84	868.50
			%	15.55%	43.11%	18.21%	18.36%	4.77%
Rural areas of Kardzhali district	2,631,26	All	Sq.km	67.33	2,414.12	702.11	22.44	0.00
			%	2.10	75.30	21.90	0.70	0.00
		Urban regions	Sq.km	67.33	1,839.00	702.11	22.44	0.00
			%	2.56	69.89	26.68	0.85	0.00
Rural areas of Pazardzhik district	3,822,28	All	Sq.km	98.10	1,685.50	847.21	1,382.29	445.90
			%	2.20	37.80	19.00	31.00	10.00
		Urban regions	Sq.km	98.10	1,048.00	847.20	1,382.30	445.90
			%	2.57	27.42	22.16	36.16	11.67
Rural areas of Plovdiv district	5,204,63	All	Sq.km	1,642.30	2,514.21	859.97	836.08	119.44
			%	27.50	42.10	14.40	14.00	2.00
		Urban regions	Sq.km	1,546.48	1,842.80	860.00	836.10	119.40
			%	29.71	35.41	16.52	16.06	2.29
Rural areas of Smolyan district	2,333,37	All	Sq.km	3.19	102.14	820.34	1,963.08	303.24
			%	0.10	3.20	25.70	61.50	9.50
		Urban regions	Sq.km	3.20	102.10	820.30	1,104.00	303.20
			%	0.14	4.38	35.16	47.31	12.99
Rural areas of Haskovo district	4,228,00	All	Sq.km	2,424.77	3,022.66	88.58	0.00	0.00
			%	43.80	54.60	1.60	0.00	0.00
		Urban regions	Sq.km	1,117.40	3,022.70	88.58	0.00	0.00
			%	26.43	71.49	2.09	0.00	0.00

Source: Information from the NSI and author's calculation [11].

The consideration of the relief in vertical relation is connected with the economic, social, ecological and infrastructural development in economic relation of the whole region. Of the five districts of the South Central region with the largest territory is the relief with an altitude of 200 to 600 m. with the exception of Smolyan district, where over 80% of the territory falls in mountainous areas. The districts of Kardzhali and Haskovo fall vertically in the area of the plain-hilly relief, as the former has a minimal percentage of the relief in the mountain zone. For the district of Pazardzhik with the highest percentage are the territories of 600 ÷ 1,600 m above sea level. Plovdiv district and the

adjacent rural areas to it for the most part fall in the range from 200 to 600 meters above sea level.

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Spatial location of settlements and assessment of the demographic situation

For the intermediate rural territories, the total number of rural municipalities should be between 15 ÷ 50% of the total number of the same in the region. The predominant rural areas must include more than 50% of the total number of rural municipalities in the region. The territories with municipalities with a population of over 30,000 are defined as urban areas. Table 2 shows the types of regions and population in the country and the region.

Table 2. Regions, territory, population and density for Bulgaria and the rural areas of the South Central region for 2018

Region	*Territory*		*Population*		*Density*
	Area (km²)	%	Number of people (thousands)	%	People per km²
Bulgaria	111,001		7,327,224		66,01
South central region	22,365	20.15%	1,479,373	20.19%	66.15
Rural areas in the South Central region	18,219.14	81.46%	700,640	47.36%	38.45
Intermediate rural areas	9,433.23	51.78%	363,660	51.90%	38.55
Predominant rural areas	8,785.91	48.22%	336,980	48.10%	38.35
Urban areas	4,325.88	19.34%	649,828	44.00%	151.00

Source: NSI and author's calculations [11].

Here is the ratio between the different types of regions in the South Central region for 2011. The intermediate rural areas in the region are 25 in number. Outside this typology remain 4 municipalities, defined as urban areas. The predominant rural areas are a total of 25. Outside the National Definition of Rural Areas, 3 municipalities remain defined as urban areas. The settlement structure gives an idea of the types of settlements, the environment in which they develop and the population that lives in them. This is the place where people carry out their socio-economic activities, determining their geodemographic behavior and culture. The indicators that are applied and used for the analysis of the settlement structure are the share and dynamics of the urban / rural population, the number of districts, the cities, municipalities and villages [6]. The ratio between the number of urban / rural population determines the level of urbanization.

The settlements in the South Central region make up 24.61% of those in the country. All municipalities in the South Central region make up 21.60%, as the rural ones are 21.64%, the cities are 21.76% and the villages - 24.78% compared to the country.

Rural areas occupy over 80% of the territory of the region, settlements over 70% and the population is 47% of this region in 2011. The South Central region is no exception to the changes taking place at the national level.

Table 3. Presentation of the settlements in the South-Central planning region (including rural areas)

		2004			2011			2018		
Regions	Area km²	Number of settlements	Towns	Villages	Number of settlements	Towns	Villages	Number of settlements	Towns	Villages
Bulgaria	111,001	5,333	246	5,087	5,302	257	5,045	5,268	257	5,011
South central region	22,365.1	1,511	54	1,448	1,306	54	1,252	1,302	54	1,248
Rural areas in the South Central region	18,441.7	974	45	929	975	46	929	972	46	926
Rural areas of Kardzhali district	2,634.3	352	4	348	353	4	349	352	4	348
Rural areas of Pazardzhik district	3,820.2	85	12	73	85	12	73	85	12	73
Rural areas of Plovdiv district	5,422.5	184	15	169	184	16	168	182	16	166
Rural areas of Smolyan district	2,338.9	156	7	149	156	7	149	156	7	149
Rural areas of Haskovo district	4,225.8	197	7	190	197	7	190	197	7	190

Source: NSI and author's calculations [11].

Table 4. Comparison of rural areas by population, area and population density in urban areas, 2018

Regions	Population	Share of the population (%)	Territory area (sq.m.)	Share of the territory (%)	Population density
Bulgaria	7,000,039	100%	110,371	100%	63.88
Northwest region	742,304	10.2%	19,047	17.2%	39.69
North Central region	784,168	11.2%	14,645	13.1%	54.2
Northeast region	929,035	13.3%	14,668	13.3%	63.76
Southeast region	1,032,079	14.7%	19,664	17.8%	52.87
Southwest region	2,102,205	30.0%	20,305	20.2%	63.55
South central region	1,410,248	20.1%	20,041	18.6%	105.2

Source: NSI [11].

The number of settlements decreased by 209 from the initial to the final period. The biggest decrease is in the villages in the region - in ten years they have decreased by 200. On the other hand, we can see the strong agglomeration potential, which combines rural and urban areas. The agglomeration processes are connected first of all with the work trips, but also with the trips related to training, service and in certain cases with the differentiation of the living and recreation environments [7]. Bad impact on the development of the South Central region for the period 2011/2018. has a decline in its population by nearly 87,562. or negative value - 7.58% of the total. The main reasons for the decline of the population at the district level is the high mortality, low birth rate, migration to the capital and abroad of the population of childbearing age. The picture is similar in the rural areas of the South Central region in the period 2011/2018, when there is a decline in population by 8.87%. From 2018 to the previous study period (initial), the population decline was 51,416 people or 6.84%. The main reasons are high mortality, an aging population in rural municipalities, low birth rates and migration to large urban centers. The rural areas of Kardzhali district in the period also reported a decline in population by 7605

people or 8.47%. In recent years, the analysis shows that the rural areas of Kardzhali district have the smallest population decline compared to other areas. This is due to the relatively high birth rate and the minimal migration of the population to the large centers of the region. The rural areas of Pazardzhik district by 2018 report a decline in population by 18,614 people or 10.60%. As for the last 7 years of 2011. so far the population decline is 9%. The main reasons are high mortality and migration of the population of childbearing age to large centers. The rural areas of Plovdiv district also report a decline in population - 14,690 people or 4.15%. This region reports the lowest population decline in a ten-year period. The proximity of the large city center and the opportunity for realization of the young population in it, keeps the population in the rural municipalities located in the area. From 2011 to the previous study period (initial), the population decline is minus 3.40% or 9807 people. The worst situation is in the rural areas of Smolyan district in the period 2004/2018, where they report a decline in population by 11,439 people or 13.01%. The main reasons are high mortality and migration of the population of childbearing age to large centers. The situation is similar in the rural areas and in the district of Haskovo, where there is a decrease in the population of 13,217 people or by 12.35%. Migrations of the population in the rural areas of the South Central region are caused by socio-economic reasons. The population is moving to territories that allow for a better social and economic way of life, ie. in the urban areas of large urban centers. The movement of the population in the rural areas of the South Central region is in the direction of village-town, village-village. In recent years, the process of suburbanization has intensified in large urban centers. The proximity of rural areas to cities forms labor migration within a working day, typical of the South Central region.

Challenges to the socio-economic development of rural areas

The localization of economic activities in the rural areas of the South Central region is developed on the basis of factors, different in type, but characteristic for a certain territory [8]. After the recovery of the Bulgarian economy in 2013, the rural areas in the South Central region began to develop at a satisfactory pace. It is evident from the table that the most developed are the rural areas in Plovdiv district, followed by those in Pazardzhik and Haskovo districts, and relatively slower development in those in Kardzhali and Smolyan districts. This trend is evident in the results of 2019 as the growth rate of GDP per capita is not as high as in 2013. This shows that rural development in the South Central region is relatively slow.

Table 5. GDP in rural areas of the South central planning region for 2013

	Agriculture	Industry	Services	BDS, BGN million	GDP, BGN million	GDP per capita, BGN
South Central region	749	4,063	6,081	10,894	12,618	8,756
Kadzhali	124	263	460	846	980	6,464
Pazardzhik	149	849	837	1,835	2,125	8,018
Plovdiv	244	2,211	3,477	5,932	6,871	10,187
Smolyan	84	361	408	853	988	8,760
Haskovo	148	380	899	1,428	1,654	6,976

Source: NSI [11].

Table 6. GDP in rural areas of the South central planning region for 2019

	Agriculture	Industry	Services	BDS, BGN million	GDP, BGN million	GDP per capita, BGN
South Central region	791	4,736	7,943	13,471	15,535	10,988
Kardzhali	145	374	598	1,117	1,288	8,472
Pazardzhik	162	801	1,088	2,051	2,365	9,213
Plovdiv	258	2,732	4,633	7,649	8,792	13,141
Smolyan	82	379	516	977	1,127	10,597
Haskovo	145	450	1,108	1,702	1,963	8,545

Source: NSI [11].

Given the slow socio-economic development of rural areas, they hope for targeted support, especially mechanisms to support the development of local business and improve the efficiency of the public sector. In this direction, it is necessary to segment various factors that will support rural development [9]. The grouping of the factors gives a more accurate idea of the economic activities that function and take place or are subject to development in the administrative-territorial unit.

Table 7. Share distribution of part of the economic sectors in the rural areas of the South Central region for 2011/2019

Share distribution of a part from economic sectors		**Rural areas of the District**											
		Kardzhali		Pazardzhik		Plovdiv		Smolyan		Haskovo		SCR	
		GVA Million	%	GVA Million	%	GVA Million	%	GVA Million	%	GVA Million	%	GVA Million	%
2011	Agriculture, forestry and fishing	3,498	2,59	77,896	57,66	41,194	30,49	5,044	3,73	7,465	5,53	**135,097**	100
	Mining industry	0,177	0,07	198,383	81,10	17,394	7,11	25,319	10,35	3,343	1,37	**244,616**	100
	Manufacturing industry	2,544	2,00	30,347	23,87	80,011	62,92	9,554	7,51	4,703	3,70	**127,159**	100
	Construction	2,900	4,62	6,567	10,46	9,022	14,37	35,878	57,13	8,431	13,43	**62,798**	100
	Trade, repair of motor vehicles and motorcycles	3,132	4,14	16,764	22,17	40,06	52,98	5,205	6,88	10,456	13,83	**75,617**	100
	Transport, warehouses and post offices	4,235	3,78	29,25	26,11	26,294	23,47	21,353	19,06	30,884	27,57	**112,016**	100
	Culture, sport and entertainment	0,484	0,28	6,396	3,75	19,322	11,32	17,074	10,01	127,371	74,64	**170,647**	100
2018	Agriculture, forestry and fishing	0,702	0,64	70,948	64,25	28,83	26,11	1,930	1,75	8,012	7,25	**110,42**	100
	Mining industry	0,177	0,06	236,923	83,49	19,081	6,72	26,443	9,32	1,155	0,41	**283,779**	100
	Manufacturing industry	3,519	2,49	25,439	18,02	98,495	69,78	9,821	6,96	3,875	2,75	**141,149**	100
	Construction	2,721	4,46	13,635	22,34	8,548	14,01	7,513	12,31	28,604	46,88	**61,021**	100
	Trade, repair of motor vehicles and motorcycles	3,883	4,10	22,764	24,04	48,002	50,7	7,104	7,50	12,926	13,65	**94,679**	100
	Transport, warehouses and post offices	2,602	2,18	27,000	22,59	50,294	42,08	10,765	9,01	28,853	24,14	**119,514**	100
	Culture, sport and entertainment	1,720	0,82	4,279	2,05	15,791	7,57	25,192	12,07	161,739	77,49	**208,721**	100

Source: NSI [11].

The study and analysis of some of the economic sectors in rural areas by districts reveals the economic picture.

In rural areas, during the economic sector survey period, the analysis showed a decrease in GVA for agriculture, forestry and fisheries. A minimal reduction of GVA is also reported for the construction sector for the studied period.

The decline in GVA in the primary sector at the micro and macro level is due to a decrease in the volume of production, limiting the activity of traditional sub-sectors in the sector, lack of clustering in rural areas, production of identical agricultural products and lack of strategy [10].

The increase in the number of enterprises in the rural areas of the South Central region is due to the natural and climatic conditions and socio-economic activities aimed at stimulating this sector. The decrease in GVA for Agriculture, Forestry and Fisheries is due to a reduction in the cost of production on domestic and foreign markets, analysis of the number of enterprises operating in the Agriculture, Forestry and Fisheries sector in rural areas. The region retains its specialization and is a leader in this field. A decrease in the number of enterprises is reported in the Mining and quarrying sector. GVA reports growth based on the increased cost of high-carbon and low-carbon minerals in the domestic and foreign markets. In the rural areas of the South Central region, despite the decline of enterprises in the Mining and quarrying sector, the region retains its specialization in this sector. In the Construction sector there is a decline in enterprises and GVA throughout the survey period in rural areas of the South Central region. Deteriorating socio-economic indicators at the micro and macro levels have a direct impact on the development and functioning of the sector. Rural areas do not specialize in this sector. Sector Trade, repair of motor vehicles and motorcycles at the end of the study period there was a decline in enterprises. As reasons we can point out the migration to urban areas, the low socio-economic indicators of the population in these areas and others [12]. Rural areas retain the specialization for this branch of the economy. In the other economic sectors there is an increase in the number of enterprises during the period of research and preservation of specialization by industry and growth of GVA.

In the Manufacturing industry, as a sub-branch of the Industry sector, for the country and the region a total increase of GVA for the studied period 2014-2019 was reported. For the rural areas of the South Central region, an increase of 9.91% is also reported. The growth of GVA at micro and macro level is due to the increased demand for finished products. In the Construction sector there is a growth of GVA for the country 13%, for the region - 20.66% and for the rural areas of the South Central region with a minimum decrease of 1.87%. The increased growth in the Construction sector in the country and the region is due to the intensified urbanization processes, development of new infrastructure sites, increased investment interest and the overall growth of GVA. For the rural areas of the South Central region, the minimal decline is due to the reduced interest of investors in rural areas, poor administration by the state and the migration of the population to large urban centers. In the sector Trade, repair of motor vehicles and motorcycles for Bulgaria, the region and the rural areas of the South Central region for the same studied period growth is reported as follows: for the country 15.72%, for the region - 15.49% and for the rural areas of South Central Region - 20.13%. The overall increase in GVA is due to the increased purchasing power, the increased quality of services and their demand. In the Transport, warehousing and postal services sector, as a sub-sector of the Services sector, for the country and the region a total increase of GVA for 2014-2019 was reported. For the rural areas of the South Central region an increase of 6.27% is also reported [13]. The growth is due to the increased demand for transport services in the country and abroad, construction of warehouses and the development of courier services. In the Culture, Sports and Entertainment sector there is an increase in GVA for the country and the region, and for the rural areas of the South

Central region the growth is 18.24% for the period 2014-2019. The increased growth of GVA due to government policy aimed at improving cultural and sporting activities in rural areas.

CONCLUSIONS

It is evident that the South Central Planning Region has its centrifugation, but also differentiation between rural areas and urban areas. In this direction, efforts and implementation of regional policies are needed in order to improve the condition of rural areas and their spatial development. It is necessary for the Rural Development Programs, as strategic documents, to really support the rural regions at the level of planning regions by creating mechanisms for financing the rural development. In order to meet the identified territorial needs, rural development programs play a significant strategic role and are the backbone for achieving good results. For rural areas, it is necessary to direct investments to overcome structural problems in the food processing and forestry industries. In the South Central Planning Region, modernization and increase of production efficiency and productivity are needed to ensure added value to agricultural and forestry products and to increase the market opportunities of primary products. The aid must be targeted at sectors with potential for export and those important for the internal market, namely the sectors for processing and adding value of the following agricultural raw materials: milk, meat, fruit, vegetables, honey, cereals, oilseeds, technical, fodder and medicinal crops and grapes. The growth of innovative micro, small and medium-sized enterprises and the modernization of tangible assets will improve the competitiveness. Priority should be given to investments for the creation and promotion of new products and diversification of the range of manufactured products.

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COUPLED SUPPORT CONTRIBUTION TO REGIONAL DEVELOPMENT OF THE SHEEP AND GOAT SECTOR IN ROMANIA

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Abstract

Coupled support is one of the main payment schemes from the "optional direct payments" category, introduced in the EU in the year 2015, funded by the Common Agricultural Policy from the European Agricultural Guarantee Fund (EAGF). At EU-28 level, in 2019, 73.2% of the total coupled support budget was directed to the livestock sector, out of which 12.6% to the sheep and goat farming sector. In the same year, the sheep and goat sector from Romania benefited from 64.3 million euros, as against 50.2 million euros in the year 2018, i.e. 37.1% of total livestock sector. The results obtained following this regional analysis reveal that the impact of this payment scheme implementation has positively impacted the development of the sector, both in terms of meat production, slaughtering in specialised units and livestock herds.

Key words**:** *coupled zootechnical support, sheep, goats*

INTRODUCTION

Although the budget allocated to the Common Agricultural Policy represented 36.25% of the total budget of the European Union (2018), the EU citizens had a positive perception of the support provided to agriculture, as they consider agriculture to be particularly important not only in terms of producing safe and healthy foodstuffs, but also for reaching the rural development and environmental objectives [12]. But, at the same time, questions are raised about the value of direct payments support and its impact on production, on the environment respectively [12]. In the current Common Agricultural Policy (2014-2020), the value of direct payments is 291.3 billion euros, i.e. 71.3 % of the total budget allocated to CAP [8]. In the future CAP (2021-2027) proposal, these payments will continue to be the main part of support to farmers, but they will be moderately reduced and better targeted [5]. For the financial exercise 2014-2020, the allocations for Romania are about 19.43 billion euros current prices for direct payments and market related expenses (Pillar 1) and for rural development (Pillar 2) [7].

These direct payments have helped European farmers to meet market requirements, representing practically a "safety net" in an unsecure and unpredictable economic environment [8]. At the same time, they represent a stable income source, independently from the market fluctuations, which have significantly contributed to overall farm income [8]. In addition, direct payments strengthen farmers' role in environmental protection and in sustainable economic development, contributing to the maintenance or creation of jobs in sectors based on agriculture, such as food industry or rural tourism [8]. Following the 2003 CAP Reform, as a general rule, the link between receiving a direct payment and producing a certain product has been phased out (decoupling) [8]. Yet, the member states can still condition (or couple) a limited volume of direct payments on certain products [8]. However, the capacity to provide coupled support has been limited to those sectors or regions of a member state in which certain farming types of agricultural sectors are particularly important out of economic, social or environmental reasons and are facing certain difficulties [13]. Coupled support is one of the main payment schemes in the

"direct payments" category introduced in the year 2015, funded from the European Agricultural Guarantee Fund (EAGF). In the year 2019, the total budget allocated to coupled support in the European Union was 4.2 billion euros (about 10% of total direct payments), out of which 39.7 % beef, 20.9 % milk and dairy products, 12.6 % sheep and goats, 11.2 % protein crops, 4.3 % fruit and vegetables, 4.3% sugar beet and 7.1 % other products (cereals, olive oil, rice, legumes, potatoes, nuts, hops, hemp, oilseeds, silk worms) [9]. Almost all member states apply this payment scheme (coupled support), although the amount of funding and the sectors covered differ significantly across countries. Thus, this budgetary limit is 8+2%, up to 13+2%, and an increase of these ceilings may be possible only if it is needed and only with the approval of the European Commission [9]. As regards the coupled support for the sheep and goat sector, initially (in 2015), 22 EU member states decided to allocate this payment scheme, but since 2017 their number has decreased to 21[9]. The yearly amount available for this sector (the third in terms of support, next to the beef and milk sectors) permanently increased from 572.6 million euros in 2017 to 586.3 million euros in 2019 [10].

The number of animals for which this budget was allocated for the period 2017-2020 is 49.7 million heads (by 7 million more than in the period 2015-2016), resulting an average amount of 13 euros/head of animal [10]. In the next period as well (2021-2027), the Common Agricultural Policy will continue to support those sectors in difficulty, considered important out of economic, social and environmental reasons, so that they can improve their competitiveness, sustainability or quality, through additional support, known as coupled income support [11]. The eligible member states can allocate maximum 10% of direct payments to the coupled income support, and a 2% supplement can be used to support protein crops [11]. In the context of Covid-19 crisis, among the livestock raising sectors that had suffered the most from this crisis, the sheep and goat meat production sector stands out. As the coronavirus pandemic started in the middle of the Easter holiday season, this caused the lamb market to collapse throughout Europe. The decreased domestic demand for lamb meat, in countries like Greece (with a well-known tradition in sheep raising and consumption), in France, Spain, Great Britain, as well as in extra-Community countries (New Zealand, Australia) led to a significant decrease in slaughtering [2]. For the optimization and management of certain specific agricultural activities, during the period when the member states are affected by the COVID-19 pandemic, a series of normative acts adopted by the European Commission were published in the Official Journal of the European Union [1]. These regulations include those referring to market intervention by granting aid for the private storage of certain agri-food products, such as beef, goat and sheep meat, butter, milk powder and cheese. Thus, the Commission Implementing Regulation (EU) 2020/595 of April 30, 2020 was issued, granting aid for private storage for sheep and goat meat and fixing the amount of the aid in advance [1]. The global crisis effects have been also felt by the sheep/goat farmers from Romania, who are trying to adapt and respond to the evolution of demand on the international markets, knowing that the export of live animals, of sheep in particular, is crucial for Romania. In the year 2018, Romania ranked 1st in the export of live animals in Europe, with a value of 357 million euros (out of which 47.7% sheep), down by 11% from the previous year, when record exports were reported in the last decade of over 424 million euros.

[14]. Sheep and lambs for slaughtering represent the greatest part of deliveries, while pure-bred sheep, for breeding, are less important, in terms of export value [4]. Given that the European Union announced that financial support is provided to cover the private storage costs for sheep and goat meat, it would have been a great opportunity for Romania to have sufficient slaughter houses to slaughter and process these types of meat. Moreover, the existence of slaughterhouses for sheep and goat slaughtering would make it possible to replace the export of live animals

(raw products) by the export of meat and carcasses (products with value added).

MATERIAL AND METHODS

Our research work was based on a comprehensive quantitative analysis, including both a descriptive part of the post-accession sheep and goat farming sector and an explicit analysis of the impact of the payment scheme application – *coupled support* – on the sector, in territorial profile, in the period 2015-2018. The coupled support is granted to those sectors or regions from a member state where certain types of farming or certain agricultural sectors that are extremely important out of economic, social or environmental reasons are affected by certain difficulties [13]. Except for the protein crops sector, the coupled support can be granted only to the extent necessary to create an incentive to maintain current production levels in the sectors or regions concerned [13]. The coupled zootechnical support (CZS) for sheep raising in Romania is granted to active farmers who have minimum 150 and maximum 500 sheep heads (for the mountain area minimum 60 to maximum 500 heads; for goats, the support is granted to active farmers with minimum 50 and maximum 500 goat heads. The herds must be identified and registered in the National Register of Holdings (NRH) and entered in the Genealogical Registry of Breeds (GRB) and the Official Control of Production (OCP). The sheep breeds benefiting from coupled support are the following: *Țurcană, Țigaie, Merinos de Transilvania, Merinos de Palas, Merinos de Suseni, Ile de France, Lacaune, Karakul, Awassi, Cap Negru de Teleorman*. The necessary data for the purpose of this study resulted from the consultation of a large volume of literature (papers and articles, scientific treatises and other scientific materials published in the country and abroad by specialised organizations). The statistical information was supplied by national databases (Tempo Online, NIS, APIA, MARD), Community databases (Eurostat database, European Commission) or international databases (FAOSTAT), as well as by specialised websites. Some data of interest were taken over from official press releases or from economic media.

RESULTS AND DISCUSSIONS

Since 2015, in order to increase productivity, maintain productions and reduce the risk of abandoning livestock farming activities, a new direct payment scheme has been introduced in the European Union, funded by the European Agricultural Guarantee Fund (EAGF), namely the *Coupled Zootechnical Support (CZS)*. In Romania, from the perspective of the sector where the coupled support was granted, we can mention that the livestock sector benefitted from a total amount of 679.3 million euros in the period 2015-2019; the share of this amount increased in the total coupled support value (crops and livestock) from 52% in 2015, to 67% in 2019. In the same period, the sheep and goat farming sector was allocated an amount of 209.2 million euros, i.e. 30.8% of the coupled support value in the livestock sector. In dynamics, the allocation for the coupled support of this sector increased from 21.5 million euros, i.e. 21.3% in 2015, to 64.3 million euros, i.e. 37.1% in 2019 (Table 1).

Table 1. Evolution of total amount authorised for payment (Coupled Zootechnical Support) in the sheep and goat sector – million euros

Specificare	2015	2016	2017	2018	2019	total
Total livestock sector, out of which	100.9	113.0	142.8	149.0	173.5	679.3
Sheep and goats	21.5	25.9	47.3	50.2	64.3	209.2
% sheep and goats	21.3	22.9	33.1	33.7	37.1	30.8

Source: author's calculations based on the Agency for Payments and Interventions in Agriculture data.

The analysis by regions of the absorption of funds for coupled support in the sheep and goat sector, in the period 2015-2018, reveals that the region Nord-Vest (Bihor, Bistrița-Năsăud, Cluj, Maramureș, Sălaj, Satu-Mare) absorbed the largest amount per total period (44,091 thousand euros), respectively 30.4%. The region Centru ranks second, with 27,656 thousand euros (19.1% of total). On the last positions (except for the region București-Ilfov) in terms of this payment scheme absorption, we find the regions Sud-Muntenia

with 4.8% and Sud-Vest Oltenia with 5.1% (Table 2).

Table 2. Evolution of Coupled Zootechnical Support (CZS), by regions, in the sheep and goat sector (thousand euros)

Region	2015	2016	2017	2018	total
Nord-Est	2,170	2,360	3,720	4,010	12,260
Sud-Est	3,527	3,470	7,093	7,865	21,955
Sud Muntenia	1,281	747	2,124	2,756	6,908
Sud Vest Oltenia	1,169	1,350	2,073	2,821	7,413
Vest	3,648	4,632	8,239	7,983	24,502
Nord Vest	4,347	9,820	14,948	14,976	44,091
Centru	5,361	3,500	9,086	9,708	27,656
Bucuresti Ilfov	7	13	14	84	119
Total	**21,510**	**25,892**	**47,298**	**50,202**	**144,902**

Source: author's calculations based on the Agency for Payments and Interventions in Agriculture data

The coupled support per head of animal increased proportionally in all the regions of the country compared to the year 2015 (Table 3).

Table 3. Evolution of coupled support in the sheep and goat sector (euros/head)

	2015	2016	2017	2018
Nord-Est	4.5	30.2	24.2	15.6
Sud-Est	4.6	30.2	24.3	15.7
Sud Muntenia	4.6	30.2	24.3	15.6
Sud Vest Oltenia	4.6	29.9	24.1	15.7
Vest	4.6	30.9	24.4	15.7
Nord Vest	4.6	30.5	24.4	15.7
Centru	4.6	30.5	24.4	15.7
Bucuresti Ilfov	4.6	30.9	24.7	15.6
Total	4.6	30.5	24.4	15.7

Source: author's calculations based on the Agency for Payments and Interventions in Agriculture data.

The explanation for the small amount of only 4.6 euros per animal head (2015 average) is that, in that year, compared to the next years, the largest number of animals authorised for payment (4.7 million heads) and the largest number of farmers authorised for payment (77.7% of total authorised livestock farmers) were recorded. The largest average amount was in the year 2016 (30.5 euros/animal head), to decrease in the next period, so that in 2018 the national average was only 15.7 euros/animal head.

Sheep are raised traditionally in the mountain areas of Romania [15]. The total number of sheep and goats increased by 2.0% nationwide, in 2018 compared to previous year, Romania ranking 4th in the European Union in terms of the number of herds, with 11.7 million heads, next to Great Britain, Spain and Greece (NIS). Overall, in the investigated period (2015-2018) when coupled support was granted to the sector, an increase of herds could be noticed by 367 thousand heads (+3.7%) in sheep and by 99 thousand heads (+6.9%) in goats (Table 4 and 5).

Table 4. Evolution of sheep herds by regions

Region	2015	2016	2017	2018	2018/2015	%
Nord-Est	1,396	1,403	1,396	1,431	35	2.5
Sud-Est	1,509	1,485	1,494	1,537	29	1.9
Sud Muntenia	936	934	960	974	38	4.1
Sud Vest Oltenia	679	686	669	687	7	1.1
Vest	1,493	1,515	1,462	1,497	4	0.3
Nord Vest	1,649	1,669	1,680	1,710	61	3.7
Centru	2,118	2,152	2,292	2,316	198	9.4
Bucuresti Ilfov	30	31	30	24	-6	-20.0
Total	9,810	9,875	9,982	10,176	367	3.7

Source: Tempo online, National Institute of Statistics.

Table 5. Evolution of goat herds by regions

Rediunea	2015	2016	2017	2018	2018/ 2015	%
Nord-Est	224	230	231	236	11	5.1
Sud-Est	368	372	378	390	23	6.1
Sud Muntenia	257	261	261	270	13	5.1
Sud Vest Oltenia	270	284	286	289	19	7.0
Vest	71	76	79	82	11	15.6
Nord Vest	107	113	115	118	11	9.9
Centru	131	135	139	142	11	8.5
Bucuresti Ilfov	12	14	14	12	0	1.8
Total	1,440	1,483	1,503	1,539	99	6.9

Source: Tempo online, National Institute of Statistics.

The analysis by regions, in 2018, reveals that although the region Nord-Vest benefitted from the largest amount for coupled support, i.e. 29.8% of total (with the largest number of animals authorised for payment), in terms of total number of sheep by regions, region Center stands out, with 22.8% of total herds, while in goats the region Sud-Est ranks first, with 25.4% of total.

Yet, in the context of crisis generated by COVID-19 pandemic, started in early 2020, the sheep/goat meat market is facing great

problems, namely the decrease of procurement prices, restrictions to the transport of animals to processors/direct sale on the market, HoReCa, decrease of live animals export. At the same time, due to movement restrictions imposed by the situation created by COVID-19, the sheep/goat raising sector suffered from significant financial losses, which led to the diminution of the number of animals and to disturbances in the supply chains. Thus, according to MARD data, the total sheep herds diminished from 16.0 million heads in April 2019 to 15.5 million heads in April 2020, (-3.4 %), and the number of ewes decreased from 9.3 million heads in April 2019 to 8.8 million in April 2020 (-5.57 %) [6]. The goat herds slightly increased in April 2020 as against April 2019 (from 2.48 million heads in 2019 to 2.49 million heads in 2020), by 0.5 %, yet the number of breeding goats decreased from 1.37 million heads in 2019 to 1.33 million heads in April 2020, by 2.4 % [6]. Meat production (live weight of animals slaughtered for consumption), at national level, increased by 6,212 tons (+5.7%) in the period 2015-2018; the region that contributed with the highest share to this production, in the year 2018, was Sud-Est with 24.5% of total (Table 6).

Table 6. Evolution of total sheep and goat meat (tons live weight)

Rediunea	2015	2016	2017	2018	2018/2015	%
Nord-Est	13,129	12,067	12,559	13,450	321	2.4
Sud-Est	28,853	33,387	29,251	28,331	-522	-1.8
Sud Muntenia	14,850	16,154	19,273	17,505	2,655	17.9
Sud Vest Oltenia	8,355	8,142	7,522	7,325	-1,030	-12.3
Vest	11,254	11,355	13,938	12,915	1,661	14.8
Nord Vest	12,707	12,992	12,420	14,256	1,,549	12.2
Centru	20,011	19,354	20,625	21,551	1540	7.7
Bucuresti Ilfov	448	399	413	486	38	8.5
Total	109,607	113,850	116,001	115,819	6,212	5.7

Source: Tempo online, National Institute of Statistics.

As regards the evolution of meat production in the investigated period, it increased in general in Sud-Muntenia (+17.9%), Vest (+14.8%), but production decreases were also noticed in Sud-Vest Oltenia (-12.3%) and Sud-Est (-1.8%).We must also signal out a positive aspect, as in the period 2015-2018, meat production obtained in specialised units (slaughterhouses) had an upward trend, up from 20.6 thousand tons live weight to 26.9 thousand tons (+30.8%). At the same time, its share in total production to be slaughtered for human consumption increased from 18.8% in 2015 to 23.2% in 2018, and the average slaughter weight reached 31.8 kg in 2018, as against 28.3 kg in 2015 (Table 7).

Table 7. Sheep and goat slaughtered in industrial units (slaughterhouses)

	2015	2016	2017	2018
Number of slaughtered heads	726,023	637,338	780,847	846,504
Live weight (tons)	20,557	18,622	24,011	26,893
Average weight (kg live weight)	28.3	29.2	30.7	31.8
Carcass weight (tons)	9,256	8,477	10,699	12,449

Source: National Institute of Statistics

In the structure of total meat production (animals for slaughtering for consumption, live weight), sheep and goat meat slightly increased in share from 7.7% in 2015, to 7.8% in 2018 (Figure 1).

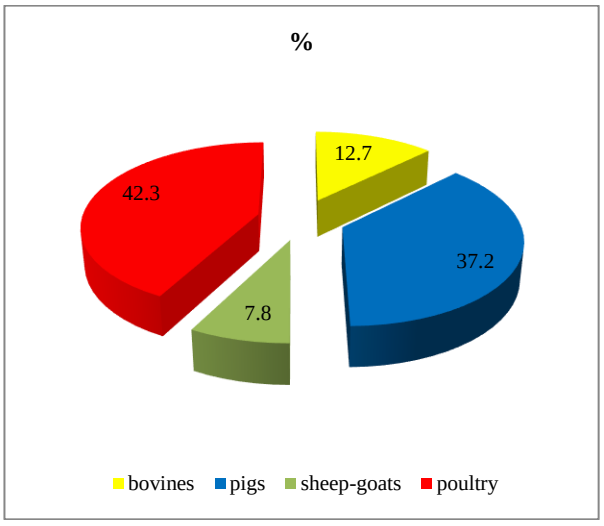

Fig. 1. Structure of meat production, live weight, in the year 2018 (%).
Source: Own calculation.

As regards the delivery of lambs to the market, in April 2020 2.72 million lamb heads were delivered, down by 10.8% compared to the same month of the year 2019 (3.05 million heads) [6].

The trade balance in live sheep and goats in the period 2015-2018 was positive due to the permanent increase in exports, from 151.4 million euros (2015), to 170.4 million euros (2018). In the first period of the year 2020, in the context of coronavirus pandemic, we specify that the export of sheep and goats decreased in March 2020 by 11.5 % compared to March 2019, from 7.9 thousand tons in March 2019 to 7 thousand tons in the same month of the year 2020 [6]. The sheep carcass average price in the EU increased from 530.4 euros/100 kg (March 2019) to 579.9 euros/100 kg (March 2020), the same as in Romania, where the average price increased from 238.2 euros/100 kg (March 2019), to 273.1 euros/100 kg (March 2020). It results that the average sheep carcass price in Romania increased by about 15%, but this represents only 50% of the average price of carcass in the EU [6]. Yet the above-mentioned price increase at national level cannot compensate the income losses of sheep/goat farmers, in the conditions of meat production decrease in the first part of the year 2020, compared to the same period of the year 2019. This adds to difficulties in supplying the market (transport restrictions, insufficient staff, etc.) caused by the SARS COV 2 (COVID – 19) pandemic.

Taking into account the difficulties in the livestock farming sector and the numerous requests of the sheep and goat farmers and to compensate the losses caused by the COVID 19 pandemic, the *state aid* scheme was established to support the activity of sheep/goat farmers. The state aid amounting to 40 million euros is granted on a flat-rate basis, namely [3]:

From 50 to 100 sheep – 500 euros/farm
From 101 to 200 sheep – 800 euros/farm
From 201 to 300 sheep – 1,300 euros/farm
From 301 to 400 sheep – 1,700 euros/farm
From 401 to 500 sheep – 2,100 euros/farm
Over 500 sheep heads – 2,500 euros/farm

The European Commission Regulation has specified that these allocations will have to be made by April 2021.

CONCLUSIONS

In the period 2015-2018, in Romania:

-the amount authorised for payment by total livestock sector increased by 47.7%, the highest increase being recorded in the sheep and goat sector (133.4%), and the lowest in beef cattle (13.3%);

-the sheep and goat farming sector benefitted from 144.9 billion euros in the period 2015-2018, which represents 28.7% of the total coupled zootechnical support;

-in evolution, the allocation for the coupled support related to the sector increased from 21.5 milion euro, i.e. 21.3% in 2015, to 50.2 milion euro in 2018 (33.7%) and to 64.3 milion euro, i.e. 37.1% in 2019;

-the number of sheep and goat farmers who applied for coupled support decreased by 6,261 (34.5%);

-by regions, throughout the period 2015-2018, it can be noticed that the region Nord-Vest (Bihor, Bistrița-Năsăud, Cluj, Maramureș, Sălaj, Satu-Mare) absorbed the largest amount per total period (44091 thousand euros), i.e. 30.4%, and the region Centru ranked second, with 27,656 thousand euros (19.1% of total).

-in the investigated period, both the total sheep herds and the goat herds increased by 367 thousand heads (+3.7%) and by 99 thousand heads respectively (+6.9%);

-in the evolution of herds by regions, it can be noticed that the region Centru had the greatest increase of sheep herds (+9.4%), while the region Vest had the greatest increase of goat herds (+15.6%);

-both meat production at national level (sheep and goats destined to slaughtering for human consumption, live weight), and the production obtained in specialised units had a positive evolution in the period 2015 – 2018;

-in the year 2018, more than half of meat production (58.2%) was obtained in three regions: Sud-Est with 24.5%, Centru with 18.6% and Sud-Muntenia with 15.1%;

-although the total number of sheep farms decreased from 355,342 in 2015 to 287,864 in 2018 (-67,478), the highest share was held by the small farms (with less than 10 heads), representing 63% of total farms;

This lowers the sector's performance, as these small farms lack capital, on the one hand, and on the other hand farmers are not well trained to manage their farms in a proper manner, which results in low incomes from their activity. Consequently, subsistence farmers do not have the motivation and the ability to meet the EU standards, including those referring to environment quality, animal welfare and food safety.

Another extremely important aspect is that in general animal diseases appear on these small holdings, and the impact may be felt at the level of the competitiveness of the entire sector.

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THE IMPACT OF NATIONAL INCOME ON THE TECHNICAL EFFICIENCY OF AGRICULTURE SECTOR IN DEVELOPING COUNTRIES (A METAFRONTIER APPROACH)

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Abstract

The agricultural sector, especially in developing countries, is defined as one of the most important sectors in terms of wealth and market creation, foreign exchange return and economic growth, In this study, technical efficiency and technology gap ratios in the agricultural sectors of developing countries are discussed in four different income groups for 2017 in order to see the effect of country income on sector performance. In the study, input-oriented model is estimated with the assumption of variable return to scale using data envelopment analysis (DEA) with one output and three input variables. According to the results, while the production gap was 4% in high-income countries, this gap was 86.1% in low-income countries, and therefore, it was revealed that the per capita income of countries affected the technological gap ratios and technology that they use in the agricultural sector.

Key words**:** *agriculture, metafrontier, efficiency, technology gap, developing countries*

INTRODUCTION

One of the most important issues in the development process in any country, especially developing countries, is the optimal use of factors of production in the production process. The increase in population and the relative improvement in the economic situation of individuals has led to an increase in per capita consumption in society, and this has led to an increase in demand for agricultural products. Therefore, economic policies should be done to increase agricultural production. In any production system, increasing the efficiency of inputs is one of the basic principles and increasing the efficiency of production is one of the main goals. In fact, all the countries of the world are trying to increase their production by consuming the same amount of available resources, in order to achieve progress in the field of agriculture, especially in cases where longitudinal expansion is faced with barriers to access using more resources [1]. Increasing technical efficiency can create more products from a fixed set of production factors. Among the methods of increasing production, developing production factors and making major changes in the technology of developing countries, it faces many problems and limitations. Therefore, increasing technical efficiency has been mentioned as a more appropriate solution in this regard.

Efficiency is considered an important factor in productivity and growth of developing countries. Improving efficiency in agricultural units is of particular importance. Because in developing countries, one of the most active and productive sectors in the economy is the agricultural sector. In these countries, the agricultural sector is considered as a producer of essential goods of the society, which due to the growing population, the demand for these goods increases significantly. On the other hand, in such countries, agricultural products are one of the important items of exports and foreign exchange inflows and therefore it is very important in increasing GDP. Since production in the agricultural sector is a function of factors of production such as land, labor, capital, technology and management, due to the limitations of these inputs, increasing technical efficiency, ie increasing production per consumption of the same

amount of input is important [15]. Therefore, agricultural development is a precondition and an essential need for the economic development of the country, and until the barriers to development in this sector are removed, other sectors will not achieve prosperity, growth and development in a meaningful way.

In this study, technical efficiency values were obtained by using the data of 2017 for the agricultural sector of developing countries and also taking into account the national income per capita of the countries.

MATERIALS AND METHODS

The most common method used in performance measurements is efficiency estimation. The concept of efficiency, which is an evaluation criterion that shows how effectively or adequately inputs are used in line with the objectives determined by the company, and the measurement of efficiency have become very important [18]. In this context, after first looking at the issues related to the meaning of efficiency and performance measurement, the metafrontier issue will also be discussed in order to analyze the national income effect.

According to economic theories, efficiency is the result of optimizing production and resource allocation. In other words, efficiency in economics term means producing the maximum possible output using a certain amount of input. In another definition, efficiency is the ratio of the actual return obtained to the standard and determined returns, or in fact the ratio of the amount of work done to the amount of work to be done [10].

A method for measuring performance was first developed by [11]. He suggested that it would be appropriate to compare the performance of a firm with the performance of the best firms in the industry. He introduced the use of firm's data for estimation in order to carry out his proposal of efficiency measurement. Farrell performance was introduced in the following three categories:

(a)Technical Efficiency: The maximum possible production that is obtained from a certain amount of production factors.

(b)Allocative Efficiency: Determines the combination of factors of production that have the least cost per unit. If price information is available and the firm's goal is to minimize costs or maximize revenue, then it is possible to measure allocative efficiency in addition to measuring technical efficiency. In other words, the purpose of this type of efficiency is to keep the price of the inputs used in a way that minimizes the cost of production. Allocative efficiency is also called price efficiency.

(c)Economic Efficiency: Shows the firm's ability to obtain the maximum possible profit with respect to price and data levels and is obtained by multiplying technical efficiency by allocative efficiency.

Technical efficiency is defined as the part of effective efficiency that is obtained from the production function. Effective efficiency introduces input efficiency sources for each output by minimizing production costs at each level of output or, equivalently, maximizing production levels with a combination of inputs taking into account their costs. Technical efficiency shows the ability of each production unit to maximize the product with the same production resources.

[2] estimated the parametric frontier production function in the form of Cobb Douglas production function. Since they did not consider the possibility of error term and other components interfering with random frontier estimation, and considered all frontier deviations to be technical inefficiencies, their model became known as the Definitive Frontier Production function model (DFP). Subsequently, the Stochastic Frontier Production function (SFP) by econometric method firstly were introduced by [3, 5, 16].

Efficiency Measurement

In general, both parametric and non-parametric methods are used to measure efficiency. In parametric methods, the community parameter is examined. The parametric method requires a mathematical function based on which the dependent variable is estimated using independent

variables and the observed data is used experimentally to estimate the parameters of a function. In fact, in this method, first a special form for the production function (such as Cobb-Douglas, CES, Translog and etc) is considered and then with the help of one of the methods of estimating the functions which is common in statistics and econometrics, the unknown coefficients (parameters) are estimated. Because in these methods, parameters of the assumed function are estimated, they are called parametric methods. Nonparametric methods generally examine the performance of a firm or decision-making unit with the best actual performance of firms within that industry. Non-parametric methods can be considered as the simplest methods of observing and estimating efficiency, because these methods do not consider a specific form for the production function and work directly with the observed data, and since this is not a statistical method, statistical tests cannot be used in it.

The most important non-parametric method used in estimating technical efficiency is Data Envelopment Analysis (DEA) method that proposed by [6]. This method has been proposed to develop Farrell's single-input and single-output model. The usual formula for measuring the relative efficiency of decision-making units is the efficiency of an organizational unit with multiple inputs and outputs as follows:

Efficiency = Weighted total of input/ Weighted total of outputs

The programming style of the model is shown below:

$$\max \theta = \frac{u_1 y_{1j} + u_2 y_{2j} + \cdots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \cdots + v_m x_{mj}}$$
$$s.t: \quad \frac{u_1 y_{1j} + u_2 y_{2j} + \cdots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \cdots + v_m x_{mj}} \leq 1$$
$$v_1, v_2, \dots, v_m \geq 0$$
$$u_1, u_2, \dots, u_s \geq 0$$
$$j = (1,2,3, \dots, N) \qquad (1)$$

One of the features of the DEA model is its return to scale structure. Returns to scale can be constant or variable. Constant return to scale means that an increase in the input value leads to an increase in output by the same ratio. In variable return to scale, the increase in output is more or less than the increase in input. The [6] model (model (1)) was one of the models of constant return to scale. In this model, u is the weights of the products, v is the weights of the factors of production, y is the quantity of products, and x is the quantity of inputs. N indicates the number of firms, s, the number of outputs, m, the number of inputs and θ the efficiency coefficient of the unit under study. This equation is a nonlinear model and can be solved by numerous optimal analyses. This model can be converted to a linear model by linear transformation. The models obtained by this analysis are defined as input-oriented models [14]. In input-oriented models, while the output is kept constant at the maximum amount, it is tried to decrease the amount of inputs in order to approach the efficiency limit. Another method of solving equation (1) is to fix the numerator of the objective function ratio to a fixed number. Such models are also defined as output-oriented models. Which model to consider depends entirely on focusing on inputs or outputs [19].

Since dual problems require fewer constraints, the duality solution of problem (1) is preferred as follows:

$$\min \theta$$
s.t:
$$-y_i + Y\lambda \geq 0$$
$$\theta x_i - x\lambda \geq 0$$
$$\lambda \geq 0 \qquad (2)$$

λ is a vector consisting of constant numbers and weights of the reference set. θ shows the efficiency scores obtained for the firm between zero and 1. Y is an s × n matrix of outputs and x is the m × n matrix of inputs, where n is the number of firms. The data envelopment analysis model with the assumption of variable returns to scale obtains technical efficiency consisting of pure technical efficiency (managerial efficiency) and scale efficiencies. Accordingly, in order to create the variable return to scale (VRS) model, it will be sufficient to add NIλ = 1

constraint to the problem (2). According to this,

$\min \theta$

s.t:

$-y_i + Y\lambda \geq 0$

$\theta x_i - x\lambda \geq 0$

$NI\lambda = 1$

$\lambda \geq 0$ (3)

These models are also described as BCC models [8]. Although the BCC model is a model with a variable constraint to scale, it does not show that the firm operates in a zone of increasing or decreasing return to scale. To solve this, instead of the variable return to scale constraint, non-increasing return to scale constraint (NI$\lambda \leq 1$) can be added to the BCC model (problem (3)). According to this;

$\min \theta$

s.t:

$-y_i + Y\lambda \geq 0$

$\theta x_i - x\lambda \geq 0$

$NI\lambda \leq 1$

$\lambda \geq 0$ (4)

In this model, the type of return to scale (increasing or decreasing) in the scale inefficiency of a particular firm is realized by comparing the technical efficiency of non-increasing return to scale with the technical efficiency of variable return to scale. Accordingly, if they are equal to each other, the firm will be faced with decreasing returns to scale. On the contrary, the condition of increasing return to the scale in the firm will remain valid [9].

Metafrontier

The concept of metafrontier production was first introduced by [12, 13]. They assumed that there is a metafrontier of production technology in the whole industry that surrounds all the separate groups with different technologies. According to the mathematical definition of [13], the metafrontier production function can be defined as a cover for certain neoclassical production functions. The concept of cross-border production is based on the simple assumption that all firms have potential access to the best technology in the industry, although these firms actually use different technologies in different groups. Suppose that X and Y are input and output column vectors with dimensions N and M (non-negative real numbers), respectively. Consider the case where K (>1) groups exist and firms in each group operate under a specific group technology T^k (per k = 1, 2,…,K).

$T^* = \text{Convex Hull}\{T^1 \cup \ldots \cup T^k\}$

K is the number of available technologies and technology set T consists of all output vectors that can be generated using a non-negative input vector. This technology set is defined as follows:

$T = \{(x, y): x, y \geq 0 \,;\, x\ can\ produce\ y\}$

The convex frontier of group k is constructed using the DEA method using all observations of firm input and output in group k. If there are L firms in K groups and T periods, the DEA problem with the input-oriented approach assuming VRS is as follows:

$Min\ \rho_{it}$

$\lambda_{it}\,, \rho_{it}$

s.t:

$Y_{it} + Y'\lambda_{it} \geq 0$

$\rho_{it} X_{it} - X''\lambda_{it} \leq 0$

$J\lambda_{it} = 0$

$\lambda_{it} \geq 0$ (5)

Here Y_{it} is the output value for the firm i in the t period, X_{it} is the $N \times 1$ vector of input value of firm i in the t period, Y is $L_k T \times 1$ vector of L_k firm output value in the period t, X is the matrix with $L_k T \times N$ dimension of the input value for the firm L_k in the t period, J is $L_k T \times 1$ vectors of units and ρ_{it} is an scalar. It can be shown that the value of ρ_{it} obtained from solving the linear programming problem (5) is not less than 1 and provides information about the technical efficiency of firm i in period t. In particular, $\frac{1}{\rho_{it}}$ is the maximum relative reduction possible in inputs if firm i's output value is kept constant in period t. Therefore, ρ_{it} is the measure of input-oriented technical efficiency by solving the linear programming problem (5). The value of λ_{it}, which solves the linear programming problem (5), provides information about the references of firm i in period t. These references are the efficiency points that determine the frontier procedure on which the best inputs and outputs of firm i in period t are identified.

Solving the linear programming problem (5) separately for each firm in its own group and in each time period, identifies all the frontier procedures of the k group. To obtain metafrontier efficiency, linear problem (5) is applied to all firms in all t periods regardless of the specific group [17].

Finally, by estimating the technical efficiencies of firms with respect to metafrontier and group frontiers, it is easy to estimate the technology gap ratio at certain levels of input and output. The input-oriented technical efficiency of an observed pair (x,y) is defined according to the k-group technology as follows:

$$TE_i^k = \frac{1}{D_i^k(x,y)}$$

If the technical efficiency of a (x,y) given is measured to be 0.6, it means that y can be produced using 60% of the input vector x. The input-axis technology gap ratio can be defined using the input distance functions of T* and T^k technology as follows:

$$TGR_i^k(x,y) = \frac{D_i^k(x,y)}{D_i^*(x,y)} = \frac{TE_i^*(x,y)}{TE_i^k(x,y)}$$

Accordingly, the technology gap ratio of each group is obtained by dividing the metafrontier technical efficiency by the group technical efficiency. Since the metafrontier technical efficiency scores are not higher than the group technical efficiency scores, the technology gap rate can take numbers between zero and 1. This ratio is always between zero and 1, and is equal to 1 when the frontier of group technology over the input and output vectors x and y, coincides with the metafrontier. When data are available, the frontier may be estimated using a non-parametric technique such as Data Envelopment Analysis (DEA) or a parametric random approach such as Stochastic Frontier Analysis (SFA) [4].

RESULTS AND DISCUSSIONS

Considering the latest and available up-to-date data common to all considered variables according to the World Bank and and Food and Agriculture Organization databases, 2017 data, in this study, the technology gap ratio and technical efficiency differences in the agriculture sector of developing countries were tried to be stated. In the study, the agricultural sector value added of the countries was used as the only output variable. For the input variables, a total of three variables as the number of countries agricultural sector labor force, the agricultural sector capital stock and also the agricultural land used by the countries are used.

In order to reveal the technology gap and technical efficiency differences in countries, they were categorized into different groups according to their per capita income. Considering that there are four groups as lower middle, low, upper middle and high income countries according to the World Bank distinction, this distinction has been adhered to in the study and these four groups were discussed. According to the World Bank report, there are 145 developing countries in total. Of these, 131 countries were In order to reveal the technology gap and technical efficiency differences in countries, they were categorized into different groups according to their per capita income. Considering that there are four groups as lower middle, low, upper middle and high income countries according to the World Bank distinction, this distinction has been adhered to in the study and these four groups were discussed. According to the World Bank report, there are 145 developing countries in total. Of these, 131 countries were included in the analysis and 14 countries were excluded due to missing data. Of these 131 countries, 31 countries are in the low-income group, 43 in the lower middle income group, 40 in the upper middle income group, and 17 in the high income group.

The data required for the variables used in the study were obtained from the Food and Agriculture Organization (FAO) and World Bank databases. Using [7] DEAP 2.1 and Excel 2013 programs, an input-oriented model is estimated with the assumption of variable return to scale (VRS).

The highest, lowest and average technical efficiency and technology gap ratios of the group countries are given in Table 1. Looking

at the results in the table, the group technical efficiency average is 0.646 in upper middle income countries and 0.539 in low income countries. This means that upper middle income countries produce 64.6% of maximum output under group technology, while low income countries produce only 53.9% of maximum output under group technology. When it is considered, it is seen that the group technical efficiency averages are almost close to each other in terms of group countries and the difference between them is not much.

Table 1. Group and Metafrontier Average Efficiency Values

Country Groups	Efficiency	Mean	Minimum	Maximum
High Income	TE^k	0.563	0.024	1.000
	TE^*	0.547	0.023	1.000
	TGR	0.960	0.622	1.000
Upper Middle Income	TE^k	0.646	0.068	1.000
	TE^*	0.343	0.008	1.000
	TGR	0.474	0.019	1.000
Lower Middle Income	TE^k	0.552	0.067	1.000
	TE^*	0.372	0.011	1.000
	TGR	0.563	0.090	1.000
Low Income	TE^k	0.539	0.083	1.000
	TE^*	0.102	0.001	1.000
	TGR	0.139	0.012	1.000

TE^k = group technical efficiency, TE* = metafrontier technical efficiency, TGR = Technology Gap Ratio.
Source: Research Findings.

Looking at the average values of metafrontier technical efficiency, the highest average belongs to high-income countries with 0.547 and the lowest average belongs to low income countries with 0.102 again. If interpreted similarly, while high income countries produce an average of 54.7% of potential output under Metatechnology, low income countries only produce an average of 10.2% of potential output using Metatechnology. Contrary to group technical efficiency averages, metafrontier technical efficiency averages show that the difference between group countries is large and this shows that countries with different income have technology differences.

Considering the results in Table 1, the highest value of group and metafrontier technical efficiency was 1 among all group countries.

This means that at least one country's group frontier in each group is tangent to the metafrontier function in the period under consideration. In other words, the group technology used by at least one country in that group is the same as metatechnology.

The average technology gap ratio was 0.960 in high-income countries, higher than the average in other country groups. This indicates that the technology gap in the agricultural sector was much lower (4%) in high income countries that year. This gap averaged 52.6% in upper middle income countries, 43.7% in lower middle countries, and 86.1% in low income countries. On the other hand, the technology gap ratio (TGR) maximum value is 1 for all country groups. This means that at least one country in each group has group technical efficiency and metafrontier technical efficiency values equal to 1. In other words, it means that at least one country in each group has no technology gap.

Technology gap ratio averages of group countries are shown in Figure 1.

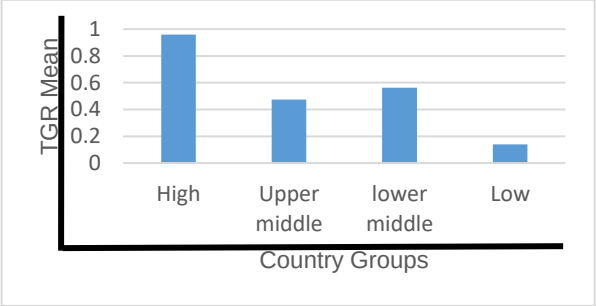

Fig. 1. TGR Average of Group Countries
Source: Research Findings.

Table 2. Technical Efficiency and Technology Gap Ratios of High Income Countries Group

Country	TE^k	TE^*	TGR
Argentina	1.000	1.000	1.000
Bahamas	1.000	1.000	1.000
Bahrain	1.000	1.000	1.000
Barbados	1.000	1.000	1.000
Brunei Darussalam	0.915	0.891	0.974
Chile	0.281	0.261	0.929
Israel	0.375	0.375	1.000
Kuwait	0.767	0.756	0.986
Latvia	0.050	0.050	1.000
Lithuania	1.000	0.915	0.915
Oman	0.070	0.070	1.000
Panama	0.039	0.039	1.000
Republic of Korea	1.000	1.000	1.000
Saudi Arabia	0.275	0.171	0.622
Trinidad and Tobago	0.328	0.305	0.930
United Arab Emirates	0.441	0.441	1.000
Uruguay	0.024	0.023	0.958
Mean	***0.563***	***0.547***	***0.960***

Source: Research Findings.

Technical efficiency, metafrontier technical efficiency and technology gap ratios of the countries within the groups are shown in Table 2, Table 3, Table 4 and Table 5.

Table 3. Technical Efficiency and Technology Gap Ratios of Upper Middle Income Countries Group

Country	TE^k	TE^*	TGR
Albania	0.611	0.121	0.198
Algeria	0.417	0.303	0.727
Azerbaijan	0.782	0.516	0.660
Belarus	0.270	0.028	0.104
Belize	0.530	0.121	0.228
Bosnia and Herzegovina	0.356	0.028	0.079
Botswana	0.303	0.269	0.888
Brazil	1.000	1.000	1.000
Bulgaria	0.708	0.061	0.086
China. mainland	1.000	1.000	1.000
Colombia	0.314	0.246	0.783
Costa Rica	0.853	0.575	0.674
Cuba	1.000	0.576	0.576
Dominican Republic	0.547	0.103	0.188
Ecuador	1.000	0.897	0.897
Equatorial Guinea	0.784	0.075	0.096
Fiji	0.421	0.083	0.197
Gabon	1.000	0.097	0.097
Guatemala	0.603	0.110	0.182
Guyana	0.641	0.063	0.098
Iran (Islamic Republic of)	0.770	0.666	0.865
Iraq	0.191	0.034	0.178
Jamaica	1.000	0.136	0.136
Jordan	0.893	0.129	0.144
Kazakhstan	0.753	0.329	0.437
Lebanon	0.679	0.137	0.202
Libya	0.429	0.008	0.019
Malaysia	1.000	1.000	1.000
Maldives	1.000	1.000	1.000
Mauritius	0.827	0.282	0.341
Montenegro	1.000	0.987	0.987
Mexico	0.438	0.399	0.911
Paraguay	0.173	0.011	0.064
Peru	0.268	0.185	0.690
Russian Federation	0.458	0.430	0.939
South Africa	0.068	0.013	0.191
Suriname	0.766	0.281	0.367
Thailand	0.713	0.463	0.649
Turkey	1.000	0.909	0.909
Turkmenistan	0.257	0.049	0.191
Mean	***0.646***	***0.343***	***0.474***

Source: Research Findings.

Looking at the results in the Tables 2, 3, 4 and 5, we may notice 6 countries in high income countries, 10 countries in upper middle income countries, 14 countries in lower middle income countries and 7 countries in low-income countries are seen as the countries that define the group frontier.

Table 4. Technical Efficiency and Technology Gap Ratios of Lower Middle Income Countries Group

Country	TE^k	TE^*	TGR
Angola	0.279	0.235	0.842
Bangladesh	1.000	0.932	0.932
Bhutan	1.000	0.590	0.590
Bolivia (Plurinational State of)	0.299	0.209	0.699
Cabo Verde	0.504	0.147	0.292
Cambodia	0.158	0.053	0.335
Cameroon	0.089	0.029	0.326
Congo	0.092	0.011	0.120
Cöte d'Ivoire	0.067	0.022	0.328
Djibouti	0.095	0.024	0.253
Egypt	1.000	0.398	0.398
El Salvador	0.145	0.048	0.331
Eswatini	0.212	0.083	0.392
Georgia	0.595	0.358	0.602
Ghana	0.265	0.169	0.638
Honduras	0.153	0.049	0.320
India	1.000	1.000	1.000
Indonesia	1.000	1.000	1.000
Kenya	0.510	0.420	0.824
Kyrgyzstan	1.000	1.000	1.000
Lao People's Democratic Republic	0.214	0.066	0.308
Lesotho	0.133	0.046	0.346
Mauritania	0.096	0.013	0.135
Mongolia	0.296	0.220	0.743
Morocco	0.309	0.223	0.722
Myanmar	1.000	0.629	0.629
Nigeria	1.000	0.864	0.864
Pakistan	0,842	0,809	0,961
Palestine	1,000	1,000	1,000
Papua New Guinea	0,945	0,547	0,579
Philippines	0,758	0,443	0,584
Sao Tome and Principe	0,816	0,273	0,335
Solomon Islands	0.675	0.176	0.261
Sri Lanka	0.421	0.140	0.333
Sudan	1.000	1.000	1.000
Timor-Leste	0.166	0.052	0.313
Tonga	1.000	0.334	0.334
Tunisia	0.070	0.023	0.329
Ukraine	0.412	0.351	0.852
Uzbekistan	1.000	0.851	0.851
Vanuatu	1.000	0.090	0.090
Viet Nam	1.000	1.000	1.000
Zambia	0.132	0.057	0.432
Mean	***0.552***	***0.372***	***0.563***

Source: Research Findings.

Table 5. Technical Efficiency and Technology Gap Ratios of Low Income Countries Group

Country	TE^k	TE^*	TGR
Afghanistan	0.193	0.032	0.166
Benin	0.330	0.031	0.094
Burkina Faso	0.354	0.028	0.079
Burundi	0.470	0.036	0.077
Central African Republic	0.564	0.013	0.023
Chad	0.096	0.007	0.073
Comoros	1.000	0.176	0.176
Democratic Republic of the Congo	0.291	0.035	0.120
Ethiopia	1.000	1.000	1.000
Gambia	1.000	0.040	0.040
Guinea	0.974	0.038	0.039
Guinea-Bissau	0.771	0.027	0.035
Haiti	0.504	0.050	0.099
Liberia	1.000	0.079	0.079
Madagascar	0.311	0.027	0.087
Malawi	0.231	0.019	0.082
Mali	0.155	0.010	0.065
Mozambique	0.087	0.007	0.080
Nepal	1.000	0.095	0.095
Niger	0.171	0.006	0.035
Rwanda	1.000	0.424	0.424
Senegal	0.354	0.020	0.056
Sierra Leone	0.408	0.033	0.081
Somalia	0.083	0.001	0.012
Syrian Arab Republic	0.234	0.011	0.047
Tajikistan	0.937	0.384	0.410
Togo	1.000	0.048	0.048
Uganda	0.376	0.031	0.082
United Republic of Tanzania	0.927	0.146	0.157
Yemen	0.744	0.301	0.405
Zimbabwe	0.137	0.007	0.051
Mean	***0.539***	***0.102***	***0.139***

Source: Research Findings.

In these countries, the technical efficiency is 1, which shows that these countries are technically fully efficient. Group technical efficiency of Turkey is equal to 1, therefore, it is among the frontier determiner countries. This means that Turkey, under group technology is used the production factors fully and efficiently.

Looking at the metafrontier efficiency results, 5 countries in high income countries, 4 countries in upper middle income countries, 6 countries in lower middle income countries and 1 country in low income countries are among the countries that define this frontier. The metafrontier technical efficiencies of these countries are equal to 1, which indicates that they are technically efficient among all countries considered, regardless of which group of countries they are in. Turkey's metafrontier technical efficiency was 0.909 and this means that among all countries Turkey used 90.9% of the production factors efficiently. In other words, under the technology set (metatechnology), can produce only 90.9% of the agricultural sector production.

Under group technology, it seems that Turkey is working full efficient and under the metatechnology its efficiency has been decreased. However, it notable that there is little difference between group efficiency and metafrontier efficiency in the real sense. On the other hand, some countries that are fully efficient within their groups have also come to the conclusion that they do not have the same efficiency among all countries and work inefficiently.

Looking at the technology gap ratios (TGR) in the groups, it is seen that there are countries where this ratio is equal to maximum 1. This indicates that the group frontier function in these countries is tangent to the metafrontier function and therefore there is no technology gap in those countries. Accordingly, it is observed that there is no technology gap in 10 countries in the high income group, 4 countries in the upper middle income group, 6 countries in the lower middle income group and 1 country in the low income group. In other words, these countries have the potential to access metatechnology. This means that they can reach the same amount of potential products using either group technology or metatechnology. This is inevitable in technically fully efficient countries. However, in high income group countries, although the countries of Israel, Latvia, Oman, Panama and United Arab Emirates have low efficiency, the technology gap ratio was equal to 1 in these countries. This shows that although these countries do not produce fully efficient but it is not important what technology (group technology or metatechnology) these countries use to achieve potential output. Because whatever technology they use they produce the same level of output. Countries

similar to this situation did not appear in other country groups.

Turkey's technology gap ratio (TGR) was 0.909. This means that, using given input set and group technology, Turkey's output will achieve 90.9% of the output it will achieve using the same input set and metatechnology. In other words, while Turkey can pro-duce all output using its own group technology, with same inputs it can produce only 90.9% of the output using metatechnology. For Turkey, there is difference between group technology and metatechnology but it is obviously that this difference is not a lot.

When the TGR results of the group countries are examined, it has been revealed that the income levels of the countries have an effect on the technology they use. As a result, the dominant technology for these four groups is that of high income countries technology. Because more countries in this group of countries have a technology gap ratio (TGR) equal to 1, which shows that there is no technology gap in these countries. In other words, the potential output obtained by group technology in these countries can also be obtained by using metatechnology. Since the countries with high technology in today's world generally consist of countries with high income and countries with more research and development expenditures, the results obtained (except for a few countries) can also be considered valid.

CONCLUSIONS

The agricultural sector is defined as one of the most important sectors, especially in developing countries. Due to its extensive links with other economic sectors, the growth of this sector can lead to wealth creation, market creation and foreign exchange return, as well as industrial growth. In this study, technical efficiency and technology gap ratios in agriculture sectors according to the income levels of developing countries are discussed in four different income groups for 2017. In the study, the technical efficiency of the countries within the group was examined by estimating the group production frontier of the countries. With the findings obtained here, when the gap between the technical efficiency of each country in the group and the efficiency of the best country (technically the most efficient country) in that group is closed, it has been tried to show how much they can produce with the same technology without increasing the input. Accordingly, it was possible to increase production by 43.7% on average in the high income group, 35.4% in the upper middle income countries, 44.8% in the lower middle income countries and 46.1% in the low income group countries.

As it is thought that different technologies are used in the agricultural sector in terms of income levels of the countries in the groups, the metafrontier approach is also considered to compare the efficiency and technological gap between the groups. The results obtained here show how much production can be increased for that group without increasing inputs when the gap between technology and metatechnology of each group is eliminated. According to the results, if technology in group countries rises to metatechnology, it can be expected to increase production by an average of 4% in high income countries, 52.6% in upper middle income countries, 43.7% in lower middle income countries and 86.1% in low-income countries. These results show that the technology gap ratio (TGR) is only 96% in high income countries and therefore the technology used by these countries is closer to metatechnology and therefore the gap in production is less (4%). In other words, countries in this group can produce 96% of the output that can be produced with metatechnology, using the existing technology. Looking at the results, it is also understood that the production gap in low income countries is higher than other groups (86.1%) and therefore the technology gap ratio (TGR) is lower (13.9%) and therefore the technology used by these countries is farther from metatechnology. Thus, it has been concluded that the technological gap ratio in the agricultural sector of developing countries is higher in high-income countries and lower in low income countries. The results here can guide the politicians in the agricultural sector and increase the production level in this sector by

improving production techniques both with the optimal use of existing resources and with incentive policies.

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EFFECTS OF AGRICULTURAL COMMERCIALIZATION ON POVERTY STATUS OF SMALLHOLDER CASSAVA FARMING HOUSEHOLDS IN OYO STATE, NIGERIA

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Abstract

Transforming the subsistence-oriented cassava production system into a market-oriented production system as a way of increasing the smallholder farmers' income, reducing poverty and thus increasing their welfare has been a policy focus in Nigeria. The study examined the effects of agricultural commercialization on poverty status of smallholder cassava farming households. Multistage sampling procedure was used to select 189 households; data were collected with the use of a well-structured questionnaire and analysed with the use of household commercialization index, FGT index, ordered probit model and logistic regression model. The result of household commercialization index revealed that larger proportion of the farmers commercialize at a high level. Level of education, farming experience, farm income, quantity of cassava produced and extension visits influenced commercialization. The results further showed that 37.28% of smallholder cassava farming household were poor. Sex, level of education, farming experience, quantity of cassava produced, farm income, level of commercialization and extension visit significantly influenced poverty status. The study concludes that most cassava farmers have a high level of commercialization which has a positive influence on the farmers' welfare. The study recommends farmers' education, effective policy intervention and programmes on commercialization and access to credit to improve farmers welfare.

Key words**:** *cassava, commercialization, poverty, ordered probit, Nigeria*

INTRODUCTION

Agriculture continues to play a strategic role in contributing to economic development and poverty reduction in most countries. In 2017, the agricultural sector contributed to a Gross Domestic Product (GDP) of 3.33% globally [31]. Also, in sub-Saharan Africa, agriculture remains one of the key sectors that serve as a primary source of income and livelihoods to the majority of rural farming households who represents 70% of the poor [25]. However, common to countries in sub-Saharan Africa, Nigeria inclusive, smallholder farmers produce most of the agricultural output and majority of the population live below the poverty line [24, 30]. Previous studies [28], [18] and [27] have attributed these challenges faced by smallholder farmers to be as a result of subsistence-oriented farming patterns that are highly vulnerable to risk and poor market orientation. Hence the need for Agricultural commercialisation of major cash crops, especially cassava due to it resilient to drought and abundant agribusiness opportunities which remains untapped [12, 1, 9]. This will serve as a strategic driver to attaining sustainable economic development, high-income levels and extreme poverty reduction.

Cassava (*Manihot esculenta*) is widely cultivated in Africa by smallholder farmers and it is the world fourth major staple cash crop after rice, wheat and maize [8, 15]. Nigeria, the world largest producer of cassava, contributes 60% of the world total production [21]. Over the years, the Nigeria cassava market is composed of subsistence-oriented section and a newly evolving industrial market where smallholder farmers are also tapping into the various cassava value chains.

Thus, cassava commercialization has been a priority to development experts due to its key role in reducing poverty among smallholder farmers.

[18] and [7] have emphasized that agricultural commercialization is a reality in many developing countries and has increased income which in turn has reflected on the poverty status of smallholder farmers. Hence, promoting agricultural commercialization is an important step to development and poverty reduction of these smallholder farmers in Nigeria, as well as other developing countries. Globally, poverty rates have reduced considerably; however, many of the world poor are still smallholder farmers [22].

Although, there is a growing emphasis on Agricultural commercialization, to make smallholder farmers more market-oriented to improve their income and poverty level especially in developing countries like Nigeria. There are also promising cases of smallholder cassava farmers engaging in commercialization.

Currently, smallholder cassava farmers operate at different levels of commercialization and these levels are still not high enough due to several social-economic and institutional factors [10, 25]. Researches had identified these factors to include farmer's level of awareness on commercialization, market imperfections and high transaction costs. These determine the participation or non-participation of smallholder cassava farmers. Similarly, smallholder cassava farmers still experience a high incidence of post-harvest losses and weak linkages between the local and international markets. Thus, making these potential markets and the cassava value chain underexploited [5]. Other challenges faced by these farmers include poor infrastructure, inadequate access to technology and credit facilities. All these factors negatively affect farmer's income, making it difficult for these farmers to integrate with the market and enjoy the benefits of commercialization [11]. This triggers food insecurity and increases poverty levels of these farmers.

Previous studies on the assessment of agricultural commercialization and poverty, like those of [29], [18], [4] and [22], dwelt on market participation, agricultural productivity and income poverty levels. There has been a limited scope as to assess how the level at which commercialization affects farmer's poverty status. Also, limited answers to whether this income generated through commercialization are used to satisfy the farmer's needs. Hence, this paper is significant in filling this gap by examining the effects of commercialization on the poverty status of smallholder cassava farmers. The specific objections are to profile the level of commercialization among cassava farmers; examine the factors that influence the level of commercialization; estimate the poverty level of the cassava farmers in the study area to their level of commercialization, and to determine the effect of commercialization on the poverty levels of smallholder cassava farmers. Consequently, the paper will serve as reference material for researchers, academics and policymakers.

Empirical Review

[25] examined Cassava commercialization and household income of Smallholder Farmers in Kenya. The study found that farmers who undertook cassava commercialization had a significantly higher income relative to those who did not. Also, several factors were found to significantly affect commercialization. These included farm size, years of education and remittances which positively ($p<0.05$) influenced cassava commercialization and group membership ($P<0.10$). However, distance to the market ($p<0.01$) had a negative effect. [14] researched status, determinants and effect of agriculture commercialization among smallholder farmers in Tanzania. The result found that Age of household head, sex, household size, land area allocated for production, use of inorganic fertilizer, use of improved seed and accessibility to agricultural inputs on credit were found to significantly influence the decision for farmers to participate in agricultural commercialization of the four commodities. [10], examined the assessment of commercialization of food crops among farming households in the southwest, Nigeria. The study found that sex,

age, household size, access to market information and non-farm income positively influenced commercialization and cooperative society, distance to the farm to the nearest market, farming experience, educational status and farm size negatively influenced commercialization. [11] conducted a study on market information and extent of agricultural commercialization: empirical evidence from smallholder farmers in the Effutu municipality of Ghana. The truncated regression estimate revealed that gender, the total number of male adults within the household, education, market information, farm size, access to land and non-farm income significantly explain variation in the extent of agricultural commercialization.

[20] carried out a study on the effects of small-scale agricultural crop commercialization on rural household welfare in Tanzania. The results showed that crop commercialization, women participation in crop income allocation, off-farm income, access to extension services and household size significantly reduce household poverty while household head's age had an adverse effect. [13] analyzed the determinants of market participation and the implication of this market participation on the welfare of the poor and marginalized households in Kenya. Their results also showed that a high proportion of households who exited poverty sold some of their crop production, and similarly, a high proportion of those who exited poverty sold a high proportion of their crop production.

MATERIALS AND METHODS

The study was conducted in Oyo State, Nigeria. Oyo state is an inland state in south-western Nigeria, with its capital at Ibadan. Oyo State was one of the three States carved out of the former Western State of Nigeria in 1976. The state is bounded in the north by Kwara State, in the east by Osun State, in the north by Ogun state and it the west partly by Ogun state and partly by the Republic of Benin.

It has the coordinates of 8º00'N 4º00'E/ 8.00'N 4.00'E and covers approximately an area of 28,454 square kilometres ranking 14th by size. Oyo state comprises of 33 local government areas. The landscape consists of mostly old hard rocks and dome shaped hills. With an average temperature of 26.5^{o}c and a mean relative humidity of 80.8%, the state enjoys the characteristic West African monsoon climate, which has two major seasons (rain- March to October and Dry - November to February). Major crops cultivated include cassava, yam, maize, cocoa, plantain and fruits.

Types and Sources of Data

Primary data were obtained from cassava farming households with the aid of well-structured questionnaires. Data were collected on variables such as socio-economic characteristics of respondents including; Age of household head, gender, farming experience, farm size, marital status and household head years of schooling. Also, information on labour, off-farm income, farming experience, irrigation availability, access to credit in the previous season, distance to input market, access to road, access to transport, access to market information, access to extension services, the total area under crop production, household gross production value, distance to nearest output market and household expenditure were obtained as well.

Sampling Technique and Sample Size

Multi-stage sampling technique was adopted for this study. At the first, three Agricultural Development Program (ADP) zones were randomly selected from the four ADP zones in Oyo state. The second stage involved random selection of three agricultural blocks from the selected ADP zones, the third stage entails random selection of three cells from the selected blocks, at the last stage seven cassava farming households were randomly selected making 189 households. However, during the process of data clean up only 180 responses were fit for analysis due to incomplete responses and outliers, thus representing 95.2% of the total responses.

Analytical Technique and Model Specification

Descriptive statistics such as frequencies, table, percentages, mean, and standard

deviation were used to describe the socio-economic characteristics of the cassava farmers and profile the level of commercialization among farmers.

Household Commercialization Index (HCI)

The study employs the household commercialization index (HCI) as used by [19], [23], [17] and [3] to determine the household level of commercialization. HCI is mathematically expressed as:

$$HCIi = \frac{\text{Gross value of crop sales in a year}}{\text{Gross value of all crop production in a year}} X100$$

.....(1)

The index measures the ratio of the gross value of crop sales by household ***i*** in year ***j*** to the gross value of all crops produced by the same household ***i*** in the same year ***j*** expressed as a percentage. The index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a subsistence-oriented household and the closer the index is to 100, the higher the degree of commercialization. If HCI ≤ 25% farmers have very low commercialization, if HCI ≤ 50% farmers have averagely (medium) commercialization, if HCI ≤ 75% farmers have high commercialization and if HCI >75% farmers have very high commercialization. The advantage of this approach is that commercialization is treated as a continuum thereby avoiding crude distinction between "commercialized" and "non-commercialized" households.

Foster Greer and Thorbecke (FGT) Poverty Index

The study employs the Foster Greer and Thorbecke (FGT) poverty measure to estimate the poverty status among smallholder cassava farmers in the study area. The formula following [6] and as adopted by [23] is specified as follows:

$$P_\alpha = 1/n \sum(Z-Y_i/ Z)^\alpha \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where:

Y_i is the expenditure per adult equivalent of i^{th} household, Z is the poverty line, n is the number of households; α is the number of the sampled population below the poverty line and a is the aversion to poverty, a coefficient reflecting different degrees of importance accorded to the depth or severity of poverty. A poverty threshold was obtained using the two-third of the mean consumption per adult equivalent of the rural farming households. This threshold was used to separate the poor from the non-poor. The Foster, Greer and Thorbecke class of poverty measures were used to profile the poverty status of the rural farming households in the study area.

Ordered Probit Model

To examine the factors influencing the level of commercialization among cassava farmers in the study area, ordered probit model was employed. The ordered probit regression model is employed to quantify the magnitude and the direction of the effects of factors influencing commercialization of smallholder agriculture. Following [19], the model specification is as specified as:

$$Y^* = \hat{a}_0 + \hat{a}_1 C_1 + \hat{a}_2 C_2 + \hat{a}_3 C_3 + \hat{a}_4 C_4 + \hat{a}_5 C_5 + \hat{a}_6 C_6 + \hat{a}_7 C_7 + \hat{a}_8 C_8 + \hat{a}_9 C_9 + \hat{a}_{10} C_{10} + \hat{a}_{11} C_{11} + ì$$

……..... (3)

Y= commercialization (High, Medium and Low)

C_1= Age (years)

C_2= Marital status (1 if married; 0 otherwise)

C_3= Sex (1 if male; 0 if otherwise)

C_4= Level of education (years)

C_5= Household size (number of persons)

C_6= Market distance (kilometres)

C_7= Total quantity produced (Kilogram)

C_8= Farming experience (years)

C_9= Access to extension service (1 if yes; 0 otherwise)

C_{10}= Farm income (Naira)

C_{11}= Primary occupation (1 if farming; 0 otherwise)

$\hat{a}_0$ = Intercept term

$\hat{a}_1$-$\hat{a}_8$ = Coefficient of parameters estimates

i = error term

Logistic Regression Model

To determine the effect of commercialization on the poverty levels of cassava farmers in the study area, the logistic regression was employed. Following [20], the model is as specified as:

$D^*_i = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_1X_1 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \varepsilon i$ …. ..(4)

D= Poverty status (poor= 1, otherwise= 0)
X_1= Age (years)
X_2= Marital status (1 if married; 0 otherwise)
X_3= Sex (1 if male; 0 if otherwise)
X_4= Level of education (years)
X_5= Household size (number of persons)
X_6= Farm size (hectares)
X_7= Market distance (kilometres)
X_8= Access to market information (1 if yes; 0 otherwise)
X_9= Total quantity produced (Kilogram)
X_{10}= Farming experience (years)
X_{11}= Access to extension service (1 if yes; 0 otherwise)
X_{12}= Farm income (Naira)
X_{13}= Commercialization index in percentage
β_0 = Intercept term
β_1- β_8 = Coefficient of parameters estimates
εi = error term.

RESULTS AND DISCUSSIONS

Socioeconomic Characteristics

Table 1 shows the frequency distribution of respondents according to sex, age, marital status, education, farming experience, household size and membership of cooperative society.

Table 1. Distribution of Respondents According to their Socioeconomic Characteristics

Variable	Frequency	Percentage	Mean	Standard deviation
Sex				
Female	67	37.22		
Male	113	62.78		
Total	180	100.00		
Age (years)				
1-20	1	0.56	42	11.76
21-40	91	50.56		
41-60	74	41.11		
61-80	13	7.22		
>80	1	0.86		
Total	180	100.00		
Marital status				
Single	28	15.56		
Married	131	72.78		
Widow	20	11.11		
Divorced	1	0.56		
Total	180	100.00		
Level of Education				
No formal	15	8.33		
Primary	47	26.11		
Secondary	59	32.78		
Tertiary	59	32.78		
Total	180	100.00		
Household size (persons)				
1-5	168	93.33	5	1.78
6-10	5	2.78		
11-15	6	3.33		
16-20	1	0.56		
Total	180	100.00		
Farming experience (years)				
1-10	104	57.78	12	4.85
11-20	56	31.11		
21-30	10	5.56		
31-40	10	5.56		
Total	180	100.00		
Member of cooperative				
Yes	122	67.78		
No	56	31.11		
Total	180	100.00		

Source: Field Survey, 2019.ț

The majority (62.78%) of the respondents were male while 37.22% were of female; this implies that more male farmers are involved in cassava farming than female. This connotes a typical Nigerian farming system especially in the western region where men are

predominantly farmers. This is substantiated by the study conducted by [26]. Most (50.56%) of cassava the farmers are within the ages of 41-60 years. The mean age was 42 years. This indicates that most of the farmers are in their active and productive age. It is expected that younger farmers will be more productive than older farmers thereby improving their poverty status as a result of additional income. This result agrees with that of [20].

Majority (72.78%) of cassava farmers were married, this implies that most of the cassava farmers are matured and responsible to cater for their households as well as have a clear knowledge of their wellbeing, there is also an implanted sense of responsibility as marital status prompts commitment to business because of the family needs that must be met and this would subsequently enhance productivity, this result corroborates the findings of [16].

Less than half (32.78%) of cassava farmers had secondary and tertiary education, this indicates that farmers can read and write, which is an important factor in the commercialization of farming, this corroborates the study conducted by [23].

Almost all (93.33%) of the respondents had between 1-5persons in their households with a mean household size of 5 persons, this implies that most of the cassava farmers had a fairly large household size they could employ on their farms whenever they are available, this result is in line with the findings of [16]. Most (57.78%) of the respondents had 1-10years experience with mean farming experience of 12years, this implies that most of the cassava farmers had enough experience about farming and this may influence their level of commercialization positively, this result agrees with [17].

The majority (67.78%) are members of cooperative society; this implies that the farmers are more likely to have access to information that will enhance their production and marketing of cassava. This may positively influence their level of market participation and reduces their poverty status. This result is in line with [13].

Level of Commercialization among Cassava farmers

Table 2 shows the level of commercialization among cassava farmers, the majority (77.22%), operated at a high level of commercialization. The mean household commercialization index is 58%. This indicates that cassava farmers highly participate in markets. The implication of this result is that the cassava farmers are more likely to be poor as commercialization provides an avenue to escape poverty.

Table 2. Distribution of cassava farmers according to the level of commercialization

Commercialization index	Frequency	Percentage
Low (≤25%)	7	3.89
Medium (26–50%)	34	18.89
High (51 – 100%)	139	77.22
Total	180	100.00
Standard deviation	12.96	
Mean comm. Index	58%	
Min. comm. index	5.45%	
Max. comm. Index	94%	

Source: Field Survey, 2019.

Factors Affecting the Level of Commercialization among Cassava farmers

Table 3 shows the relationship between the level of commercialization among cassava farmers and factors such as; age, sex, marital status, educational background, household size, family labour, years of experience, distance to output market, farm income, the quantity of cassava produced, primary occupation and extension visit. The significant LR chi-square value of 32.30 indicates that the explanatory variables jointly influence commercialization. The diagnostic tests (Pseudo R^2 = 0.1401 and Prob> chi2 = 0.0007), indicates that the model is a good fit for the data.

The result of the marginal effect shows that the coefficient of the level of education is significant ($p<0.01$) and positively influenced commercialization, this implies that an additional year of education would increase the extent of commercialization by 0.145%. This result corroborates the findings of [25] that farmers operate well in the market when they can read and write and this aid

transaction process. Farming experience is significant (p<0.05) and positively influenced commercialization, the marginal effect coefficient indicates that an additional 1 percent increase in farmer's years of experience will increase the extent of commercialization by 0.923%, this result aligns with the findings of [13] that postulated that years spent in the marketing of farm produce could improve customer base and make negotiations easier with buyers. Farm income is significant (p<0.10) and positively influenced commercialization. The marginal effect coefficient indicates that 1 percent increase in the amount realized from farm business will increase the extent of commercialization by 0.000028%, this result is in line with the findings of [11]. Quantity of cassava produced is significant (p<0.01) and positively influenced commercialization, the marginal effect coefficient indicates that an additional 1% in the quantity of cassava produced will improve the extent of commercialization by 0.00016%. This result is following the postulation of [2]. Extension visit is significant (p<0.01) and positively influenced commercialization, the marginal effect coefficient indicates that an additional 1% in the number of times extension agents visit farmers will improve the extent of commercialization by 2.17%. This result is following the postulation of [13].

Table 3. Factors influencing levels of commercialization

Variable	Coefficient	Std. Err.	Z	P>z	Marginal effect
Age	0.01926	0.01527	1.26	0.207	-0.00056
Sex	0.02838	0.24060	0.12	0.906	-0.00084
Marital status	-0.35692	0.25238	-1.41	0.157	0.01055
Years of education	0.04930**	0.02415	2.04	0.041	0.00145
Household size	0.28421	0.31948	0.89	0.374	-0.00840
Years of farming experience	-0.31244*	0.17733	-1.76	0.085	0.00923
Primary occupation	0.23540	0.25255	0.93	0.351	-0.00684
Farm income	-9.46e-06*	5.61e-06	-1.69	0.092	2.80e-07
Quantity of cassava produced	0.00005***	0.00001	3.57	0.000	1.68e-06
Distance to output market	0.01316	0.01017	1.29	0.195	-0.00038
Extension visit	-0.63977***	0.24765	-2.58	0.010	0.02174
/cut1	-1.89376	0.71725			
/cut2	-0.70173	0.69681			
Log likelihood	-99.17125				
LR chi2	32.30				
Prob>chi2	0.0007				
Pseudo R2	0.1401				

Note: Significance level: *** (p<0.01), ** (p< 0.05), * (p< 0.10)
Source: Field survey, 2019.

Level of Poverty among Cassava farmers

The result in Table 4 shows the distribution of cassava farmers' food and non-food expenditure.

The total monthly food and non-food expenditure is ₦1,535,490, the poverty line is ₦5,544.83 the implication of this result is that households whose per capita expenditure fell below the poverty line were classified as being poor while those equal or above the poverty line were classified as non-poor.

Table 4. Distribution of Cassava farmer's Food and Non-Food Expenditure

Estimate	Non-Food	Food	Total
Total monthly expenditure	679,030	856,460	1,535,490
Mean per capita expenditure	3,772.39	4,758.11	8,530.5
Two-third of the mean	2,452.05	3,092.77	5,544.83

Source: Field Survey, 2019.

Estimates of Poverty Indices among Cassava farmers

The result of the poverty indices among cassava farmers was presented on Table 5. The results show the estimates for the headcount poverty gap and poverty severity. The headcount ratio indicates that 37.28% are poor. That is, their expenditure on food and non-food items fell below the poverty line; the implication of this result is that poverty is pervasive among the sampled cassava farming households. The poverty gap reveals that poor households need 10% of the poverty line expenditure to move out of poverty. The poverty severity shows that 3% of the cassava farming households were the poorest among the poor, that is, 3% of the sampled households require the attention of policy makers in the provision of welfare indicator materials such as clean water, healthcare facilities, good roads, school, etc.

Table 5. Poverty indices of cassava farmers

Poverty status	Estimate	Std. Err
Headcount P_o	0.37286	0.00741
Poverty gap P_1	0.10007	0.00427
Poverty severity P_2	0.03104	0.00290

Source: Field Survey, 2019.

Effects of commercialization on poverty status of cassava farmers

Table 6 shows the relationship between poverty status among cassava farmers and age, sex, marital status, educational background, household size, family labour, years of experience, distance to output market, farm income, the quantity of cassava produced, extension visit, farm size and level of commercialization. The significant LR chi-square value of 82.69 indicates that the explanatory variables jointly influence poverty status.

The diagnostic tests (PseudoR^2 = 0.3425 and Prob> chi^2 = 0.0000), indicates that the model is a good fit.

Sex of the farmers was found to be significant ($p<0.05$) and positively influenced poverty status, the marginal effect coefficient indicates that an additional percentage increase in farmer's household head sex been male will reduce the probability of been poor by 19.2%. This result conforms to the postulation of [20]. Year of education was found to be significant ($p< 0.05$) and positively influenced poverty status, the marginal effect coefficient implies that an additional increase in years spent on education will reduce the likelihood of being poor by 11.1%. This result agrees with the postulation of [26]. The farming experience was found to be significant ($p< 0.10$) and positively influenced poverty status, the marginal effect coefficient indicates that an additional percentage increase in the year spent in farming will reduce the probability of been poor by 12.5%. This supports the findings of [12]. Quantity of cassava produced was found to be significant ($p< 0.01$) and positively influenced poverty status, the marginal effect coefficient indicates that an additional percentage increase in the quantity of cassava produced will reduce the chances of been poor by 0.00227%. This result is in line with the postulation of [29], which says that the higher the quantity produced, the more the farm income, thus improving farmer's welfare. Level of commercialization was found to be significant ($p< 0.01$) and negatively influenced poverty status, the marginal effect coefficient indicates that an additional percentage increase in the level of commercialization will reduce the chances of been poor by 0.15%, this result supports the findings of [20]. Farm income was found to be significant ($p<0.05$) and positively influenced poverty status, the marginal effect

coefficient indicates that an additional percentage increase in the amount realized as farm income will reduce the chances of been poor by 0.000004%. This result is also consistent with the findings of [29]. Access to extension agent was found to be significant ($p< 0.10$) and positively influenced poverty status, the marginal effect coefficient indicates that an additional percentage increase in the number of extension visit will reduce the chances of been poor by 14.11%. This result is in line with the postulation of [26].

Table 6. Result of logistic regression analysis

Welfare	Coefficient	Std. Err.	Z	P>z	Marginal effect
Age	0.0057681	0.0242392	0.24	0.812	0.0010003
Sex	1.037362**	0.4229941	2.45	0.014	0.1919401
Years of education	0.6383387**	0.2844218	2.24	0.025	0.1107029
Marital status	0.2982699	0.4075099	0.73	0.464	-0.051727
Household size	0.2440948	0.7039535	0.35	0.729	0.0423318
Farming experience	-0.7245195*	0.3926977	-1.84	0.065	0.1256486
Farm size	-0.5340952	11.08489	0.49	0.623	-0.0926246
Quantity of cassava produced	0.000131***	0.0000338	4.32	0.000	0.0000227
Distance to output market	-0.0001925	0.0199823	-0.01	0.992	-0.0000334
Level of commercialization	-0.008641***	0.0029137	-2.95	0.003	-0.0014985
Farm income	0.0000219*	0.0000127	1.72	0.085	-3.80e-06
Extension visit	0.8336745*	0.4276782	1.95	0.051	0.1411495
Constant	0.1803194	1.881192	0.10	0.924	-9.40574
LR chi2	82.69				
P>chi2	0.0000				
Pseudo R2	0.3425				

Note: Significance level: *** ($p< 0.01$), ** ($p< 0.05$), *($p< 0.10$)
Source: Field survey, 2019.

CONCLUSIONS

The study examined the effects of agricultural commercialization on poverty status of cassava farming households. It can be concluded that smallholder cassava farmers show a high level of commercialization. Furthermore, level of education, farming experience, farm income, quantity of cassava produced, and extension visit were the positive and significant factors influencing the level of commercialization among cassava farmers. The study further established that poverty is pervasive among the cassava farming households in the study area. Sex, level of education, farming experience, quantity of cassava produced level of commercialization, farm income and extension visit were the significant factors that promote cassava farmers welfare. The study concluded that agricultural commercialization reduces the poverty status of cassava farming households, it was recommended that to reduce poverty; interventions which would support cassava commercialization should be enhanced for improved farmer's welfare. These include better education for farmers and encouraging the youth into cassava production. Access to Extension agents should be improved among cassava farmers. There should be an increase in the number of visits on cassava farms and the introduction of new technologies to farmers as this was found to improve cassava farmer's level of commercialization. The government should improve the road network and other infrastructural facilities so that the farmers can easily move their produce to the market for sales, this will at the long run improve their level of commercialization and stamp out poverty.

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REALIZING SUSTAINABLE FOOD SYSTEMS AMONG ORGANIC FARMERS IN NIGERIA: EVIDENCE FROM COMMUNITY SUPPORTED AGRICULTURE

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Abstract

Achieving a resilient food system through the Community Supported Agriculture (CSA) greatly depends on how informed farmers and subscribers are to the benefits associated with it. The study examined the role of Community Supported Agriculture (CSA) on organic farmers. Multistage sampling technique was used to select 130 respondents; data were collected with the use of a well-structured questionnaire and analysed through the use of descriptive statistics. The results of the socio-economic characteristics revealed that majority of the respondents are male, middle-aged, married and had tertiary education. The result also characterizes respondents as organic-based crop farmers, fewer adopters of community supported agriculture and inadequate access to extension agents. Also, "increasing food security for the population" was perceived as the most (Mean=4.56) important about community supported agriculture and "effecting change through awareness-raising and encouraging sustainable behaviour" was perceived as the greatest (Mean=4.39) effect of community supported agriculture. The study concludes that community supported agriculture helps consumers, producers, and the environment build connections together through a local food network. The study recommends the need for policy and popularization that would encourage community supported agriculture. Also, extension agents and other relevant stakeholders need to be supported and strengthened in order to disseminate agricultural innovations to farmers in rural communities.

Key words**:** *community supported agriculture, sustainable agriculture, organic farming*

INTRODUCTION

Globally, population increase coupled with environmental challenges continues to raise questions on how to transform the global food system. According to the Food and Agriculture Organization (FAO), an estimated 821 million people on a global scale still lacked sufficient food for healthy living [9]. Thus, the need for a food system that is based on the principles of sustainability. In sub-Saharan African (SSA) countries, Nigeria inclusive, agriculture continues to play a vital role in the economy, with organic farming contributing to agricultural productivity and the food system [2,13,19,6,8]. Consequently, in order to strengthen the food system and meet the food demand of the growing population, sustainable agriculture with localised alternatives that have a direct connection between consumers and farmers such as the concept of community supported agriculture (CSA) is necessary and cannot be overemphasized [17].

Community Supported Agriculture (CSA) continues to be an innovative partnership that connects the farmers (producers) with end consumers, where the risks and benefits of farming are shared [10]. The CSA concept was first initiated in Japan and Chile in the 1970s and subsequently spread to the USA after World War II [4]. The CSA concept over the years has provided resilient in times of crisis as well as awareness of local foods and dietary diversity among its members (or shareholders). Also, the concept is conceived as a sustainable way to produce food, and at the same time connecting farmers and subscribers who are both shareholders.

At present, the CSA concept is spreading across the continents of the world [11]. However, achieving a food system that is sustainable through the Community Supported Agriculture (CSA) greatly depends on how informed farmers and subscribers are to the benefits associated with CSA. This is also coupled with the dissemination of

extension messages and agricultural innovations among farming communities to allow for more participation. In Nigeria, attaining a resilient food system through Community Supported Agriculture (CSA) is still unsuccessful as community farmers and subscribers are less informed about its benefits. The ratio of extension agents to community farmers is very low consequently leaving farmers to no or less adequate information and neglecting agricultural innovations. This situation calls for virile extension services that will link farmers with researchers effectively and allow them to adopt sustainable agricultural practices.

Furthermore, despite recognition garnered by CSA, most research [14,4,12,17,18,20] focus more on the consumers' side of the partnership with little attention given to the farmers—the suppliers of this product. Also, few studies have examined if the CSA concept is providing adequate and sustainable food system, considering farmers perception and the effects of CSA on the farmers. Therefore, this paper aims to address these gaps in the literature: first, by determining the level of familiarity and knowledge of CSA; second, by examining farmers perception about CSA; and third, by analysing the effects of CSA on farmers.

MATERIALS AND METHODS

Study Area

This research was conducted in Southwest region of Nigeria. The Southwest region is made up of six states: Ogun, Ondo, Osun, Oyo, Ekiti and Lagos. Southwest is mainly a Tropical Rainforest Zone, with swamp forests in the coastal regions of the states of Lagos, Ogun and Ondo. The zone covers an area extending from the swamp forest to the western upland, between the rainforest and the northern sections of the Oyo and Ogun states, which have developed Guinea savannah vegetation. The areas lie between latitude 5 degrees and 9 degrees North and longitude 2 degrees and 8 degrees East. It is bounded by the Atlantic Ocean in the south, Kwara and Kogi states in the north, Eastern Nigeria in the east and Republic of Benin in the west. It has an area of approximately 114,271 km^2 representing 12% of the country's total land area. The high concentration of agricultural activity supports the option of the study area [15].

Types and Sources of Data

Primary data was employed to obtain information from organic farmers with the aid of well-structured questionnaires. Data was collected on variables such as socio-economic characteristics of respondents including; age, gender, farming experience, farm size, marital status, farming experience, household size, organic farming practised, awareness of CSA and adopters of CSA. Also, information was collected on knowledge and perception of farmers to adopt community supported agriculture, willingness to participate in CSA and the effect of CSA.

Sampling Technique and Sample Size

Multistage sampling technique was employed for this study. The first stage involves random sampling of three states in south-west Nigeria which are Oyo, Ogun and Ondo due to the prevalence of organic agriculture in these states. The second stage involves a random selection of two agricultural zones from each state to give a total of six agricultural zones which are Ibadan, Oyo, Abeokuta, Ilaro, Akure North and Ifedore. In the third stage, two communities/villages were chosen from each of the zones to give a total of 12 villages. Finally, twelve organic farmers were selected each from the 12 communities, bringing a total of one hundred and forty-four (144). One hundred and thirty organic farmers were however used for the study due to incomplete responses and outliers.

Analytical Technique and Model Specification

Descriptive statistics such as (frequencies, table, charts, percentages, mean, and standard deviation), was used to describe the socio-economic characteristics.

Also, a 5-point scale was employed in the study to identify the relevance and significance of the farmers' perception of community supported agriculture. Strongly agree (5), Agree (4), Undecided (3), agree (2) strongly disagree (1).

RESULTS AND DISCUSSIONS

Socioeconomic Characteristics

Table 1 shows the frequency distribution of respondents according to sex, age, marital status, education, farming experience, household size and membership of cooperative society. The results show that most farmers, most (63.08%) are male while others, (36.92%) are female. This result agrees with the findings of [5] that low percentage of women participation in organic farming could be attributed to cultural differences were married women are to carry out domestic responsibilities and the limitations in accessing capital to operate on the farm. About (33.85%) of organic farmers fall within the age group of 21-30 years. The mean age is 39 years. This indicates that most of the farmers are in their active and productive ages. This result is similar to that of [1]. The majority (56.15%) are married, this result corroborates the findings of [3] that farmers are matured and responsible to cater for their households as well as have a clear knowledge of their wellbeing, there is also an implanted sense of responsibility as marital status prompts commitment to business because of the family needs that must be met and this would subsequently enhance production. Most (53.07%) of organic farmers had tertiary education, this implies that majority of the farmers are literate which will help them in decision making process as well as the adoption of innovations. Also, being educated will influence their participation in community supported agriculture. This result contradicts the findings of [1] that the majority of organic farmers had secondary education. The mean household size is 4 people and the standard deviation is 1.73. This result is against the report of [7] cited in [16] that the average household size for farmers in Nigeria is about 6-7 persons per household. Most (76.92%) of the respondents had 1-10years experience with mean farming experience of 7years. The majority (90.77%) of organic farmers cultivates on the farm land that ranges within 1-5 ha, this result is in tandem to that of [1], that is organic farmers in the study are small to medium scale farmers.

Table 1. Distribution of Respondents According to their Socioeconomic Characteristics

Variable	Frequency	Percentage	Mean	St. dev.
Sex				
Female	48	36.92		
Male	82	63.08		
Total	130	100.00		
Age				
21-30 years	44	33.85	39	10.78
31-40 years	34	26.15		
41-50 years	30	23.08		
51years & above	22	16.92		
Total	130	100.00		
Marital status				
Single	54	41.54		
Married	73	56.15		
Widow	3	2.31		
Total	130	100.00		
Level of Education				
Primary	2	1.53		
Secondary	59	45.40		
Tertiary	69	53.07		
Total	130	100.00		
Household size				
1-3 persons	61	46.92	4	1.73
4-6 persons	56	43.08		
7 persons & above	13	10.00		
Total	130	100.00		
Farming experience				
1-10 years	100	76.92	7	6.59
11-20 years	22	16.93		
21-30 years	8	6.15		
Total	130	100.00		
Farm size (ha)				
1 - 5	118	90.77		
6 - 10	12	9. 23		
Total	130	100.00		

Source: Field Survey, 2019.

Organic Farming and Community Supported Agriculture

Figure 1 showed the pie chart result of the type of organic farming practice distribution among respondents which indicated that most

(60.77%) of the organic farmers majored on crop cultivation alone. Figure 2 presented the pie chart of the time of extension visit to farmers' farm. It indicated that the majority (56.15%) claimed that extension agents visit their farms annually. Figure 3 showed the cylinder chart result of farmer's awareness about community supported agriculture. It showed that the majority (73.82%) are not familiar with community supported agriculture. Figure 4 showed that about (17.69%) have adopted community supported agriculture in their communities.

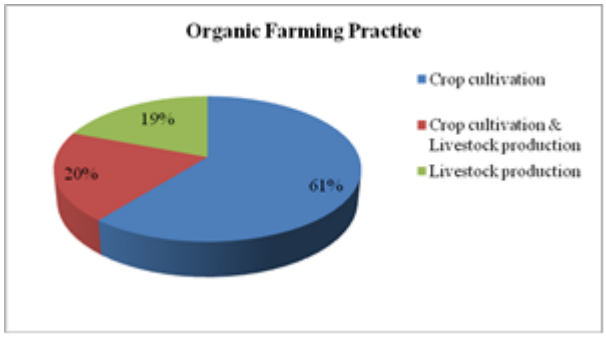

Fig. 1. Types of organic farming practice
Source: Field Survey, 2019.

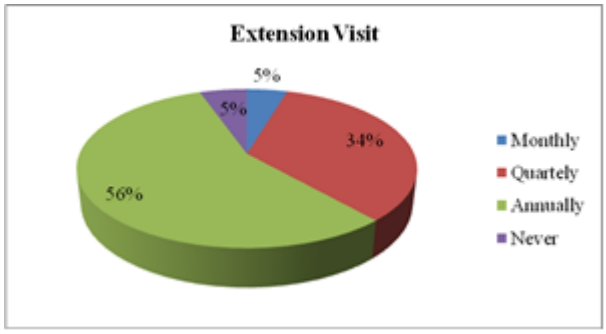

Fig. 2. Time of extension visit
Source: Field Survey, 2019.

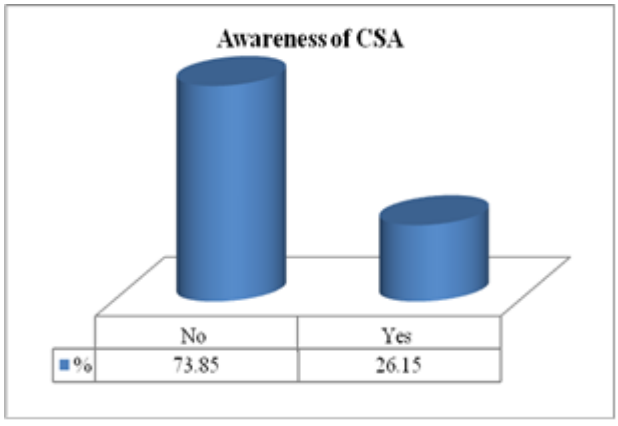

Fig. 3. Awareness about community supported agriculture
Source: Field Survey, 2019.

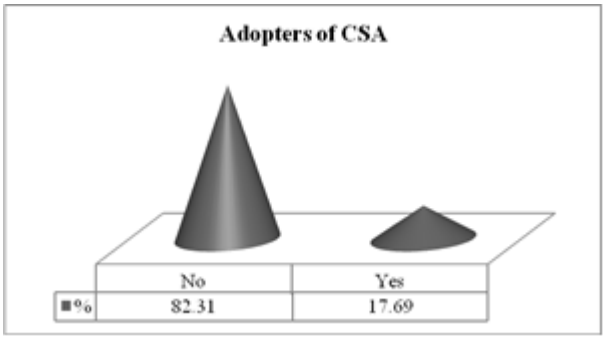

Fig. 4. Adopters of community supported agriculture
Source: Field Survey, 2019.

Farmers Perception about Community Supported Agriculture

Table 3 revealed the results of farmers' perception of community supported agriculture among respondents. The mean scores were used to identify perception that is significant or important to community supported agriculture. "Increasing food security for the general population" was ranked 1st as it had the highest (Mean=4.56), this was followed by "CSA helps tackle marketing and financial problems of the farmer" were ranked 2nd with the (Mean=4.45). "Both parties share the costs and benefits of maintaining the farm", "Bridges the gap between farmer and ordinary individuals through community involvement" and "allows the underprivileged sectors of society to afford healthy, nutritious produce, bringing more money and wealth into the community" were ranked 3rd as they have equal (Mean=4.40). "Help to sustain the economic viability of individual farms" was ranked 6th with the (Mean=4.36), followed by "Fostering a close intimate relationship between two vital parts" was ranked 7th with the (Mean=4.31) and "High-quality produce that is readily available at the community level" was ranked 8th with the (Mean=4.30). "Makes the consumer more conscious of his or her role in the food production process" was ranked 9th with the (Mean=4.28) and lastly, "Refining the food supply chain as it reduces our need to rely solely on the unsustainable practices" was ranked 10th with the (Mean=4.26).

Table 2. Distribution of respondents by their perception about Community Supported Agriculture

STATEMENT	Max	Min	MEAN	STD. DEV	RANK
CSA helps tackle marketing and financial problems of the farmer	5	3	4.45	0.68	2nd
Both parties share the costs and benefits of maintaining the farm	5	3	4.40	0.70	3rd
Bridges the gap between farmer and ordinary individuals through community involvement	5	3	4.40	0.68	3rd
Help to sustain the economic viability of individual farms	5	2	4.36	0.67	6th
Fostering a close intimate relationship between two vital parts	5	3	4.31	0.73	7th
Makes the consumer more conscious of his or her role in the food production process	5	3	4.28	0.75	9th
High-quality produce that is readily available at the community level	5	2	4.30	0.81	8th
Reduces the travel miles that are required to reach people's places	5	1	4.36	0.83	4th
Refining the food supply chain as it reduces our need to rely solely on the unsustainable practices	5	2	4.26	0.82	10th
Increasing food security for the general population	5	3	4.56	0.63	1st
Allows the underprivileged sectors of society to afford healthy, nutritious produce, bringing more money and wealth into the community	5	3	4.4	0.68	3rd

Source: Field Survey, 2019.

Effect of Community Supported Agriculture on Respondents

Table 3 revealed the results of farmers' perception of the effect of community supported agriculture on both farmers and subscribers in the study area. The mean scores were used to identify perception that is significant or important as the effect of community supported agriculture on both farmers and subscribers. "Effecting change through awareness-raising and encouraging sustainable behaviour" was ranked 1st as it had the highest (Mean=4.39), followed by "Improving the local environment through land management" was ranked 2nd with the (Mean=4.36).

Table 3. Effect of community-supported agriculture on respondents

STATEMENT	Max	Min	MEAN	STD. DEV	RANK
Perceived effect on members' health, skills and well-being	5	1	4.33	0.82	4th
CSA is cost saving for both farmers and members	5	**2**	4.29	0.94	10th
Increased food production, improve farmers' income level	5	3	4.33	0.82	4th
Improving the local environment through land management	5	3	4.36	0.75	2nd
Effecting change through awareness-raising and encouraging sustainable behaviour	5	3	4.39	0.75	1st
Providing food of low environmental impact	5	2	4.26	0.90	11th
Provide a high proportion of their members' food needs	5	2	4.33	0.79	4th
Bring together a set of assets to create a wider enterprise	5	2	4.31	0.79	12th
Contribute directly to local economies through the employment they provide	5	3	4.32	0.77	8th
Build economic potential through the provision of education, training and volunteering opportunities	5	2	4.35	0.65	3rd
Offer a wide range of social events and activities for participants and other community members	5	1	4.06	0.88	13th
Bringing people together or providing a focal point for community activities	5	3	4.33	0.71	4th n
Actively developed or supported other community enterprises	5	3	4.25	0.68	9th

Source: Field Survey, 2019.

"Build economic potential through the provision of education, training and volunteering opportunities" was ranked 3rd with (Mean=4.35).

"Perceived effect on members' health, skills and well-being", "Increased food production", "improve farmers' income level", "Provide a high proportion of their members' food needs" and "Bringing people together or providing a focal point for community activities" was ranked 4th with each having equal (Mean=4.33).

"Contribute directly to local economies through the employment they provide" was ranked 8th with the (Mean=4.32), "Bring together a set of assets to create a wider enterprise" was ranked 9th with the (Mean=4.31), "CSA is cost saving for both farmers and members" was ranked 10th with the (Mean=4.29), "Providing food of low environmental impact" was ranked 11th with the (Mean=4.26), "Actively developed or supported other community enterprises" was ranked 12th with the (Mean=4.25) and "Offer a wide range of social events and activities for participants and other community members" was ranked 13th with the (Mean=4.06).

CONCLUSIONS

It could be concluded that farmers were middle-aged and the major type of organic farming is organic-based crop production. It is also established that organic farmers are new to community supported agriculture and are willing to participate in it as they have favourable perception toward community supported agriculture. Also, community supported agriculture helps consumers, producers, and the environment build connections together through a local food network.

The following recommendations are presented below:

(i)There is a need for policy and popularization that would encourage community supported agriculture, especially in rural Nigeria. Hence, the government should employ seamless awareness campaigns to sensitize Nigerian populace on the significance and relevance of community supported agriculture in ensuring sustainable food security and environmental conservation.

(ii)Extension agents and other relevant stakeholders need to be supported and strengthened to disseminate agricultural innovations to farmers in rural communities.

(iii)There is need to develop on indigenous knowledge in response and partnership with community farmers; and encourage the expansion of local and regional markets for organic products.

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DESIGN, DEVELOPMENT AND IMPLEMENTATION OF A RISK MANAGEMENT MODEL ADAPTED TO PROJECTS CARRIED OUT WITH EUROPEAN FUNDING

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Abstract

The economic reality of today shows us more and more that only by adopting and implementing innovative management methods and/or techniques is it possible to obtain an efficient and effective use of available resources, to avoid possible losses, to achieve results and, where appropriate, to demonstrate the usefulness of a public institution or the profitability of a private organization. In this context, but also based on that a significant benefit is considered to have the best possible results with limited resources, we aimed to focus on the economic events in the area of grants allocated to Romania through the European Structural and Investment Funds and to approach the chosen topic, understanding that, probably, the most important challenge for the next period will be for potential beneficiaries to identify and subsequently position themselves in an environment characterized by a balance between risk, cost and added value, which will certainly no longer be achievable without a clear determination of the main key risks they may face during the steps required to carry out an investment project, as well as the measures to mitigate any adverse effects resulting from the occurrence of the risks.

Key words**:** *management, risk, EU funds, process, concept*

INTRODUCTION

Over the last few years, humanity has had to go through a series of important stages, full of decisive and difficult moments in terms of burden and collective responsibility, which have dictated the trend of general transformations and have built new models, rules and concerns about people's lifestyle, business environment, industry and agriculture; administrative policies and the administration itself have been modernized as a result, and the field of health, culture and education has undergone remarkable developments for those times. In all this context favorable for development and innovation, the concept of project management also appeared, being first used somewhere in the early 1950s, in the United States, in the aeronautical sector, by NASA – National Aeronautics and Space Administration [8].

Subsequently, the project management followed a path characterized, rather, by the decrease of the level of complexity of the main components and has oriented towards the simplification of the methods and techniques for applying it, gradually becoming an extremely accessible management tool and more and more adaptable to all areas and sectors of activity.

The newest and most evolved approach to this sub-branch of management refers to a strategic model of project management, through which it is recommended that within an organization to achieve an integration and unification of the elements related to project management, with a series of other elements specific to organizational management. This unique interpretation allows managers to plan, organize, coordinate and control in an integrated manner all the processes within the entity they lead. Consequently, it is considered that strategic project management encourages the innovation process and brings added value at the level of an entity precisely through its capacity to correlate the organizational strategy with the management of projects and/or programs [10].

Moreover, on the basis of these developments in the field of project management and as a result of its flexibility in the context of new approaches proposed by specialists, a particularly important role in the new strategic concept of project management was gained by the notion and, at the same time, the idea of risk.

In assessing and capitalizing on the above considerations, we mention that the research conducted and presented in this article was initiated, on the one hand, from the assumption that the interest of funding authorities, and here we refer especially to the managing authorities and intermediate bodies in Romania, is closely linked to the consolidation and increase of the financial resources available at national level through the high use of the instruments provided by the European Union, so as to ensure a maximization of economies of scale, and, on the other hand, from the expressed desire and the declared need of the potential beneficiary organizations to access non-reimbursable grants in order to achieve their objectives.

MATERIALS AND METHODS

In general terms, we wanted to approach a new, modern hypothesis from the perspective of working methods and techniques, namely that according to which risk management tends to become one of the most important tools that a manager can have in an organization or during the conduct of an investment project. Given that the field is vast, but also in order to obtain a result that can be validated under normal conditions, the focus was particularly on the field of structural funds and non-reimbursable European investments available in Romania and on the possibility of developing and implementing a new mechanism for ensuring risk management at the level of funded projects [7].

Therefore, we aimed to improve the risk management process by increasing the capacity to identify and reduce them and/or eliminate the negative effects they could generate in a project financed by European structural and investment funds and less the conduct of a comparative analysis of certain categories of results obtained in two or more different situations, hypothetical or not.

That being said, we note that the most important questions that led to the start of the scientific research process sought to obtain answers which to validate or refute, as appropriate, the following elements or theories:

-It is beneficial, more than ever, to adapt and correlate the mechanisms for granting and managing European funding, in relation to the risk management process provided at the level of investment projects.

-Improving the risk management process would generate, inter alia, the relaxation and simplification of the relationship between beneficiaries and managing authorities or intermediate bodies.

-Providing a strategic project management based on risk management leads to a better coordination and adaptation of project activities through direct reference to the objectives assumed.

-Overall, a better organization of the process of accessing non-reimbursable grants as a result of the implementation of a new model of risk management insurance would lead to the efficiency of the results registered at national level in this field, by increasing the absorption of European funding.

-Such a management system would support the simplification of reporting, monitoring and control methodologies in the implementation stage of projects financed by European structural and investment funds.

In order to establish and define the working methods applied and used, we considered two main questions to be answered in connection with them, namely *"How?"* and especially, *"Why?"*.

To answer the first question, we started from the premise that simplifying the working procedures and reducing the workload as a result of the development of an insurance system at the level of investment projects financed from European funds of a strategic management, strongly risk-oriented. at the same time, would streamline the process of

accessing non-reimbursable grants and, at the same time, would streamline the reporting, monitoring and control activities. In this respect, we considered that the research activities and, especially, their conclusions to be supported with solid arguments that come from at least two different directions or sources, more precisely, from the study, analysis and interpretation of the specialized literature in the field and of the modern tendencies of development of the studied concept, as well as from the activities of data collection as a result of carrying out thematic interviews.

The answer to the second question is rather simple because, regardless of the specifics of the activities, the interest is to ensure that at the level of an organization they are achieved in conditions of maximum efficiency and effectiveness, just as in the case of risk management activities in projects benefiting from non-reimbursable grants coming from European structural and investment funds. Thus, the answer is that through the studies and research undertaken we want to identify and change or adapt a modern model of risk management to increase the efficiency and effectiveness of activities carried out in a project such as those mentioned above.

The approach was made from a qualitative perspective, this being preferred to a quantitative one as, from a technical point of view, it would support and allow a modernization of the risk management concept used in European funded projects based on current development trends, identified in the much stronger economies of Western Europe, as well as a rapid implementation of the solutions and conclusions obtained, a situation which, in turn, could place us, as a country, in a not too distant future, on a higher position in terms of the national rate of accessing non-reimbursable grants [2].

Thus, regarding the research tools used, we mention that we used the following:

-At an early stage we consulted and studied a series of documents and specialized publications from which were extracted the data and information that we considered useful in the process of improving the concept of risk management used in projects funded by European structural and investment funds.

-Subsequently, we considered that it is particularly important to conduct a number of 20 (twenty) interviews with people who have been actively involved in recent years in any type of activities aimed at attracting and/or accessing on the Romanian territory of non-reimbursable European financing.

Regarding the second tool used, we mention that we wanted to collect relevant data with a significant impact on the field studied and, in this regard, we have chosen an in-depth, nondirectional, semi-directed or partially structured interview, in which the topics of discussion were largely defined, but without imposing a certain order of addressing them. The solutions for conducting the interviews were chosen in the context in which we understood from the very beginning that, without a doubt, an interview that benefits from a freer and more permissive structure will considerably increase the probability of collecting qualitative data and with a high degree of novelty.

The results obtained after going through the two stages, specified above, led us to the design and development stage of a risk management model adapted to projects carried out with European funding.

RESULTS AND DISCUSSIONS

Proposed risk management model

Risk management is often associated at the level of investment projects with a process responsible for identifying possible risks, of quantifying and assessing the effects they may generate in relation to the objectives assumed and, at the same time, of effectively monitoring and controlling the positive or negative impact it could have at some point during the course of the investment. For the purposes of this assessment, before presenting and evaluating the proposed risk management model, we must understand that the impact of risk is associated, in a modern perspective, with both threats and opportunities [6].

For certain this way of interpretation is not a very well-known one, but the reality of today shows us that any management team faces in the process of carrying out an investment project with negative risks, defined in the context of identified threats, but also with positive risks, delimited by the opportunities that arise.

This approach is supported by one of the most frequently used and invoked definitions of risk, according to which it is "*... an uncertain event or situation which, if it occurs, has a positive or negative effect on one or more objectives of a project*" [9].

In addition to the above considerations, we mention that to the extent that the risk will occur, in one form or another, in an investment project, it will have a direct impact on the elements and baselines of the project, defined through its specific objectives and in the context of the time reserved and/or the budgetary allocations made. Therefore, regardless of the nature and type of risks that may occur in carrying out a project, they will generate extensions of the implementation period of the investment project, additions to the allocated budget and even changes to the specific objectives set or the general purpose stated.

Moreover, these are the reasons that led us to consider the design and development of a risk management model that takes into account an integrated approach to the specific purpose and objectives, time and elements of the project budget and costs.

To define the new risk management model, we will use a series of essential elements that will represent the central control panel within the risk management process related to an investment project financed from European non-reimbursable grants.

Also, in addition to two of the most common variables in the field, namely the probability of a risk occurrence and its impact, we will consider another important factor represented by a triggering event. The role of the latter is to signal the occurrence of a risk or the possibility of a risk occurring and materializing in a given conjuncture. In principle, triggering events can occur long before the risk manifests itself, at the same time and even after its effects have occurred. For sure the last option presented is the one we never wish for, in any context, for the simple fact that in that situation it would be too late for anyone to manage, in one form or another, the risk in question.

The ideal version, regarding the occurrence of the triggering event, is the one in which we identify the factor in question long before the possibility of occurrence of the risk and/or before its actual manifestation.

The proposed model is based on and is developed on a cyclical nature of the management process itself, which keeps repeating itself, going through the same stages each time, until the moment when the investment project reaches the final phase and the specific objectives are achieved to a greater or lesser extent, depending on each case. As a matter of fact, this is an extremely important moment in which the heads of the management team within the project should objectively evaluate the measures implemented, the actions taken and, obviously, conclude with the formulation of proposals that could improve the risk management process in the future [5].

Although the next template presented fragments the risk management process into components and stages clearly delimited and distributed in a logical sequence, in reality all these intertwine harmoniously to create a whole, fluent and coherent whole. In accordance with the aspects documented, we appreciate that risk management is not and cannot be ever considered a linear process, its cyclical nature being supported, first of all, by the simple fact that all its components interact directly and constantly throughout the progress of an investment project.

It can also be seen that the graphically represented model demonstrates in parallel that the approach to risk management cannot be done from the perspective of an isolated organization, because it would not have any applicability in the context in which any entity, regardless of the field of activity, is permanently integrated into its environment of existence.

Moreover, we recall that, although it was not highlighted distinctly in the proposed pattern of risk management, there is another element that exerts its influence and often dictates the limits of actions.

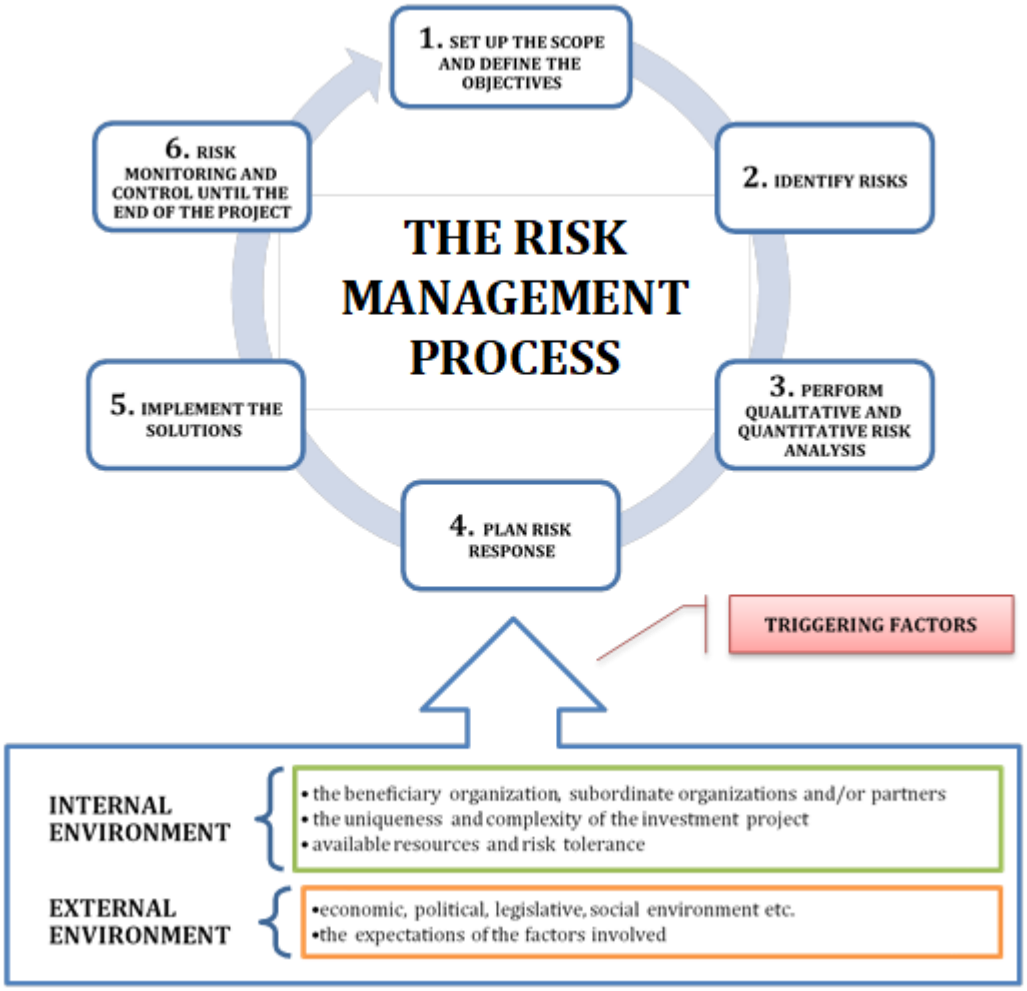

Fig. 1. The risk management process
Source: own contribution.

It is represented by the tolerance of the organization at risk and often defines the profile and type of general management practiced by the team of that entity in an investment project and not only. In this context, we consider it absolutely necessary to reiterate that risk tolerance is closely linked to the resources available at the organization level and, at the same time, that the main concern is to find a perfect balance or as close as possible to perfection between resources and benefits.

The risk management model developed as a result of the research carried out and adapted to the specifics of the projects financed by European structural and investment funds was designed on the premise that it is not a component of a classic project management process that can be placed entirely under the responsibility of the beneficiaries, for which reason, in this article, we will briefly address the issue of how to implement it within the mechanism of accessing European funding.

Implementation of the new risk management model within the mechanism for accessing European non-reimbursable financing

The risk management model proposed and described at the level of the previous sections is one that completes a strategic interpretation of the management processes used in the projects financed from structural and

European investment funds allocated to Romania.

As we have already stated in other specialized publications, it has been designed to ensure a modern approach to the risk management process that could materialize during the stages of accessing a European grant and, at the same time, to improve and streamline mechanisms for granting financial grants by simplifying or relaxing the procedures and orienting the latter to the main elements of an investment project, respectively to the parameters of carrying it.

According to the results of the bibliographic study carried out, the strategic orientation of the project management involves, first of all, three major components aimed at defining the specific purpose and objectives of a project, delimiting the necessary time span, from the perspective of the action plan and the activities envisaged, as well as the allocation of an appropriate and sufficient budget to meet the assumed result indicators. In consideration of the previously stated, we mention that the procedure for implementing the new risk management model within the mechanism for accessing European funding is also based on this desideratum.

The absolute novelty of this model developed through scientific research undertaken in the context of and in this article is that project management will be ensured through a modern mechanism, integrated from the perspective of a beneficiary – national granting authority (funder and administrator of funding programmes) – European granting authority (funder), which is based on a project draft configured in a unique way and at the same time particularly focused on the idea of risk.

For a better highlighting of the way in which it will be possible to adopt and implement the new risk management process at the level of activities in Romania for attracting European non-reimbursable financing, we will further describe the necessary actions and estimated results in relation to each stage of accessing the European structural and investment funds.

Stage 1 – Defining of the main areas of intervention, the general and specific objectives of the funding programme and establishing the outcome indicators

The first stage of the process of attracting non - reimbursable grants coming from European funds is one of planning and clearly establishing the headings or general development directions addressed at national level during a new multiannual financial framework.

Although experts in the field of project management consider that planning is extremely important, therefore recommending that this stage represent and occupy approximately 5% of the total implementation time of the actions considered [3], in the case of our country there are very few situations, particular in fact, about which we can say that fall into these proposed patterns.

The concept of risk management, through the model developed and presented previously, comes to propose and adopt a new approach, much more flexible and efficient in terms of the volume of work involved to carry out in optimal conditions the programming activities of a multiannual financial framework. Therefore, in accordance with the principles and phases of ensuring risk management, we consider that this particularly important stage will be much better fulfilled given that the negotiations between the representatives of our country and those of the European Union will focus on exactly the same elements as in the case of a simple investment project, respectively on the objectives of the multiannual financial framework, on its duration and the budget allocations made for the achievement of the result indicators, and, at the same time, on the identification and management of the risks that could materialize in a certain context and that could produce effects with negative impact.

In the meaning of the previously expressed considerations, we consider that the implementation of the risk management model within the first stage of accessing the European non-reimbursable financing will be possible through the five key points, represented graphically in Fig. 2.

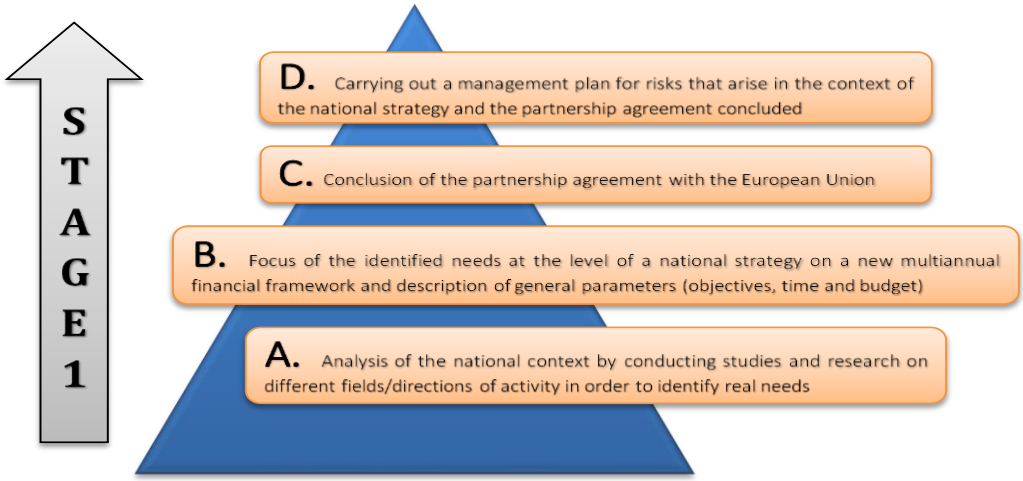

Fig. 2. The key points of Stage I
Source: Own contribution.

Stage 2 – Preparation by the managing authorities of the specific documentation for accessing the grants and launching calls for projects according to the established priorities

From the perspective of the new management tool developed, the risk management plan drawn up following the partnership agreement concluded for a multiannual financial framework must be transposed, depending on each heading and/or direction of development, into the guidelines for applying for non-reimbursable grants as methodologies for drawing up risk management plans for project proposals through which funding will be requested and/or obtained.

At the same time, we must understand that the need to reduce the workload and implicitly the time allocated to this stage is more than obvious if we want to achieve good results at national level in terms of the degree of absorption of European structural and investment funds. In this context, as can be seen from Table 1, the relaxation invoked can be achieved in this stage precisely as a result of the adoption of this modern risk management mechanism and the implementation of a simplified process for drawing up the documentation for requesting non-reimbursable European grants.

Stage 3 – Evaluation of the submitted project proposals, their ranking according to the established selection criteria and contracting of the projects admitted

Given the proposed context and the modern interpretation of the previous stage, we admit that the third stage will continue to address the process of evaluating project proposals submitted also from the perspective of risks that could materialize during the implementation of a project.

In the light of the above, we appreciate that the funding application documentation could be analyzed, evaluated and scored according to the selection and evaluation grid of the project proposals, in a first phase, through a programming software.

If we study carefully a classic evaluation grid of an investment project we will notice that there are a series of general elements according to which a project proposal will be scored better or less well. These elements and/or evaluation criteria are represented by the NACE codes for which funding is requested, the operation time of the applicant, the turnover, the operating profit, the average number of employees and other technical-financial indicators that can be taken from reliable sources, respectively from the financial statements already submitted to the National Agency for Fiscal Administration or from any other documents issued by the National Office of the Trade Register and/or

other state institutions, as well as the expected results as a result of the investment, among which we mention evaluation criteria such as the number of new jobs created, the share of certain types and categories of expenses in the total value of the project, the region where the project will be implemented, the beneficiary's own contribution, the existence of components for environmental protection and of support for disadvantaged people and the like, which the system can access from the funding application forms.

Table 1. Comparative analysis of funding application documentation

CRT. NO.	FUNDING APPLICATION DOCUMENTATION -CLASSIC MODEL-	FUNDING APPLICATION DOCUMENTATION -RISK FOCUSED MODEL-
The stage of submitting the funding application documentation		
1.	Funding Application Form	Funding Application Form
2.	Mandate/Power of Attorney electronic signature	Single Declaration
3.	Proof of registration and Provision of extended information - The National Office of the Trade Register (issued no later than 30 days before the submission of the funding application)	Documents concerning the applicant's right on the land/buildings covered by the project (if applicable)
4.	Declaration of Eligibility	Risk Management Plan
5.	Declaration of Commitment	Evidence of the financial capacity
6.	SME Declaration (if applicable)	
7.	Declaration of VAT eligibility	
8.	Consent on the processing of personal data	
9.	Annual financial statements for the financial year preceding the submission of Funding Application Form	
10.	Documents concerning the applicant's right on the land/buildings covered by the project (if applicable)	
11.	Town Planning Certificate (if applicable)	
12.	Estimate for projects that include construction works	
13.	Business plan/Feasibility study, including analysis and financial forecast	
Pre-contracting and contracting stage		
1.	Declaration of Eligibility	Single Declaration, updated (if applicable)
2.	Declaration on the classification in the SME category	Evidence of financial capacity, updated (only if more than 90 days have elapsed since the previous one)
3.	Proof of registration and Provision of extended information - The National Office of the Trade Register (issued no later than 30 days before the submission of the funding application)	
4.	Tax Registration Certificate	
5.	Fiscal Record Certificate	
6.	The most recent annual financial statements	
7.	Evidence of the financial capacity	

Source: own contribution.

Note: The classic model of funding application documentation presented in the table is valid for private beneficiaries in the category of small and medium enterprises (SMEs), being used in the 2014-2020 Regional Operational Programme, Priority Axis 2 - *Improving the competitiveness of small and medium enterprises, Investment priority* 2.2. - *Supporting creation and expansion of advanced production capacities and the development of services*. It has been presented as an example and can be adapted or exported in the same way also in the case of funding addressed to public institutions at central, regional or local level.

This mechanism would streamline the process of evaluating funding applications and could generate an objective first impression for the evaluators who will intervene in the second phase of the evaluation, respectively when focusing their attention on the risk management plan proposed by each applicant.

The assessment carried out in this point will focus on the coherence, quality and veracity of the risk management plan proposed in the context of the parameters for carrying out the investment projects defined at the level of the grant application documentation, respectively on the specific purpose and objectives

declared, during implementation of activities and on the budget allocated to the latter.

Furthermore, during this phase, we consider it necessary to have an exchange of recommendations and/or requests for clarification between the members of the evaluation committees and the representatives of the applicants, but not more than two, through which to finalize the structure and actions of the risk management plan associated with the projects. Therefore, the existence of the specific principles of an integrated and participatory strategic management will be simultaneously ensured and guaranteed, supported, in this case, by the direct relationship between the beneficiary and the national granting authority (funder and administrator of the funding programmes).

Stage 4 – Implementation of projects by beneficiaries according to the financing contracts concluded with the granting authorities

The biggest problems in attracting and accessing European non-reimbursable funds most likely occur in the implementation phase of contracted projects, when the reality shows us that the projections associated with the financing application documents and the specific activities aimed by the projects cannot be put into practice and fulfilled under the declared conditions and/or in compliance with the assumed parameters (specific purpose and objectives, time and budget).

A further aspect not to be underestimated regarding this stage is the fact that the related, administrative and procedural activities, necessary to be carried out according to the provisions of the concluded financing contracts, are so many and complex that they often consume the most part of the attention and concentration of the implementation team and/or of the resources of the beneficiary entity.

The reality is that, just as in the case of the other stages, insofar as we manage to use a strategic project management system, strongly oriented towards the identification and management of risks that could materialize, we will obtain a quick solution of the two previously stated problems. In this regard, we believe that by implementing a modern risk management mechanism, such as the one developed, we will obtain, first of all, a better attention on the parameters of carrying out the investment projects and not on the related activities of reporting, modification and reimbursement.

Also, given that we will opt for a risk-focused reporting system, we will be able to achieve a reduction of at least 40% in the volume of information reported (given the number of sections required to be completed in the report). This aspect will facilitate the high-efficiency fulfillment of the actions for reporting the stage of the investment project and, at the same time, will considerably reduce the time for the preparation of the necessary supporting documents.

In essence, the model promoted would ensure the achievement of the objectives pursued in connection with this stage, respectively to focus the attention and resources of the beneficiaries, but also those of funding authorities, on the parameters for carrying out the projects and not on the procedural aspects or on the formal and/or complementary activities.

Stage 5 – Completing the project implementation process and starting of the stage of monitoring their sustainability

From the perspective of the new risk management model proposed and the unique way in which the process is being dealt with in a general manner, we consider that even at this stage the relations between beneficiary – national granting authority (funder and administrator of funding programmes) – European granting authority (funder) must be based on the same principles as in previous cases. We also consider that the risk management plan should be updated and supplemented only with risk factors that may still occur and may manifest until the project monitoring is completed. Furthermore, we believe that the sustainability reports submitted by the beneficiaries should highlight only the issues related to this stage and less the elements related to the implementation and carrying out stage of the

projects, as they have already been verified and approved by the granting authority as being carried out in compliance with the provisions of the concluded financing contracts.

In this case, the focus will be on the remaining issues and less on the ones already completed, so as to ensure the premises for streamlining activities and relieving the beneficiaries of all unnecessary tasks.

CONCLUSIONS

In conclusion, as can easily be seen from a simple reading of this article, all the proposed solutions focus on the idea of reforming and streamlining the mechanism for accessing non-reimbursable grants through a modern risk management process. The latter would generate, in accordance with the studies carried out, a relaxation and a streamlining of the procedures to be followed and would determine in a short time a strong impact on the level of absorption of the European non-reimbursable financing available in Romania.

We also understand that the biggest problems of the process of accessing a non-reimbursable grants are in a close interdependence with the notion of risk and, at the same time, that they could be kept under control only by applying a particular concept of management. Therefore, we have concluded that, in the event that we really want to reform the mechanism for accessing European funding, we must start in this national approach from the causes generating problems, which we recommended to approach seriously, from a unique perspective and with the help of a modern and strong management tool oriented towards the risk management process.

Moreover, the innovative mechanisms and techniques of ensuring an efficient risk management process have proved, following the research carried out, to be capable of having a positive and economically significant impact precisely because they could ensure a relaxation and a streamlining of the stages related to the process of accessing the European structural and investment funds available in Romania, as well as an increase in the absorption rate.

Finally, we believe that more attention should be paid to this issue and we recommend that the national institutions managing the budgets of European funding programmes should study and consider the possibility of adopting and implementing such a system.

Regarding to the common agricultural policy (CAP) and its fundamental role to supports the vibrancy and economic viability of rural communities through rural development measures, we think that the new risk management system could be a key to a better management of financial allocations and also to a fast fulfillment of the three long-term rural development objectives for the 2021-2027, namely:

-fostering the competitiveness of agriculture,

-ensuring the sustainable management of natural resources and climate action,

-achieving a balanced territorial development of rural economies and communities including the creation and maintenance of employment [4].

On the other hand, because the European agricultural fund for rural development (EAFRD) acts as a source for loans and microcredits available to recipient in agriculture, forestry and rural areas who are undertaking financially viable project that support the priorities of the EAFRD, we should understand that a much more simple structure of the management process will be more responsive to current and future challenges while continuing to support European citizens for a sustainable and competitive rural environment.

That being said, we are in the position to say that providing and implementing a strategic project management concentrate on risk management process will lead to a better coordination and adaptation of the EAFRD objectives, to better absorption rank and, of course, to a relaxation and a simplification of the relationship between beneficiaries and managing authorities or intermediate bodies [1].

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STATISTICS OF THE RURAL POPULATION FROM THE REGIONAL PERSPECTIVE

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Abstract

The paper aims to analyze the regional level trends of the rural population, in the period 2010-2018. We used the following demographic indicators: rural population, rural internal migration, natural population growth in rural areas, rural female population, rural female fertile contingent, rural elderly population, rural young female population and labor force indicators: female labor renewal in rural areas, rural employed population, rural employment rate, unemployment in rural areas, rural unemployment rate, rural employed population by activity sectors. If in the period 2005-2010 there are trends of deruralization, starting with 2010 a reversal of trend is identified: in all development regions we identify a sharp increase in the percentage of rural population. The accentuated increase of rurality is mainly due to the internal migration of the population, with a positive balance in the rural environment. On the other hand, the analysis of the data regarding the fertile female quota shows that the share of the fertile female population decreased in all development regions, hence the negative values of the natural population growth, all in the context of the constant accentuated increase of the elderly population. From the perspective of the structure by sectors of activity of the employed population, the following are highlighted: predominantly agrarian areas: North-East Region, South-West Oltenia Region and South-East Region - areas dominated by industry and constructions, Central Region and West Region, areas dominated by services Bucharest-Ilfov Region.

Key words**:** *rural population, regional profile, Romania*

INTRODUCTION

In 2019, the rural population counts 8,959,096 people, which represents a percentage of 46.15% of the total population [2].
Lack of technical endowment and financial resources, aging population, lack of jobs, low level of training and low productivity are the main characteristics of rural areas [2, 3, 9]. Also, low level of education has a profound impact on work performance in terms of concerns the production and management of farms, product quality and market competitiveness [8].
The rural area has a multitude of resources (natural, economic, social, cultural) [1, 4] but the main resource of rural development is the rural population.
Knowing its characteristics is extremely important from the perspective of planning and implementing regional and national development policies. It is necessary to develop national programs, focused on regional needs, in order to increase the birth rate, promote social inclusion, and reduce poverty and economic development in rural areas [5, 6].
In this context, the paper aims to analyze the demographic and economic characteristics of the rural population, in the period 2010-2018, in regional profile.

MATERIALS AND METHODS

In this research we used statistical data provided by the National Institute of Statistics, for the period 2010-2018 through the following publications: Regional economic and social landmarks: Territorial Statistics, 2020, Tempo online and were processed using index, sharing and comparison methods.

We used the following demographic indicators: rural population, rural internal migration, natural population growth in rural areas, rural female population, rural female fertile contingent, rural elderly population, rural young female population and labor force indicators: female labor renewal in rural areas, the population employed in rural areas, the employment rate in rural areas, unemployment in rural areas, the unemployment rate in rural areas, the rural population employed by activity sectors.

RESULTS AND DISCUSSIONS

Demographic Indicators

Percentage of the rural population evolution

The deruralization tendencies, present in the period 2005-2010, can be identified in the form of continuity in the Bucharest-Ilfov and West Development Regions or of the specificity in the North-East and South Muntenia Development Regions due to the high percentage of the rural population which has a significant share in total population.

Starting with 2010, a trend reversal is identified: in all development regions we identify a sharp increase in the percentage of rural population, more significant in the Bucharest-Ilfov Region (3.32 percentage points), the West Region (2.33 percentage points), the Center Region (2.13 percentage points), South-East Region (2.12 percentage points) (Table 1).

The evolution of internal migration

The accentuated increase of rurality is mainly due to the internal migration of the population, with a positive balance in the rural environment. In 2016 there is a significant increase in the number of people who settled in rural areas with high values in Macro-region 3 of 11,519 people and Macro-region 1 of 10,951 people. (Table 2).

Table 1. Percentage of the rural population evolution **(%)**

	2005	2010	2015	2016	2017	2018
MacroRegion1	43.6	43.7	45. 24	45. 20	45.30	45.28
Region North-West	46.8	46.6	47.44	47.60	47.67	47.59
Region Center	40.1	40.6	42.39	42.56	42.69	42.73
Macro-region 2	51.3	51.6	53.33	53.38	53.40	53.32
Region North-East	56.6	56.7	58.34	58.31	58.26	58.13
Region South-East	44.5	44.8	46.74	46.87	46.95	46.92
MacroRegion 3	38.8	37.8	39.14	39.20	39.17	38.95
Region South Muntenia	58.3	58.4	60.48	60.59	60.62	60.51
Region Bucharest-Ilfov	9.5	8.1	10.7	11	11.26	11.42
MacroRegion 4	45.1	45.0	46.63	46.88	46.96	46.81
Region South-West Oltenia	52.4	51.8	53.91	54.12	54.08	53.77
Region West	36.4	36.9	38.57	38.91	39.14	39.23

Source: Own calculations based on data from "Regional Economic and Social Landmarks: Territorial Statistics", NIS, 2020 [6].

Table 2. Evolution of internal migration (persons)

	2015	2016	2017	2018
MacroRegion 1	8,458	10,951	8,778	8,249
Region North-West	5,152	6,778	5,604	4,883
Region Center	3,306	4,173	3,174	3,366
MacroRegion 2	5,206	5,754	1,007	-203
Region North-Est	2,722	2,438	263	-450
Region South-Est	2,484	3,316	744	247
MacroRegion 3	8,271	11,519	6,303	5,234
Region South Muntenia	2,106	3,849	-636	-1,159
Region Bucharest-Ilfov	6,165	7,670	6,939	6,393
MacroRegion 4	6,834	10,114	6,218	5,885
Region South-West Oltenia	1,562	3,512	-207	-728
Region West	5,272	6,602	6,425	6,613

Source: own calculations based on data from "Regional Economic and Social Landmarks: Territorial Statistics", NIS, 2020 [6].

The evolution of natural population growth

In the period 2015-2018, negative values of the "natural population growth" were registered in all the analyzed regions, except for the Bucharest-Ilfov Region. In 2018 in Bucharest-Ilfov region, the level of the indicator was 452 people (Table 3).

Table 3. Evolution of "natural population growth" in rural areas (persons)

	2015	2016	2017	2018
MacroRegion 1	-9,089	-6,146	-7,033	-8,779
Region North-West	-5,303	-3,531	-4,262	-4,729
Region Center	-3,786	-2,615	-2,771	-4,050
MacroRegion 2	-15,104	-14,160	-24573	-19,896
Region North-East	-5,067	-4,410	-6,281	-7,523
Region South-East	-10,037	-9,750	-11,259	-12,373
MacroRegion 3	-17,698	-16,488	-17,008	-16,537
Region South Muntenia	-16,110	-15,984	-16,829	-16,989
Region Bucharest-Ilfov	-1,588	-504	-179	452
MacroRegion 4	-18,556	-15,837	-17,670	-15,955
Region South-West Oltenia	-11,618	-10,274	-10,903	-10,222
Region West	-6,938	-5,563	-6,767	-5,733

Source: own calculations based on data from "Regional Economic and Social Landmarks: Territorial Statistics", NIS, 2020 [6].

The evolution of the rural female population

From the perspective of the structure of the rural female population, the data shows a slight continuous decrease in the number of women, in all the development regions of Romania (Table 4). The largest decrease in the female population is registered by Macro-region 3 with -0.65 percentage points.

Table 4. Weight evolution of the rural female population (%)

	2010	2015	2016	2017	2018
MacroRegion 1	50.10	49.98	49.94	49.86	49.79
Region North-West	50.30	50.22	50.17	50.08	50.01
Region Center	49.80	49.69	49.65	49.58	49.53
MacroRegion 2	49.60	49.49	49.42	49.33	49.23
Region North-East	49.50	49.31	49.23	49.14	49.02
Region South-East	49.90	49.78	49.72	49.65	49.58
MacroRegion 3	50.60	50.29	50.20	50.08	49.95
Region South Muntenia	50.60	50.23	50.12	50.00	49.86
Region Bucharest-Ilfov	51.30	50.77	50.72	50.66	50.62
MacroRegion 4	50.40	50.16	50.06	49.94	49.82
Region South-West Oltenia	50.30	50.04	49.92	49.79	49.65
Region West	50.20	50.36	50.27	50.18	50.08

Source: own calculations based on data from "Regional Economic and Social Landmarks: Territorial Statistics", NIS, 2020 [6].

The evolution of the fertile female contingent

The analysis of data on the female fertile contingent shows that the share of the fertile female population has decreased in all development regions.

The highest value of the decrease is registered by Macro-region 3 (-0.89 percentage points) and Macro-region 4 (-0.62 percentage points) (Table 5).

The evolution of the fertile female contingent, aged 25-29 years

The decrease of the rural female population in the age category 25-29 years is continuous in the period 2015-2018, with the largest decreases in Macro-region 3 (-12,705 persons) and Macro-region 2 (- 12,396 persons) (Table 6).

The structure of the rural population aged 65 and over

The analysis of the evolution of the rural population aged 65 and over shows a constant accentuated increase of the percentage of the

elderly population. The oldest rural areas of Romania are the South-West Oltenia Region (25%) and the South Muntenia Region (22.17%) (Table 7).

Table 5. Evolution of the fertile female contingent, in the period 2015-2018

	Feminine fertile contingent (15-49 years old)							
	2015		2016		2017		2018	
	Number	%	Number	%	Number	%	Number	%
MacroRegion 1	492,830	44.42	494,417	44.60	491,878	44.49	485,358	44.12
Region North-West	270,959	44.05	271,707	44.22	270,238	44.12	266,502	43.79
Region Center	221,871	44.88	222,710	45.07	221,640	44.94	218,856	44.52
MacroRegion 2	650,687	42.90	652,272	43.32	646,720	43.33	633,844	42.96
Region North-East	405,852	43.21	407,098	43.65	404,355	43.72	397,467	43.44
Region South-East	244,835	42.40	245,174	42.78	242,365	42.69	236,377	42.17
MacroRegion 3	458,842	43.70	458,790	43.94	451,756	43.63	437,856	42.81
Region South Muntenia	395,836	42.76	393,584	42.94	385,141	42.57	371,039	41.72
Region Bucharest-Ilfov	63,006	50.72	65,206	51.10	66,615	50.90	66,817	50.06
MacroRegion 4	371,903	41.70	372,042	41.92	366,941	41.72	356,373	41.07
Region South-West Oltenia	218,132	40.33	217,102	40.51	212,581	40.24	204,485	39.50
Region West	153,771	43.80	154,940	44.06	154,360	43.94	151,888	43.39

Source: Own calculations based on Tempo online data, NIS, 2020 [7].

Table 6. Evolution of the fertile female contingent, aged 25-29, during 2015-2018

	2015	2016	2017	2018	Evolution 2018/2015
MacroRegion 1	68,198	65,599	61,912	58,254	-9,944
Region North-West	36,930	35,512	33,622	31,787	-5,143
Region Center	31,268	30,087	28,290	26,467	-4,801
MacroRegion 2	76,819	72,679	67,521	64,423	-12,396
Region North-East	46,623	44,427	41,760	40,555	-6,068
Region South-East	30,196	28,252	25,761	23,868	-6,328
MacroRegion 3	60,929	57,584	52,734	48,224	-12,705
Region South Muntenia	51,327	48,128	43,667	39,770	-11,557
Region Bucharest-Ilfov	9,602	9,456	9,067	8,454	-1,148
MacroRegion 4	47,105	44,932	41,880	39,329	-7,776
Region South-West Oltenia	26,286	24,712	22,611	20,938	-5,348
Region West	20,819	20,220	19,269	18,391	-2,428

Source: Own calculations based on Tempo online data, NIS, 2020 [7].

Table 7. Weight evolution of the elderly population (%)*

	2015	2016	2017	2018	2019
MacroRegion 1	17.90	18.08	18.28	18.43	18.55
Region North-West	18.46	18.65	18.86	18.98	19.08
Region Center	17.20	17.37	17.57	17.74	17.89
MacroRegion 2	19.22	19.37	19.56	19.65	19.70
Region North-East	18.73	18.86	18.99	19.05	19.05
Region South-East	20.01	20.21	20.48	20.64	20.79
MacroRegion 3	20.46	20.66	20.85	21.03	21.18
Region South Muntenia	21.26	21.51	21.75	21.98	22.17
Region Bucharest-Ilfov	14.32	14.42	14.41	14.49	14.61
MacroRegion 4	21.85	22.13	22.34	22.60	22.82
Region South-West Oltenia	23.82	24.15	24.37	24.70	25.00
Region West	18.78	19.02	19.23	19.44	19.58

*65 years and over population/total population. Source: own calculations based on data from NIS, 2020 [7].

The structure of the rural female population aged between 0 and 19 years

The structure of the rural female population shows a continuous decrease of the age segment 0-19 years. The exception is the

Bucharest-Ilfov Region with a growing percentage of the young female population (21.17%). The youngest areas of Romania, from the perspective of women are the North East Region (25.68%) and the Central Region (24.05%) (Table 8).

Table 8. Percentage evolution of the young female population (%)*

	2015	2016	2017	2018	2019
MacroRegion 1	23.29	23.29	23.24	23.24	23.16
Region North-West	22.66	22.62	22.51	22.53	22.44
Region Center	24.09	24.12	24.13	24.11	24.05
MacroRegion 2	25.13	25.00	24.86	24.71	24.45
Region North-East	26.45	26.29	26.15	25.97	25.68
Region South-East	23.00	22.88	22.75	22.66	22.45
MacroRegion 3	20.50	20.42	20.33	20.29	20.15
Region South Muntenia	20.48	20.35	20.23	20.15	20.00
Region Bucharest-Ilfov	20.72	20.92	21.08	21.23	21.17
MacroRegion 4	19.82	19.66	19.42	19.31	19.12
Region South-West Oltenia	19.28	19.06	18.70	18.52	18.28
Region West	20.64	20.58	20.51	20.49	20.35

*0-19 years female population / total female population
Source: Own calculations based on data from NIS, 2020 [7].

Labor force

The evolution of the female labor force renewal index

The female labor force renewal index has been steadily declining, showing the inability of rural areas to secure their female labor force (Table 9).

Table 9. "Renewal of the female labor force" index value evolution *

	2010	2015	2016	2017	2018	2019
MacroRegion 1	95.5	86.47	86.73	86.25	84.98	84.12
Region North-West	95.7	85.74	85.88	85.33	84.27	83.58
Region Center	95.0	87.38	87.78	87.38	85.86	84.77
MacroRegion 2	95.8	90.54	93.14	95.11	96.12	97.98
Region North-East	98.2	93.18	96.22	98.99	100.87	103.67
Region South-East	92.0	86.30	88.16	88.89	88.54	88.97
MacroRegion 3	85.2	81.81	82.38	81.65	79.92	78.35
Region South Muntenia	85.5	83.62	84.69	84.50	83.19	82.18
Region Bucharest-Ilfov	82.8	71.16	69.48	66.81	63.83	60.64
MacroRegion 4	89.8	85.52	86.45	86.23	85.19	84.30
Region South-West Oltenia	88.1	85.71	87.21	87.21	86.61	85.95
Region West	82.1	85.25	85.40	84.90	83.32	82.17

Source: Own calculations based on data from NIS 2020 [7].

Thus, in the Bucharest-Ilfov Region we notice a decrease from 82.8 percent in 2010 to a value of 60.64 percent in 2019. The exception is found in the North-East Region where the value of the index increased from 98.2 in 2010 to the value of 103, 67% in 2019.

The evolution of the structure of the employed population

The evolution of the structure of the employed population at regional level shows two specific trends:

- Increases in the number of employed population appear in 2018 in the South-West Oltenia Region with an increase of 27,000 people, the North-West Region with an increase of 26,000 people and the Bucharest-Ilfov Region with 21,000 people.
- In Macroregion 2 there are decreases of the employed population with 20,000 people (Table 10).

Table 10. The evolution of the employed population in the rural area, at regional level, in the period 2015-2018 (thousands of persons)

	2015	2016	2017	2018
MacroRegion 1	837	842	891	865
Region North-West	513	507	543	539
Region Center	324	335	348	326
MacroRegion 2	1,451	1,396	1,394	1,431
Region North-East	1,001	967	961	989
Region South-East	450	429	433	442
MacroRegion 3	875	851	880	894
Region South Muntenia	773	743	763	771
Region Bucharest-Ilfov	102	108	117	123
MacroRegion 4	710	676	737	730
Region South-West Oltenia	444	412	468	471
Region West	266	264	269	259

Source: Own calculations based on data from NIS, 2020 [7].

Evolution of the employment rate

The employment rate of the Bucharest-Ilfov Region shows a significant increase of 8.3 percentage points, from 59.7% in 2015 to 68% in 2018. Increases also occur in the South-West Oltenia Region of 6.3 percentage points to a value of 64.6% in 2018 (Table 11).

Table 11. The evolution of the employment rate in the rural area, at regional level, in the period 2015-2018 (%)

	2015	2016	2017	2018
MacroRegion 1	56.3	56.7	59.6	58.6
Region North-West	61.5	60.9	64.6	65.1
Region Center	50	51.6	53.5	50.6
MacroRegion 2	68.7	66	66.5	68.6
Region North-East	75.3	72.9	72.7	75
Region South-East	58.1	54.8	56.4	58.1
MacroRegion 3	60.6	59.9	62.2	63.7
Region South Muntenia	60.7	59.6	61.7	63
Region Bucharest-Ilfov	59.7	61.5	65.7	68
MacroRegion 4	57.8	55.3	60.7	61.1
Region South-West Oltenia	58.3	54.5	62.6	64.6
Region West	57.1	56.5	57.9	56.1

Source: Own calculations based on data from NIS, 2020 [7].

The evolution of unemployment

The evolution of the number of unemployed registers a decreasing trend in all development regions. The largest decreases are observed in the South Muntenia Region with a decrease of 34,000 people, followed by the South-West Oltenia Region with 15,000 people and the Center Region with 10,000 people (Table 12).

Table 12. The evolution of the unemployed in the rural area, at regional level, in the period 2015-2018- (thousands of persons)

Unemployed	2015	2016	2017	2018
MacroRegion 1	56	51	46	40
Region North-West	24	27	25	18
Region Center	32	24	21	22
MacroRegion 2	67	57	59	54
Region North-East	27	26	26	19
Region South-East	40	31	33	35
MacroRegion 3	86	76	68	56
Region South Muntenia	82	68	60	48
Region Bucharest-Ilfov	-	8	8	8
MacroRegion 4	64	68	51	44
Region South-West Oltenia	46	49	38	31
Region West	18	19	13	13

Source: own calculations based on data from NIS, 2020 [7].

Evolution of the unemployment rate

The unemployment rate has been downward in most regions. Thus, in the South Muntenia Region the decrease is of 3.7 percentage points, in the South-West Oltenia Region of 2.2 percentage points, and in the Central Region of 2.9 percentage points.

On the other hand, the Bucharest-Ilfov Region registered an increase in the unemployment rate by 1.8 percentage points (Table 13).

Table 13. The evolution of the unemployment rate in the rural area, at regional level, in the period 2015-2018 (%)

	2015	2016	2017	2018
MacroRegion 1	6.4	5.7	5.0	4.3
Region North-West	4.6	5.1	4.4	3.2
Region Center	9.1	6.7	5.7	6.2
MacroRegion 2	4.4	3.9	4.1	3.7
Region North-East	2.6	2.5	2.7	1.9
Region South-East	8.1	6.7	7.0	7.4
MacroRegion 3	8.9	8.2	7.2	5.8
Region South Muntenia	9.6	8.4	7.3	5.9
Region Bucharest-Ilfov	4.0	7.2	6.6	5.8
MacroRegion 4	8.3	9.1	6.5	5.7
Region South-West Oltenia	9.4	10.6	7.6	6.2
Region West	6.4	6.8	4.4	4.7

Source: Own calculations based on data from NIS, 2020 [7].

Structure by sectors of the employed population activity

From the perspective of the structure by sectors of the employed population activity, we observe the following:

-predominantly agricultural areas: North-East Region with a decrease of the agricultural field from 72.8% in 2015 to 67.3% in 2018, South-West Oltenia Region with a decrease of 71.7% in 2015 to 63, 6% in 2018 and the South-East Region with a decrease from 52.3% in 2015 to 44.7% in 2018;

-areas dominated by industry and construction, the Central Region with an increase from 36.6% in 2015 to 43.1% in 2018, the West region with an increase from 41.8% in 2015 to 51.2% in 2018;

-areas dominated by services appear in the Bucharest-Ilfov Region with an increase from 68.2% in 2015 to 70.6% in 2018 (Table 14).

Table 14. Structure by sectors of the employed population activity in the rural area, at regional level

		Thousands of people	Agriculture (%)	Industry and constructions (%)	Services (%)
MacroRegion 1	2015	837	36.8	32.6	30.6
	2018	865	31.2	37.8	31.0
Region Nord - West	2015	513	42.9	30.0	27.1
	2018	539	36.5	34.6	28.9
Region Center	2015	324	27.2	36.6	36.2
	2018	326	22.4	43.1	34.5
MacroRegion 2	2015	1,451	66.5	16.2	17.3
	2018	1,431	60.3	18.7	21.0
Region North-East	2015	1,001	72.8	13.2	14.0
	2018	989	67.3	15.3	17.4
Region South-East	2015	450	52.3	23.0	24.7
	2018	442	44.7	26.4	28.9
MacroRegion 3	2015	875	39.8	25.7	34.5
	2018	894	32.5	29.2	38.3
Region South Muntenia	2015	773	43.7	26.2	30.1
	2018	771	37.1	29.8	33.1
Region Bucharest-Ilfov	2015	102	9.7	22.1	68.2
	2018	123	3.9	25.5	70.6
MacroRegion 4	2015	710	53.9	24.1	22.0
	2018	730	46.6	29.3	24.2
Region South-West Oltenia	2015	444	71.7	13.5	14.8
	2018	471	63.6	17.2	19.2
Region West	**2015**	266	24.2	41.8	34.0
	2018	259	15.7	51.2	33.1

Source: own calculations based on data from "Regional Economic and Social Landmarks: Territorial Statistics", NIS, 2020 [6].

CONCLUSIONS

Even if in the period 2005-2010 there are trends of deruralization, starting with 2010 a reversal of trend is identified: in all development regions we identify a sharp increase in the percentage of rural population.
The accentuated increase of rurality is mainly due to the internal migration of the population, with a positive balance in the rural environment, especially in 2016.
Unfortunately, the natural population growth that shows negative values does not contribute to the increase of the number of the rural population, except for the Bucharest-Ilfov Region where the natural population growth is 452 people in 2018.
We have identified decreases of the rural female population, of the fertile female contingent, of the rural female population aged of 0-19 years, of the female labor force renewal index in all the development regions of Romania. All of this is noted in the context of the constant accentuated growth of the elderly population. The oldest rural areas of Romania are the South-West Oltenia Region (25%) and the South Muntenia Region (22.17%).
The evolution of the employed population structure at regional level shows two specific trends: - Increases in the number of employed population appear in 2018 in the South-West Oltenia Region, the North-West Region and the Bucharest-Ilfov Region. In Macroregion 2 there are decreases of the employed population.
The evolution of the number of unemployed registers a decreasing trend in all development regions.
From the perspective of sectors of activity of the employed population structure, we observe the following: Predominantly agricultural areas: North-East Region, South-West Oltenia Region and South-East Region; areas dominated by industry and construction, Central Region and\ West Region; service-dominated areas appear in the Region Bucharest-Ilfov .

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SELECTION OF SOCIAL INDICATORS FOR MEASURING SUSTAINABLE RURAL DEVELOPMENT

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Abstract

Rural development, sustainable development and sustainability are nowadays often mentioned in scientific publications, as well as in political discussions and the media. The concept of sustainability includes three sets of goals: economic, environmental and social. In this paper emphasis is put on the selection of the most appropriate social indicators for measuring sustainable rural development at NUTS 3 level. Objectives of the paper were: (1) to identify the most appropriate social indicators for measuring sustainable rural development already used or proposed in literature, (2) to choose the five most appropriate indicators according to experts' assessment. The analysis of existing research outlined and explained 18 social indicators. After the first phase of selection, an additional selection of indicators by expert evaluation was carried out. Based on the expert evaluation, five most relevant social indicators were identified, namely according to the average grade: age structure (4.70), availability of educational institutions (4.45), educational structure (4.34), availability of health institutions (4.32) and population growth between two censuses (4.32). Looking at separate assessments of each of the expert groups, it is evident that their selection of the five most relevant indicators coincides in three indicators: age structure, availability of educational institutions and educational structure.

Key words**:** *experts' evaluation, social indicators, sustainable rural development*

INTRODUCTION

Rural development, sustainable development and sustainability are nowadays often mentioned in scientific publications, as well as in political discussions and the media. The concept of sustainability includes three sets of goals: economic, environmental and social, which are connected by numerous and complex relationships [9]. Kordej-De Villa [26] believes that economic sustainability means achieving growth, efficiency and equitable distribution of wealth, while social s. implies the participation of the whole community in the decision-making process, their mobility and cohesion, institutional development, etc. As for the environmental dimension, the author says that it respects the integrity of different ecosystems, reception capacity and protection of natural resources.

The strategic goal of the European Union (EU) "to become the most competitive and knowledge-based dynamic economy in the world capable for sustainable economic growth with more and better jobs and better social cohesion" [3] in practice implies that the economic growth supports social progress and cares for the environment, that the social policy supports economic achievements and that the environmental policy is cost-effective. This is particularly important for the preservation of rural areas, which in the EU-28 occupy 52% of the area [11] and 22.8% of the population [10]. In some Member States, rural areas occupy more than 80% of the territory [11]. Differences in the age structure between urban and rural areas of the EU-27 are reflected in a smaller share of the population aged 0-14 in rural areas (15.3%) than in urban (16%) and a higher share of the elderly population (> 65 years) in the rural area (18.6%) compared to the urban (17%). The share of the population with completed minimum secondary school in rural areas of the EU-27 is 70.7%, rural-urban 73.5% while

the highest share is noted in the urban areas where it amounts to 77% [13].

Sustainable development covers many areas, of which sustainable rural development is the most interesting one for the agricultural profession. It is generally recognized as the result of those human activities that use rural resources to increase the well-being of residents [36]. Morgan et al. [30] highlight the multifunctionality of agriculture as one of the goals of sustainable rural development. As a broad generalization, within a large part of Northern Europe, multifunctionality is seen more in terms of the delivery of environmental services, whereas in Southern Europe, multifunctionality is perceived more in socio-cultural terms [38].

The main role in achieving sustainable rural development should be played by the local community, which is also emphasized in Agenda 21, while in Croatia only local authorities, which are only one of the components of the local community, are recognized as the ones who "play a vital role in achieving the main objectives at the local level" [35]. Sustainable rural development can be achieved in different ways and with different tools, i.e. by organizing expert workshops for local people and improving access to information, resources and innovative technologies.

As demonstrated above, the social component of sustainable rural development is indeed very important and therefore the first objective of the paper is to identify the most appropriate social indicators for measuring sustainable rural development already used or proposed in literature. The second objective is to choose the five most appropriate indicators according to experts' assessment.

MATERIALS AND METHODS

The first step of the research was a literature review with the objective of defining theoretical-methodological determinants of the paper and identifying a broader set of social indicators of rural development used in different works of research, as well as the ones only proposed by competent institutions. Those are the indicators that certain institutions (e.g. the European Commission) proposed in their templates for assessing rural space sustainability, but examples of their use in specific works of researchers have not been found.

The second step was the experts' assessment of identified indicators with the objective of a narrower selection.

On a scale from one to five, the experts determined the relevance of each indicator for the assessment of sustainable development.

The experts could also suggest other indicators that they consider important, and were not on the list of offered indicators.

The expert assessment was conducted face to face and via e-mail, among 47 expert representatives of scientific institutions connected with rural development, sociology and economy, representatives of counties connected with rural development and agriculture, representatives of various relevant agencies and associations and leaders of Local Action Groups (LAG) operating in Croatia. The expert assessment included 20 representatives of scientific institutions, 20 representatives of LAGs and associations and seven representatives of local and state bodies (counties, ministries and agencies).

The research was conducted in the period from July to August 2016.

The data was processed in the SPSS Statistic 17.0 program, that calculated the average for each indicator and performed a Chi-square test for the experts' workplace dependence with grades assigned to each indicator.

RESULTS AND DISCUSSIONS

Proposed social indicators for measuring sustainable rural development with results

Based on the literature existing at the disposal, and analyzing the previous works of research on the subject of sustainable rural development, especially its social component, it was singled out a number of 18 indicators.

The names of these social indicators and the names of the authors who studied them are synthetically presented in Table 1 and described below.

Table 1. List of proposed social indicators with specified authors that used/proposed them

Social indicator	Authors using/proposing the indicator
Number of women in local self-government councils in relation to the total number of councilors	Niggemann, 2009; Golusin and Munitlak Ivanović, 2009; FAO, 2013 [32, 19, 16]
Number of agricultural holdings in which women are stakeholders	Niggemann, 2009; FAO, 2013 [32, 16]
Age structure	EC, 2001; EC, 2013 [9, 13]
Number of single person households in rural areas	-
Availability of health institutions – number of general practice clinics per km^2	UN, 2007; Khalifa and Connelly, 2009; Ramos, 2009; OG 30/2009; Global Ecovillage Network (n.a.) [39, 24, 37, 35, 18]
Availability of postal services – number of post offices per km^2	-
Availability of basic groceries – number of grocery stores per km^2	Niggemann, 2009 [32]
Availability of educational institutions – number of primary and secondary schools per km2	OG 30/2009; Global Ecovillage Network (n.a.) [35, 18]
Quality and frequency of public transport lines	Ferrarini at al., 2001; Niggemann, 2009; OG 30/2009; Dolata, 2013; Global Ecovillage Network (n.a.) [17, 32, 35, 7, 18]
Tradition and cultural facilities	Global Ecovillage Network (n.a.) [18]
Voter turnout in the last local and parliamentary elections	Niggemann, 2009; Ramos, 2009 [32, 37]
Crime rate	UN, 2007; OG 30/2009; Ramos, 2009; Niggemann, 2009; Global Ecovillage Network (n.a.) [39, 35, 37, 32, 18]
Number of active theaters, cinemas and cultural and artistic societies in the county in relation to the number of inhabitants	Niggemann, 2009 [32]
County expenditure (NUTS 3 region) for culture	Niggemann, 2009 [32]
Population growth between two censuses	UN (2007); Ramos (2009); OG 30/2009; Khalifa and Connelly, 2009 [39, 37, 35, 24]
Age and gender structure	Niggemann, 2009; EC, 2001 [32, 9]
Institutional efficiency (legislative framework, informal links, governance mechanism)	EC, 2001 [9]
Educational structure	EC, 2001; Ramos, 2009; EC, 2013a [9, 37, 14]

Source: Authors' synthesis based on literature.

Number of women in local self-government councils in relation to the total number of councilors

This and the next indicator belong to the group of gender equality indicators. When measuring this indicator, gender equality is observed within the county assembly. The County Assembly is a representative body of citizens and a body of regional self-government (NUTS 3 level) which adopts acts within the scope of the county and is elected every four years. The assumed ideal ratio of men to women in the convocation is 50:50 [32]. The gender equality indicator is proposed by the FAO [16] and used by Golusin and Munitlak Ivanović [19] to measure sustainable development in the countries of Southeast Europe as a share of women in the parliament. When measuring this indicator, the county whose ratio is closer to ideal is attributed more points.

Number of agricultural holdings in which women are stakeholders

Niggemann [32] also cites differences in income between men and women as one of the indicators of gender equality. Here, the number of family farms with women as stakeholders is taken as an indicator directly showing these inequalities, since agriculture is one of the main sources of income in rural areas. The gender equality indicator proposed by the FAO [16] also coincides with this indicator. The closer the share of women who run a family farm in a particular county (NUTS 3 level) to 50%, the higher the grade attributed to the county.

Age structure

Age structure is related to education level, behaviors, managerial skills, and commitment to agriculture [5]. Age structure determinants are: birth rate, mortality, migration and external factors (economic crisis, war, natural disasters, etc.). Age structure also affects future changes in population movement by determining the birth rate, mortality and population growth rate [41]. As highlighted in the EU Sustainable Development Strategy [9], Europe must face the economic and social impact of an aging population.

The indicator is proposed by the EC [9] in the Framework for Indicators for the Economic and Social Dimension of Sustainable Agriculture and Rural Development. It has also been used by the EC [13] to produce reports on rural development in the EU.

In order to determine the degree of aging, it is proposed to use a special model for evaluating age composition (Table 2). Nejašmić [31]

states that such model is better than the usual one because it scores each parameter separately (young and old population), and by summing these values, allows to obtain a point-based indicator of the aging of a certain population.

Table 2. Scoring procedure of the population aging indicator

Share of young people (%)	Points	Share of old people (%)	Points
0.0-5.0	0.0-5.0	0.0-10.0	70.0-60.5
5.5-10.0	5.5-10.0	10.5-20.0	60.0-50.5
10.5-15.0	10.5-15.0	20.5-30.0	50.0-40.5
15.5-20.0	15.0-20.0	30.5-40.0	40.0-30.5
20.5-25.0	20.5-25.0	40.5-50.0	30.0-20.5
25.5-30 and more	25.5-30.0	50.5-60.0	20.0-10.5
		60.5-70.0 and more	10.0-0.0

Source: [31].

Points are attributed according to the aging standardization given in Table 3.

Table 3. Aging categorization based on point value

Aging point indicator	Type	Characteristic
90.5-100.0	1	On the verge of aging
84.5-90.0	2	Aging
73.0-84.0	3	Old age
65.5-72.5	4	Deep old age
50.5-65.0	5	Advanced deep old age
30.5-50.0	6	Very deep old age
0.0-30.0	7	Extremely deep old age

Source: [31].

Number of single person households in rural areas

Single person households, according to the definition by Eurostat [15], are those households in which a person lives alone in a separate housing unit as well as those in which the person lives independently, as a tenant in a separate room in the same household as other tenants. As seen from Eurostat [15] data, more than 15% of single person households in Croatia are people over 65 years of age.

The starting point here is the fact that elderly single person households in rural areas present a special problem. These people are very often engaged in agriculture (either extensively or intensively) and after their death there will be neglect of the land and space where they lived.

The indicator is measured as the share of single person households in the county, which is then compared with the national average. If the share of single person households in a certain county is higher than the average, the county receives less points.

Presented below are several indicators (availability of health and educational institutions, postal services, basic groceries and quality public transport) that could be collectively called Accessibility of goods and services. The indicator is proposed by the EC [9] in the Framework for Indicators for the Economic and Social Dimension of Sustainable Agriculture and Rural Development, with a suggestion that transport, telecommunications and accessibility of health institutions, social and cultural activities are included within this indicator. Niggemann [32] measures this group of indicators as the distance from one social security (pension) office to another. We are of the opinion that these offices in Croatia are not of key importance for the well-being of the population, and they are neither necessary on a daily basis, which is why the Indicator of the availability of health institutions is proposed here instead.

Availability of health institutions – number of general practice clinics per km^2

According to the World Health Organization, primary health care is based on five basic principles [1] of which the most important for this work is the first one: accessibility (equal distribution). This principle applies to the equitable distribution of care to all people regardless of gender, age, race, economic status and geographical location. Primary health care seeks to meet the needs of the whole community and each individual as close as possible to their place of residence and work, at an affordable price and with the use of scientific, practical and socially acceptable methods [23]. In addition to being a value in itself, health is also a prerequisite for economic progress, as it affects economic performance in terms of productivity, labor supply, human capital and public spending

[12]. The importance of health care in rural areas is highlighted by Dolata [7] in Infrastructure and Sustainable Rural Development – Some Theoretical Aspects. The indicator is used in the Community Sustainability Assessment manual [18], where the availability of primary health care, dental medicine, pediatricians, emergency care and other forms of health care and alternative treatment methods is monitored. It has also been used to monitor sustainable development in rural areas of Egypt as the number of hospital beds per 10,000 inhabitants [24]. It is proposed by the UN [39], Ramos [37] and the Strategy for Sustainable Development of the Republic of Croatia [35].

The indicator is measured as the number of patients per doctor, the number of women per gynecologist and the percentage of residents of the observed county who do not have a doctor of general practice in their municipality. The obtained results are compared with the national average and the counties are then ranked.

Availability of postal services – number of post offices per km^2

The basic indicators of the postal network development level according to international conventions are: (1) average number of inhabitants served by one post office, (2) average number of inhabitants per counter, (3) size of territory (in km²) covered by one post office, (4) size of delivery areas and (5) number of mailboxes, vending machines, etc. [25]. The postal sector is an important infrastructural element that provides access to crucial networks and services for the development of economic activities and the overall functioning of society. Ramification and accessibility of the national postal network and its integration into the global networks, as well as the quality of the postal service, directly stimulate economic growth [29].

This indicator is measured as the area of the territory covered by one post office. The county with the lowest score receives more points.

Availability of basic groceries – number of grocery stores per km^2

Lerch [27] states that complex security policies are needed for food security, including the development of sustainable agriculture, food processing and trade; the provision of financial support to vulnerable groups and the fight against malnutrition. In this paper, availability of basic groceries meant the possibility of buying them in the closest possible environment. Since a large rural population is elderly, traveling to nearby cities with larger shopping malls poses a problem (not owning a car, lack of public transport). It is very important for these people that their grocery stores are as close as possible to their place of residence so that they can buy basic groceries on a daily or at least weekly basis.

Niggemann [32] cites this indicator as one of the components within the indicator "Availability of goods and services".

This indicator is measured as the number of grocery stores per square kilometer. Shopping centers and shops in city centers are excluded from the calculation. The county with a larger number of shops per square kilometer receives more points because it is considered that basic groceries are more accessible to these residents.

Availability of educational institutions – number of primary and secondary schools per km^2

The Strategy of Science, Education and Technology states that education in Croatia is available to all under equal conditions and in accordance with their abilities [33]. According to the Primary and Secondary Education Act [34], school institutions network must meet the requirements of accessibility and rational organization of enrollment areas, i.e. school institutions and education programs. Accessibility of school institutions means the possibility of regular upbringing and education in a primary school, i.e. a school building or institution appropriately distant from the place of residence, with traffic connections that do not endanger the safety of pupils. Availability of educational institutions is measured as the

number of primary and secondary schools per km^2. Higher number means better availability. The indicator is used in the Community Sustainability Assessment manual [18], which apart from the availability of primary education, also observes the availability of pre-school education, lifelong learning, secondary and higher education, various seminars and workshops, etc. The indicator was also proposed in the Strategy for Sustainable Development of the Republic of Croatia [35].

Quality and frequency of public transport lines

Mobility is a very important factor in today's society. People who do not own a car often depend on public transportation. Niggemann [32] states that this most often applies to old and young people and disabled persons. He believes that well-developed transport would contribute to better inclusion of residents in the community. Hanžek [21] states that public transport ensures mobility for all but this is not the case with cars. The importance of transport accessibility in rural areas is emphasized by Dolata [7]. The access to public transport indicator was proposed in the Strategy for Sustainable Development of the Republic of Croatia [35]. Public transport in Croatian rural areas is less developed, which is reflected in the small number of public transport lines to city centers, which consequently reduces the mobility of citizens who do not own a car or a driver's license. Ferrarini et al. [17] measure this indicator as a percentage of the population using public transport. In Sweden, Niggemann [32] measured this indicator as the percentage of people living within two kilometers of a train station. The result of 80%, was considered excellent 50% was satisfactory, and 20% was extremely unsatisfactory. The indicator is also used in the Community Sustainability Assessment manual, but in terms of reducing environmental pollution by more frequent use of public transport instead of cars. The indicator is measured as the frequency and proximity of bus lines in a particular area. The county in which transport is more accessible to a larger number of users and where the lines are more frequent receives more points. Due to the complexity of the calculation, it is proposed that the indicator be qualitative rather than quantitative.

Tradition and cultural facilities

The term tradition denotes cultural heritage such as the transmission of knowledge, customs and artistic crafts [6]. The Community Sustainability Assessment handbook [18] emphasizes the importance of cultural events and that they are accessible to all.

Due to the complexity and large scope, this indicator is divided into two sub-indicators: (1) tradition and (2) culture. The tradition sub-indicator is measured as the number of traditional crafts and events with old crafts in relation to the number of households, while the culture sub-indicator is measured as the number of events, performances, festivals and other cultural events in the county in one year.

Voter turnout in the last local and parliamentary elections

Voter turnout indicates the involvement of residents in the community [32]. The indicator is also suggested by Ramos [37]. This indicator is measured as the percentage of turnout in the last local elections, a result closer to 100% means a better county score.

Crime rate

This is a very important indicator that contributes to the overall quality of life in a particular area [32]. Niggemann [32] also states that this indicator is related to economic and social indicators such as unemployment rate and population growth. The indicator is used in the Community Sustainability Assessment manual [18], and is expressed as the frequency of criminal activities in the community. The Strategy for Sustainable Development of Croatia [35] proposes an indicator of the number of recorded violent crimes and murders per 100,000 inhabitants. The crime indicator is proposed by the UN [39] and Ramos [37] and used by Niggemann [32] who compared counties in Sweden. Here, it is proposed to measure the indicators by monitoring the number of reported crimes in the county in relation to the number of

inhabitants, and the national average is taken as a reference value.

Number of active theaters, cinemas and cultural and artistic societies in the county in relation to the number of inhabitants

Although the number of active theaters, cinemas and cultural and artistic societies in a given area does not reflect the number of cultural events or their attendance, their presence can be considered as a prerequisite for cultural events.

Niggemann [32] in her work measures the attendance of cultural events organized by the umbrella cultural organization in Sweden. Here it is proposed to measure the number of active theaters, cinemas and cultural and artistic societies per 1,000 inhabitants. The county with the higher number is attributed more points.

County expenditure (NUTS 3 region) for culture

Niggemann [32] divides the culture indicator into two sub-indicators, one of which is county expenditure on culture. The indicator is measured as the share of cultural expenditures in the county budget. The obtained result is compared with the share of expenditures for culture in the state budget. The county with the higher share is attributed a higher grade.

Population growth between two censuses

Population growth is very important for the sustainable development of an area because no matter how favorable the other indicators are, if there are no people in the area, the system is unsustainable. The indicator is proposed by Ramos [37], the UN [39] as well as the Croatian Parliament in the Sustainable Development Strategy of the Republic of Croatia [35]. It was used by Khalifa and Connelly [24] to monitor sustainable development in rural areas of Egypt.

It calculates the population movement in the past 25 years, i.e. the ratio between then and the present day. If there is no available data for the 25-year period, it is proposed to monitor population movements between the two censuses, which is usually 10 years.

Age and gender structure

"One of the most important population structures is the age structure, as it affects the socio-economic development of a certain population. It is a reflection of population development over a long period of time" [20]. The age and gender structure of a rural area is very important for its sustainability as young people increasingly leave these areas due to the lack of jobs and other facilities. Niggemann [32] calls this indicator population structure, consisting of three sub-indicators: (1) the share of people under 14, (2) the share of people over 65 and (3) the gender structure. The region with the highest share of young people (<14), the lowest share of old people (> 65) and where the gender ratio is equal receives the most points. Both of these indicators are also proposed by the EC [9] in the Framework for Indicators for the Economic and Social Dimension of Sustainable Agriculture and Rural Development.

This indicator is divided into two sub-indicators. The first sub-indicator is age and the second gender structure. To calculate the first sub-indicator, the population aged 0-19 and 65+ is taken and divided by the population aged 20-64 and multiplied by 100. The first two age groups are either too young or too old to work and thus depend on the working population [32]. The higher the number, the higher the county score. The second sub-indicator is the female-male population ratio. The county with the same number of men and women, or with the smallest deviation from the ideal ratio, receives the highest score.

Institutional efficiency (legislative framework, informal links, governance mechanism)

This indicator is listed in the Framework for Indicators for the Economic and Social Dimension of Sustainable Agriculture and Rural Development [9]. Quantitative measurement of this indicator is very difficult, so it is proposed to conduct interviews with several stakeholders in rural development and, based on the obtained data, rank the counties according to institutional efficiency. The questions in the interview should be focused

on the speed of obtaining various permits, availability of information, existence of legal acts regulating the area of rural development and their implementation, as well as existence and implementation of strategies in this area.

Educational structure

According to the OECD, the level of education of farmers and effective farm management as well as the timely adoption of environmentally sound management practices are positively correlated [5]. In terms of sustainability and the CAP, innovation is seen as key to stimulating a greater degree of acceptance of the more significant challenges of the future, including climate change, water conservation, and biodiversity protection [8] and for the acceptance of the innovation, education of farmers is prerequisite [22].

The indicator is proposed by the EC [9] in the Framework for Indicators for the Economic and Social Dimension of Sustainable Agriculture and Rural Development as the share of the population with higher education than the majority of the population; as the percentage of early school leavers; and as the share of the population between 18 and 24 years having only a high school diploma. It is also suggested by Ramos [37]. In addition to the level of completed education, he proposes measuring the share of early school leavers. The indicator was used in the EU Rural Development Report [14] as a percentage of the population between the ages of 25 and 64 with a minimum high school diploma.

Here, it is proposed to measure the indicator as a ratio of residents with completed secondary, higher and tertiary education and those who are without school, have completed only a couple of primary school grades and those who have completed primary school. Higher number means better education.

Ranking of the social indicators of sustainable rural development according to experts' assessment

As stated in the Methods chapter, experts of different profiles evaluated the relevance of the described indicators in the overall assessment of the economic viability of the rural area. Based on the obtained results, the five most relevant indicators with regard to the level of the average grade were selected. The best rated indicators with the corresponding grades are shown in Table 4.

Table 4. List of the most relevant social indicators according to the expert opinion

Indicator	Average grade given by the experts
Age structure	4.70
Availability of educational institutions	4.45
Educational structure	4.34
Availability of health institutions	4.32
Population growth between two censuses	4.32

Source: Own results.

Respondents were given the possibility to suggest indicators that they considered to be very important and were not offered in the survey. Only five respondents (three representatives of scientific and educational institutions and two from associations and LAGs) availed themselves of this opportunity and their suggestions are: life expectancy, population density, average number of household members, involvement in non-governmental organizations (civil society), poverty index, social capital, number of LAGs, number of projects in which the local community participates, number of associations in rural areas, social services, presence of kindergarten and average settlement size.

Below is Table 5 with selected five (or more) indicators and their average grades assigned t by representatives of individual groups that participated in the research.

Table 5. Social indicators with the highest average grades according to the opinion of different groups of experts

Scientific and educational institutions	LAGs and associations	State institutions
age structure (4.85)	age structure (4.60)	age structure (4.57)
availability of educational institutions (4.50)	availability of educational institutions (4.45)	quality and frequency of public transport lines (4.43)
population growth between two censuses (4.50)	age and gender structure (4.40)	availability of educational institutions (4.29)
educational structure (4.50)	availability of health institutions (4.30)	availability of basic groceries (4.14)
availability of health institutions (4.45)	quality and frequency of public transport lines (4.25)	educational structure (4.14)
	educational structure (4.25)	tradition and cultural facilities (4.14)
		population growth between two censuses (4.14)
		institutional efficiency (legislative framework, informal links, governance mechanism) (4.14)

Source: Own results.

The most relevant indicators in the paper are selected based on the average score of all respondents, but it is interesting to consider the opinions of individual expert groups, each participating in rural development with a different capacity. In some groups of respondents, more than five indicators were listed because they achieved the same average grade.

The coincidence in the selection of the five most relevant economic indicators in all three expert groups is visible in the case of three indicators: age structure, availability of educational institutions and educational structure. The importance of education in sustainable rural development projects is also emphasized by Bruckmeier and Tovey [2] and Csurgó, Kovách and Kučerová [4].

Although the choice of indicators varies depending on the workplace of the expert, no significant difference was found between the assessments of experts from different groups. The only exception is the indicator age structure by the Chi-square test, for which a statistically significant difference ($p \leq 0.05$) was determined in the assigned assessment, depending on which expert group the experts belong to.

It is interesting to point out the "quality and frequency of public transport lines" indicator which, according to the average rating of respondents from LAGs and state institutions, would enter among the five indicators with the highest grades, while according to the choice of representatives of scientific and educational institutions it would not. The reason for this is very likely the fact that most respondents who are representatives of scientific and educational institutions live in Zagreb and Osijek, cities where the public transport network is well developed and do not consider public transport important. LAG leaders and representatives of institutions live in smaller communities and understand the importance of having a good public transport network, i.e. they have a first-hand experience of its shortcomings.

This is one of the reasons why it is very important to include different stakeholders in the selection of indicators for the sustainable rural development, from different backgrounds, because each of them has different perceptions of sustainable rural development and experience in how to achieve it. A heterogeneous group of respondents was also selected to reduce the subjectivity of judgments as much as possible because each group has its own priorities determined by the level of education, area of scientific interest, attitudes, background etc. The importance of group heterogeneity in a work of research containing sensitive topics (environment, sustainable development and socially responsible business) is also emphasized by Mardle et al. [28] and Von Solms [40]. The disadvantage of the conducted research is the fact that not all respondents from all groups responded to the research in equal numbers, and as a result, the opinion of the representatives of scientific and educational institutions, who are mostly from large cities, as mentioned earlier, prevails.

CONCLUSIONS

The paper proposed 18 social indicators that have been used in similar research or suggested in professional literature for the purpose of measuring sustainable rural development. Based on the expert assessment on a scale of one to five, the five most relevant indicators were selected with regard to the obtained average assessment: age structure (4.70), availability of educational institutions (4.45), educational structure (4.34), availability of health institutions (4.32), population growth between the two censuses (4.32). Looking at the assessments of each of the expert groups separately, it can be seen that in their selection of the five most relevant indicators, three of them match: age structure, availability of educational institutions and educational structure.

However, no significant difference was found between the assessments of experts from different groups. The only exception is the indicator age structure by the Chi-square test, for which a statistically significant difference ($p \leq 0.05$) was determined in the assigned

assessment, depending on which expert group the experts belong to.

Although not statistically significant, there is a difference in the choice of indicators and it is due to the heterogeneity of expert groups as well as individuals because everyone has their own priorities according to education level, area of scientific interest, attitudes, background and so on.

Because of the above outlined, it is very important to involve as many stakeholders with diverse profiles as possible in order to reach utmost credible results.

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SERVQUAL METHOD IN ASSESSING THE QUALITY OF RURAL TOURISM SERVICES

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Abstract

The main supply factors at the rural tourism services market (on the example of rural tourism households of the Transcarpathian region of Ukraine) are characterized. The SERVQUAL method has been modified taking into account the usage of certain elements and assessment principles of the most important criteria for the rural agritourism services quality. A marketing research of the proposed rural tourism products with a comparison of the expected and perceived quality of the tourist product was conducted. The rural tourism services quality assessment depends primarily on the personal perception of tourists during their stay at rural tourism households and is assessed through the prism of hospitality, competence, propensity to provide qualitative tourist services, family atmosphere, obscenity with tourists' needs and ability to meet safety and security, willingness to respond to guests' complaints.

Key words**:** *rural tourism, services quality, SERVQUAL method, consumer satisfaction, rural tourism product, rural agritourism household*

INTRODUCTION

In the process of tourist services market development and under the influence of competitors' actions there is a necessity to expand the offer and improve the tourist products quality.
The determinant of the quality level of each product and service in tourism is a consumer (individual) with all his cultural, psychological and physical aptitudes and preferences. At the same time, a person as a consumer is an expert in assessing the good or service quality level, formulating a conclusion according to the personal satisfaction level. The consumer expresses his opinion not only based on the technical quality of the tourist service; he also pays more and more attention to its functional side [2, p.365].
According to M. Shapoval, evaluating the provided service, the consumer uses only his subjective opinion and seldom informs the organization on his own initiative. In case of dissatisfaction with the services the consumer is likely to stop using or buying them. The impression of consumer satisfaction based on the absence of claims can lead to mistaken conclusions [6, p.237].
Therefore, an important problem in the field of tourist services quality is to determine their level in the most objective way.

MATERIALS AND METHODS

To determine the guests' satisfaction level with the provided services in rural agritourism households, the SERVQUAL method was used. The authors slightly modified this method using certain principles of assessing the most important criteria for guests during their stay at green tourism households and while forming their expectations. To determine the provided services quality, the direct reporting method among 42 guests who rested in July 2019 in 28 green agritourism households of Mizhhirya and Berehiv districts, Transcarpathian region of Ukraine was used.
We took into account criteria which are most important for "rural" tourists [5, p.43-44]:

1. The technical quality, which includes the household's figuration, aesthetics and adaptation to the tourist services provision; view, area and furnishing of rooms; number, type and equipment of sanitary facilities; inventory and facilities for recreation; tourist facilities condition located near the rural agritourism household; 2. Meal – menu variety, portion size, nutritional value, way of presenting and setting the table; 3. Activities (animation) – encouraging the owners to organize integration meetings by the bonfire, walking and cycling tours, horseback riding, providing equipment, involvement into farm work etc; 4. Prices – the prices level for accommodation, meals, rental equipment and other payments; 5. Reliability – providing the service in the appropriate way and time; 6. Responsiveness – appropriate response to the guests needs, the effectiveness of the desires implementation, the ability to give advice, tact; 7. Competence – possession of relevant knowledge, experience and necessary skills; 8. Hospitality – kindness, family atmosphere, politeness and respect, friendly attitude to guests [7, p.40]; 9. Faithfulness and safety – responsibility, trust and sincerity as well as financial and material security; 10. Sociability – facilities of establishing contacts and providing any information in the understandable language for tourists, the ability to recognize their needs, listen to and understand their problems, find an individual approach to each guest.

Determining the quality level of the provided tourist services in the rural tourism household in every of the 10th elements was carried out on a five-point scale, in which 1 means the lowest, and 5 – the highest degree of a service quality assessment. In addition, the evaluation structure and the weighted average evaluation indicator are characterized.

The degree of realization of the guest's expectations in each of the 10 elements was found using the difference of estimates. The first assessment was to compare the provided services quality with the minimum guests' requirements. The second assessment reflected the difference between the quality of provided services and the expected guests' requirements. Two approaches define the services structure at lower, acceptable and higher levels.

RESULTS AND DISCUSSIONS

The service quality for the customer arises from his expectations comparison related to the process of the service providing and its actual provision. Quality assessment is preceded by a condition of satisfaction (or dissatisfaction) with the provided service, if expectations are met (or not met). The emotional customer's condition after receiving the service is satisfaction or lack thereof. If the quality of the purchased service exceeds expectations, it can be described as an impressive quality, a condition of pleasant surprise, satisfaction and even admiration (Fig. 1).

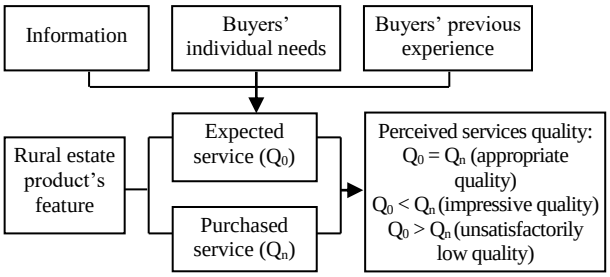

Fig. 1. Perception of the tourist services quality according to the *SERVQUAL* model
Source: Based on [5, p.48].

The result of the services impressive quality contributes to the consumer's loyalty growth to the provider that is confirmed by the repeated services purchase and their promotion among other customers (friends, relatives, colleagues etc.).

From the tourism product providers' point of view, the quality is expressed by the degree of compliance with tourism legislation, compliance with standards or compliance with the requirements they set for themselves according to their own experience and imagination [3, p.76].

Rural tourism households' owners, if they want to succeed, have to take into account the preconditions and trends in rural tourism. The tourists' demand in the rural tourism field is influenced by the following factors [1, p.25]:

- appropriate provision by fixed and working

capital required to receive tourists (house, number and rooms area, sanitary equipment, the yard view and order, meal offer, etc.);
- professional service for tourists and atmosphere of hospitality, which is an important social aspect, because every customer wants to be the object of attention and be in a cozy atmosphere created by the host family. Guests pay more and more attention to the hostess' culinary skills, the organization of interesting meetings and spending time together, acquiring new skills and more. This requires relevant knowledge not only in the rural tourism household management, but also in the field of culture, history, art, foreign languages skills;
- the territory attractiveness – unique landscapes, saturated with forests, lakes, hills, glades are an important motive for tourists wishing to spend their free time outdoors, breathe fresh air and consume clean water;
- tourist value of the territory – traditional rural buildings, cultural landscape, the presence of sports and tourist facilities, SPA-centers with appropriate infrastructure.

Within the subjective assessment of the rural tourism products quality by tourists, we can distinguish two categories [8, p.37]:
1. Material and technical quality, so that the customer receives from the provider as a part of the tourist package (e.g., cozy bedrooms, well-equipped living room, rental equipment, furnished place for recreation which allows to meet guests' needs); 2. Abstract quality, so that the emotional service component, the way of serving the tourists, which includes the host family attitude to guests, its loyalty, courtesy, competence, ways of complaints satisfaction etc).

The quality of supply in rural tourism has much broader dimension and provides:
- natural environment quality;
- recreational, natural and anthropogenic resources quality;
- social and technical infrastructure quality.

The aim of the research was to examine the guests' opinion who rested in rural tourism households, on the services quality and its comparison with their own requirements. This assessment will make it possible to determine the extent to which the offered services quality meets the rural tourism households' guests' expectations.

Tourists aged 21-45 years (66.8%) with higher (54.4%) and secondary (32.8%) education dominated the study group. People aged 46-65 were 18.6% and up to 20 years 14.6%. In the study sample there were 54.5% women and 45.5% men. Tourists come to the studied rural tourism households mainly from Kyiv (26.3%), Lviv (19.6%), Kharkiv (12.7%), Ternopil (9.1%) and other (22.5%) regions of Ukraine, foreign tourists were 9.8%, mainly from Hungary, the Czech Republic and Poland. More than half of the respondents (64.8%) came in an organized group for cognitive and recreational purposes; 21.6% rested in the company of friends; 11.1% rested with family and 2.5% came to relax alone.

The motives for choosing rural tourism facilities as a place of recreation differed slightly in the administrative districts of Transcarpathia, Ukraine (Figs. 2 and 3), which is mainly related to the geographical location, relief, climate, cultural and historical heritage and the territory image.

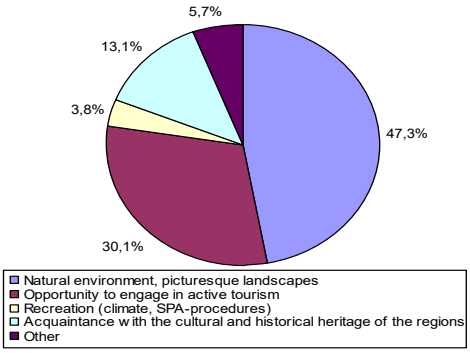

Fig. 2. Rural tourism households of Mizhhirya district
Source: Authors' own results.

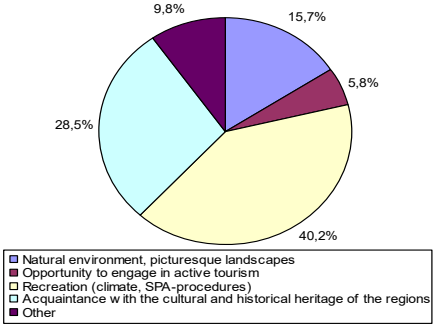

Fig. 3. Rural tourism households of Berehiv district
Source: Authors' own results.

According to the above figures, the main motives for coming to selected areas of the mountainous and plains of the Transcarpathian region of Ukraine are: the desire to relax in an attractive natural environment with picturesque landscapes (47.3%) and the opportunity to be engaged in active tourism (30.1%), namely hiking, cycling, rafting. The health-improving qualities of the thermal waters and the warm climate Berehiv district, a large number of tourist facilities, festivals are the main motives for staying at the rural tourism households of Borzhava, Variv and Velyka Bihan areas. The main information sources used by guests when choosing a rural tourism household were the Internet (78.3%); friends', relatives', acquaintances' advices (19.6%); advertising booklets and business cards (2.1%). A small proportion was information obtained from travel exhibitions, media, newsletters, travel guides, travel agencies catalogues. More than 60% of respondents have chosen this form of recreation and stayed at the researched rural tourism households for the first time; 27.7% – for the second time, 11.8% visited households three or more times. Approximately the same number of respondents prefers recreation using rural tourism households for accommodation in other regions of Ukraine. Thus, it can be claimed that more than 1/3 of the respondents are loyal guests of rural recreation at the rural tourism households. The majority of tourists (86.4%) noticed that finding the rural tourism household location is quite difficult, especially in the evening. Exceptions are rural tourism households in Velyka Bihan, which, according to survey, are well (25.3%) or very well (40.9%) marked on the main roads and on the side streets. On the other hand, about 85% of the surveyed households do not have any signs at all that would indicate the place of providing the tourist services. The roads quality in direction to most households - asphalt or paved and, as was noticed by respondents (51.7%), is relatively good; and 48.3% rated it as satisfactory and poor.

Respondents rated the tourist attractiveness of the area where the households are located as highly attractive (54.9%) and attractive (39.1%), and 6% were disappointed because they had different expectations.

Assessing the quality of tourist services provided by rural tourism households based on the analysis of respondents' answers, it can be suggested that the quality elements, which are a part of its comprehensive assessment, are formed at a fairly high but differentiated level (Table 1).

Table 1. Assessment of factors shaping the quality of services of agritourism farmstead

Indicators	The structure of answers (in %) in scale from 5 (excellent) to 1 (very bad)						Weighted average
	5	4	3	2	1	Total	
Services material component	56.0	37.1	4.6	1.4	0.7	100	8.54
Meal	66.6	27.2	4.1	2.1	–	100	8.56
Organization of tourist events	45.9	31.7	12.3	9.4	0.7	100	7.65
Prices	73.5	24.2	1.7	0.6	–	100	8.76
Reliability	63.4	29.8	5.5	1.3	–	100	8.54
Responsiveness	74.5	18.6	5.5	1.0	–	100	8.66
Competence	66.4	27.8	4.7	1.1	–	100	8.72
Hospitality	80.6	14.0	4.3	1.1	–	100	8.77
Faithfulness and safety	79.4	17.3	2.2	1.1	–	100	8.78
Sociability	64.6	31.4	2.2	1.7	0.1	100	8.69

Source: Authors' own results.

Similar studies were conducted in rural tourism households of Lviv region where the vast majority of respondents rated the tourist services quality as good – 4 (60%), 5 points were given by 30% of respondents and unsatisfactory score – 10% of respondents [4, p.141]. Taking into account the individual quality elements weighted average assessment of, it can be pointed out that the highest assessment was given to such factors as faithfulness and safety, hospitality and competence. During the provided services analysis from the technical point of view, their very high price is taken on the first place, which includes the living and meal cost, recreational equipment rental and other costs. However, it can be concluded that prices are usually within the tourists' expectations. For example, more than 94% of respondents admitted that food prices match the portion size. The situation with the assessment of menu diversity is somehow worse; about 60% of guests who used the food services in the household stated that the offer was richer and more diverse. Similarly,

the taste of the dishes prepared by the hostess, which are produced in a personal farm, has been rated. Thus, 66.7% of respondents who ate in the surveyed rural tourism households positively assessed the meal cost, slightly lower – the serving quality. The lower assessment given by the respondents to the services material component (8.54%) covers the aesthetic view and the economy adaptation to the tourist services provision; the rooms' size and furnishing; sanitary facilities number and equipment; recreation inventory and equipment and tourist attraction of the neighbourhood where the rural tourism household is located.

The analysis of the received responses showed that in some farms the services material provision is insufficient. The lowest scores were connected with functionality, bedroom and living room equipment. The guests had the least remarks about the objects cleanliness and aesthetic view. The diversity of the offered recreation equipment is the lowest: almost 2% of respondents gave a grade "well", 29.4% – "satisfactory", and – 68.6% – "unsatisfactory".

The organization of tourists' leisure (animation service) has gained the lowest rate (7.65%). The evaluation parameters include the possibility of organizing free time by the fire; musical accompaniment; hiking, biking; horseback riding or sleigh or cart; participation in agricultural work and other tourist activities offered by the rural tourism households owners. In our opinion, the low scores arose through the providers' misunderstanding of the importance of diversifying the holiday offer. This confirms the analysis of the leisure usage structure, according to which the dominant forms are walking and cycling (80.3%); active tourism (53.6%); participation in cultural events, especially in festivals organized on rural areas (47.2%); passive rest (25.4%); games, competitions (13.2%), participation in the agriculture (8.8%); horseback riding, sledding (4.1%), other ways of time spending (21.5%).

The second way of assessing the services quality level is to compare the service compliance with the previous conditions and the tourist's own expectations about it (Table 2).

Table 2. Comparative assessment of factors shaping the quality of services in relation to the minimum requirements of guests

Indicators	Evaluation of service quality in comparison with the minimum requirements			Evaluation of service quality in comparison with the desired requirements		
	Low	Acceptable	High	Low	Acceptable	High
Services material component	7.5	47.0	45.5	6.3	73.7	20.0
Meal	1.3	49.3	49.4	5.9	61.8	32.3
Organization of tourist events	17.0	60.4	22.6	19.7	60.7	19.6
Prices	2.5	58.8	38.7	4.6	72.3	23.1
Reliability	2.0	51.0	47.0	7.8	69.4	22.8
Responsiveness	3.9	44.6	51.5	7.8	68.6	23.6
Competence	2.0	50.1	47.9	5.9	70.6	23.5
Hospitality	2.0	45.5	52.5	3.9	66.7	29.4
Faithfulness and safety	2.0	48.2	49.8	4.1	70.6	25.3
Sociability	3.9	50.0	46.1	3.9	70.6	25.5

Source: Authors' own results.

The Table 2 shows that the quality indicators of most services components provided by rural tourism households were formed at a fairly high level, compared with the minimum and desired guests' requirements. The percentage of dissatisfied people has slightly increased. The practice shows that along with the increase in consumer demand, the percentage of people who evaluate quality at a high level decreases. At the same time, it is necessary to pay attention to the relatively high percentage of people (about 30%) who are interested in the meal quality and the hosts' hospitality. On the other hand, the material base quality, reliability, homeowners' sensitivity and competence received the least (below 24%) positive feedback, compared to the relatively high percentage of assessments according to minimum requirements. The lowest value of the services quality comparative assessment was the indicator of the tourist events organization. The results of the research showed that these services quality mostly met the minimum and desired requirements, while in this area there were the most disappointed tourists (19.7%) and the least – enthusiastic about this activity (19.6%). In the field of accommodation services, the consumer's service quality assessment is based on the formation a positive or negative emotional mood in his mind [9, p.226].

Thus, it can be considered that the service

quality assessment in rural tourism arises from the comparison of the consumer's expectations about this service, including emotional and the actual condition of its provision. Confirmation of the positive opinion about the conditions of rest and psychological atmosphere during the stay in the studied rural tourism households are the responses to two questions concerning the choice of the rural estate and its popularization among relatives, acquaintances, friends. Answering the first question, 86.6% of respondents confirmed a good choice in favor of holidays in the village, 25.5% said that holidays were quite interesting, and only one person (2%) said that the choice of the estate (household) that provides tourist services was unsuccessful. Regarding the rural tourism household recommendation to their friends, relatives, acquaintances, 74.5% of respondents answered "yes", 23.5% – "maybe", and only one person (2%) – "probably not". Tourists especially enjoyed the host family atmosphere in the rural tourism household (51.1%), beautiful views, landscapes, silence, landscaping (23.4%); cooked meals quality (21.1%) and accommodation conditions (4.4%).

CONCLUSIONS

Lots of subjective factors influence the tourist services quality assessment. It depends primarily on the tourists' personal perception during their stay on the rural tourism household and is assessed through the prism of hospitality, competence, propensity to provide tourist services, family atmosphere, knowledge of tourists' needs and ability to meet them, as well as ensuring safety and response to complaints. Friendly treatment of guests is sometimes more important than the standard of the offered accommodations or the offer originality. The rural tourism household owner turns his own estate into a unique place which should become the most interesting, useful, convenient and comfortable for tourists of different ages, social and financial status and interests. To satisfy the tourist's wish, it is necessary to anticipate his expectations and use his positive communicative experience with people. It also should be noticed that the vast majority of surveyed tourists confirmed that the host family serves guests with an open heart and in the spirit of meeting their needs. Those rural tourism households in which guests feel like at home, that care about their guests, quickly and efficiently satisfy their needs and desires, deserve this assessment.

Thus, it can be confirmed that the product of rural tourism is inextricably linked with the host family, which is an important component of it. The host family ability to provide tourist's services and the hosts' personal skills to interest the guests are a very important part of the tourist services offer. Therefore, peasants who care not only about material benefits but also pay much attention to their guests who are resting in their household, meeting their needs and expectations, should provide rural tourism services.

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ASSESSMENT OF THE DEVELOPMENT OF ORGANIC PRODUCTION IN VARIOUS MARKET SYSTEMS

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Abstract

Organic agriculture, based on natural production technologies, has a great potential for the reversion of mankind to a healthy diet and living in harmony with nature by improving the state of the ecosystem. The share of organic products in the food market of the developed countries is already quite sizable; in the top countries various institutional systems of the industry have been introduced and improved. Russian agribusiness is lagging behind in these issues but the situation should be significantly changed by the adopted law and the state standard regulating the requirements for the organic sector. Our work is an application of applying a two-sided quantitative-and-qualitative approach to the survey of existing markets from the standpoint of extant results and dynamics, on the one hand, and their organizational-and-economic structure, on the other hand. The presented conclusions are confirmed by systematized absolute and relative indicators of the number of market entities, areas of land certified for organic production, retail sales in domestic markets and consumption of organic products per capita. The qualitative characteristic of organic production systems is reflected in the description of the national characteristics of regulatory and control and supervisory support, research support, state regulation of production and turnover, and ways of doing the business under study. Our research is addressed to the world business community operating in the organic food market and industry research institutions.

Key words**:** *organic production, two-sided approach, quantitative and qualitative approach, organic market*

INTRODUCTION

The state significance, promotion of healthy lifestyles, and informed personal objective necessity jointly stimulate and form a significant growth in demand for organic products and their market all over the world. The scientific basis for the development of organic segment of the economy started its formation with awareness of the need to live "in harmony with nature", and it was a prerequisite for emergence of the concept of organic agriculture as a promising area for eliminating the negative impact of chemical fertilizers, crop protection agents and animals on the ecosystem, promoting its social and environmental advantages compared to conventional intensive method of farming as mentioned by Bolotov (1770) [5], King (1911) [16], Lord Northbourne (1940) [19], Howard (1947) [14], Rodale (1961) [25].

The development of the ideas of "biodynamic agriculture" creates a systemic view of relationship between the quality of resources, technologies, standards and principles in use, spiritual aspects, and cosmic rhythms (Steiner, 1997) [29].

Conducted scientific experiments comparing conventional and organic agriculture, author's farming practices that contribute to soil conservation (non-plow tillage, weeding-free, pesticide-free, three-field system, and others) lay the practical foundations of the "green" economy as obtained by Balfour (1943) [2], Williams (1949) [31] and Bromfield (1954) [6]. The works of contemporary authors are aimed at comparing the indicators of productivity, nutrients content in the soil, crop rotation schemes, potential for providing food

to the population, including drawing an analogy with the results of growing genetically modified crops (Badgley, Moghtader, Quintero et al., 2007) [1], De Ponti, Rijk, & van Ittersum (2012) [9], Ceccarelli (2014) [7], and Firsov (2019) [11].

The problems of production and market of organic agricultural food products and their competitiveness are also covered in the works of contemporary Russian researchers such as: Revenko (2003) [24], Ushachev, Paptsov & Tarasov (2009) [30], Leksina, Popova &, Sapogova (2014) [18], Dolgushkin, Paptsov, Avarsky, etc. (2018) [8].

World statistics shows significant fluctuations in the number of organic producers and certified agricultural land. For example, in the period 2000-2010, the number of organic farms in Germany and Norway decreased by 10% each year, as farmers transferred back from "organic" to conventional agriculture, and this process is currently continuing. The main reasons for the reverse conversion are economic aspects: difficulties with certification and production control, problems with equipment needed for organic farming and infrastructure complexity. However, 10 years later, the same countries registered an increase in the total number of organic farms: by 50 % in Norway and by 70 % in Germany (Sahm, 2012) [26].

The importance of having motivation for transition of economy to "organic" category is confirmed by many studies (Mala & Maly, 2013) [20], Plews-Ogan, Mariola & Ananta, 2017) [23]). For example, in Canada, health and safety are the primary issues and dominant for conversion, while economic reasons are less important for farmers (Granfield, Henson, & Holliday, 2010) [12]. Social decisions, sustainable and environmentally friendly agriculture are the main goals in transition to organic production in Europe (Koesling, Flaten & Lien, 2008, and Best, 2010 [17, 3]. The results of the surveys of farmers in West Germany (Best, 2009) [4] show that when taking decision on conversion, farmers think primarily about the daily production process (Can I effectively control insects and weeds? How will productivity change when transferring to organic methods?). The second key factor is economics (Can I sell my products on the market? Can I ensure the long-term economic stability of the farm?). This is followed by the issues of subsidies and ecology.

MATERIALS AND METHODS

As a basis for the development of organic production, we propose to take an interconnected system of theories recognized as classical (Serdobintsev, Leksina, Chernyaev, et al., 2020) [27]:

(1) Pareto optimality (a success of the industry can be achieved by taking into account the conservation of a key production resource, that is land, based on the consistency between material and environmental interests);

(2) maximum flow of total income J. Hicks-E. Lindahl (2006) [13], in terms of the economic approach (the necessary condition for achieving economic growth of any economic system is not just the effective use of production resource with which the public product was created, but also its preservation);

(3) state regulation (Keynes, 1978) [15] (the revival of economic situation is facilitated by an increase in public investment, which can act as an "ignition key" that triggers the multiplier mechanism);

(4) Harvard School, in particular Warren M. Persons (1923) [22] and Wesley C. Mitchell (1930) [21], allowing the use of the Harvard barometer to predict events (in the dynamics of various elements of the economy, there are such indicators that are ahead of others in their changes, and therefore can serve as precursors for the latter).

To make decisions of transition to organic production technologies, we have formulated the key principles addressed to producers:

• principle of alternativeness, which assumes that producers can choose one or another type of farming – conventional (industrial) or organic;

• principle of maintaining ecological equilibrium, which is realized through the compromise of replacing the technogenic management system with an organic one;

• principle of interdependence, based on the presence of a direct relation between the output

product and the resources necessary for its creation, formation of the organization's income and the environmental component of the production processes;

• principle of reclamation, based on the availability of land that has not been cultivated for a long time, has passed the phase of natural self-cleaning, which opens up wide opportunities for reducing the conversion period and transformation costs;

• principle of dynamism in the development of production, which allows assessing the transformation of the phenomenon under the influence of the determinants acting on it, which must be constantly adjusted depending on the course of events (growth in demand and the cost of gross output, etc.);

• principle of forming an optimal price policy that ensures the establishment of such a level of price markup (premium) for organic products that will allow taking into account the high quality of the products sold while maintaining a sufficient level of demand.

Organic products markets of the top countries of the world were selected for the study: – the United States, Germany, Canada (was selected as the country's climatic conditions and production potential of which are the most comparable to those of Russia), and Austria (the Austria's market is characterized by a strategically-oriented flexible system of state support). For the purpose of scientific substantiation of the formation of the system of an effectively operating Russian organic market, we have studied these markets from the standpoint of extant results and dynamics, on the one hand, and their institutional structure: mechanisms for development, regulation, control, supervision and interaction, on the other hand. The theoretical, methodological and informational base of the study was made up of the works of scientists devoted to various organizational and economic aspects of organic business, as well as FiBL materials [10]. Along with general scientific research methods (dialectical, abstract-logical, structure, optimality, etc.), general logical (analysis, generalization, etc.), specific scientific (comparison, formalization, etc.), specific (monographic, economic-statistical, etc.) methods.

RESULTS AND DISCUSSIONS

Two-sided quantitative-and-qualitative approach to the study of the state of national organic products markets

The growth of the world organic food market is more than 2 times faster than the growth of the conventional food market. According to FiBL [10], the world organic market in 2017 amounted to USD 97 billion (EUR 92 billion) and has grown 5.4 times since 2000 (from 17.9 USD billion). The study of the vector of changes allows characterizing the state of the business under study as growing in all key indicators. Retail sales of organic products in domestic markets for the period 2007-2017 increased 3 times in the United States, 1.9 times in Germany, 2.7 times in Canada, 2.3 times in Austria, and 4 times in Russia. Statistics shows significant fluctuations in the area of land certified for organic production in the United States, the number of producers – in the United States, Austria and Canada (Figure 1, Tables 1 and 2). Germany demonstrates absolute stability in the growth of these indicators. In Russia, the greatest range of fluctuations in the rate of land area growth is observed (in 2010 it decreased from 78.5 to 44 thousand hectares; in 2011 it increased 2.9 times; in 2017 it increased 2.1 times) as well as the growth rate in the number of organic producers (from 12 in 2007 to 89 in 2017; with a slight reduction by 2, 3 and 16 in 2011, 2014 and 2016, respectively). This situation is a typical feature of the beginning of growth of a new industry in the life cycle and a vivid reflection of the ongoing institutional changes that determine the basic "rules of the game".

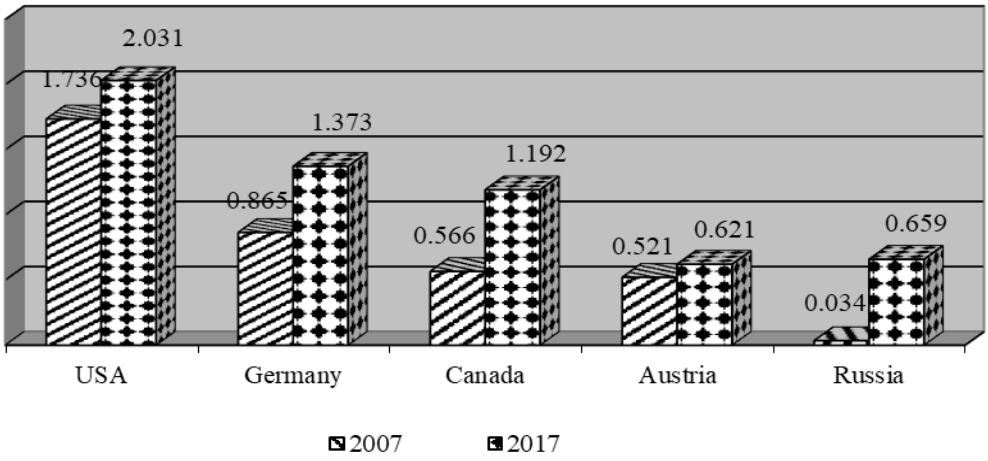

Fig. 1. Dynamics of growth in the area of land certified for organic production (thousand hectares)
Source: calculated by the authors according to FiBL.

Table 1. Growth rate of the area of land certified for organic production (%)

Countries	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
USA	12.3	0.0	-9.2	23.2	0.0	0.0	-28.6	30.5	0.1	0.0
Germany	4.9	4.3	4.6	2.5	1.9	1.0	0.3	3.9	14.9	9.7
Canada	13.0	12.0	0.0	19.5	-0.9	4.2	4.0	4.5	16.4	8.4
Austria	2.3	2.7	4.0	-1.0	-0.1	-0.5	-1.3	0.5	3.3	8.6
Russia	39.1	67.0	-43.9	188.4	15.3	-1.4	70.4	56.6	-18.1	108.4

Source: calculated by the authors according to FiBL.

Table 2. Growth rate of the number of organic producers, %

Countries	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
USA	13.9	0.0	1.9	-2.3	0.0	0.0	3.1	12.0	-4.4	27.8
Germany	5.9	6.2	4.3	2.6	2.3	1.0	0.6	5.7	9.7	9.7
Canada	-1.8	5.4	-4.6	-0.4	-3.4	-2.1	7.6	12.9	-1.4	14.2
Austria	0.8	4.5	5.2	-0.4	-1.0	-0.1	-3.9	0.5	15.4	3.2
Russia	108.3	60.0	25.0	-4.0	18.8	15.8	-4.5	30.2	19.5	34.9

Source: calculated by the authors according to FiBL.

The achievements in the development of the organic market of the United States are characterized by increase in retail sales of products in domestic markets from EUR 13.3 billion to EUR 40 billion for the period 2007-2017 and increase in exports 10 times (to EUR 3 billion) in the period 2011-2017. The study of the systems of state regulation and management of organic production, types of products and their turnover in the food market of the United States allows drawing a conclusion of the effective integrated management approach to this sphere of economy. Thus, the activities of five of the nineteen structural divisions that are part of the United States Department of Agriculture (USDA) are related to the implementation of long-term Federal product quality programs and introduction of innovative technologies in the organic sector.

The advantage of the organic market of Germany is its clear regulation, impressive state support (to 580 EUR/ha) and the established mechanism for certification and labeling of the relevant products with the famous national logo "Bio-Siegel", which guarantees the buyer the declared quality (Figure 2). In addition, the significant "players" in the market are 9 farmers' associations of organic producers with their own standards (more stringent than the state ones) and logos, as well as supporters of biodynamic agriculture with their own certification and the «Demeter» trademark.

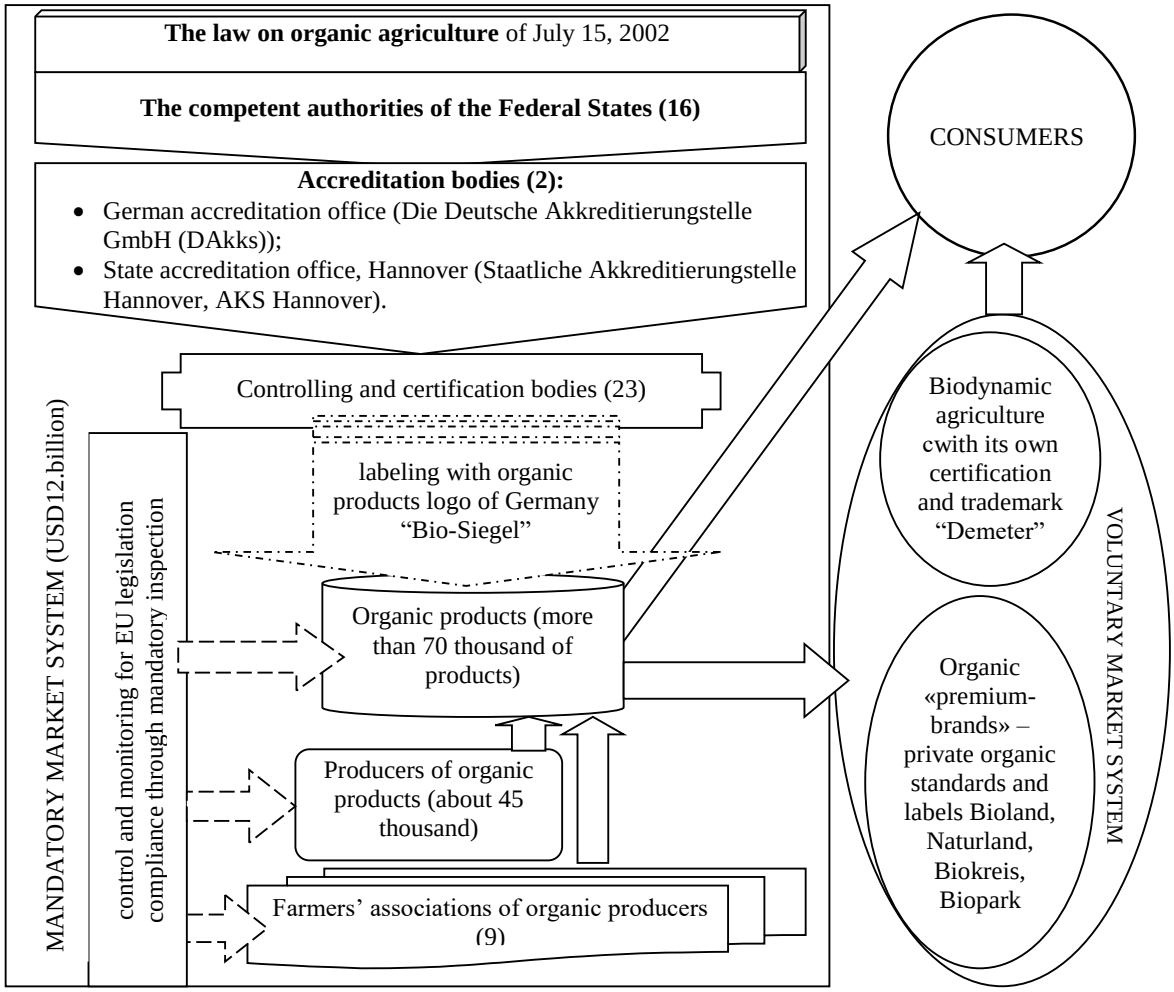

Fig. 2. Characteristics of organic market in Germany
Source: generalized and systematized by the authors.

The results of the development of such market system in the period 2007- 2017 are characterized by an increase in the area of land certified for organic production by 58.7%, retail sales of products in domestic markets - by 89.4%, the number of producers and processors - by 16,702, consumption of the products in question per capita - from 64.5 to 122.3 EUR/person/year.

A detailed analysis of Canadian organic market (Figure 3) allows stating a stable positive dynamics of its development (since 2007 retail sales of organic products in domestic markets have increased from EUR 1.1 billion to EUR 3 billion, since 2008 the volume of exports increased from EUR 0.1 billion to EUR 0.4 billion) thanks to the powerful work of the "research unit", which was aimed at offering the best options for production and marketing technologies, well-functioning and coordination of associations, agencies and committees of the "regulatory control-and-supervision unit", confirming the quality for the final buyer, as well as a stable system of state support and effective cooperative relations.

The European practice of developing the organic segment of the food market has shown that the high efficiency of this process is ensured when there is a so-called Action Plan, which, for example, in Austria is accompanied and financed in accordance with the governmental Organic Farming Action Programme (in German: Bio-Aktionsprogramm). In Action Plans and related programs of Austria, a significant place is given to information-intellectual support for organic market operators. In 2004 an Austrian branch of the Research Institute for Organic Agriculture was established in the country. The results of the approach are the highest indicators of the share of the land certified for organic production in the total amount of agricultural land (24%)

and consumption of organic products per capita (196.4 EUR/person/year) among the analyzed countries.

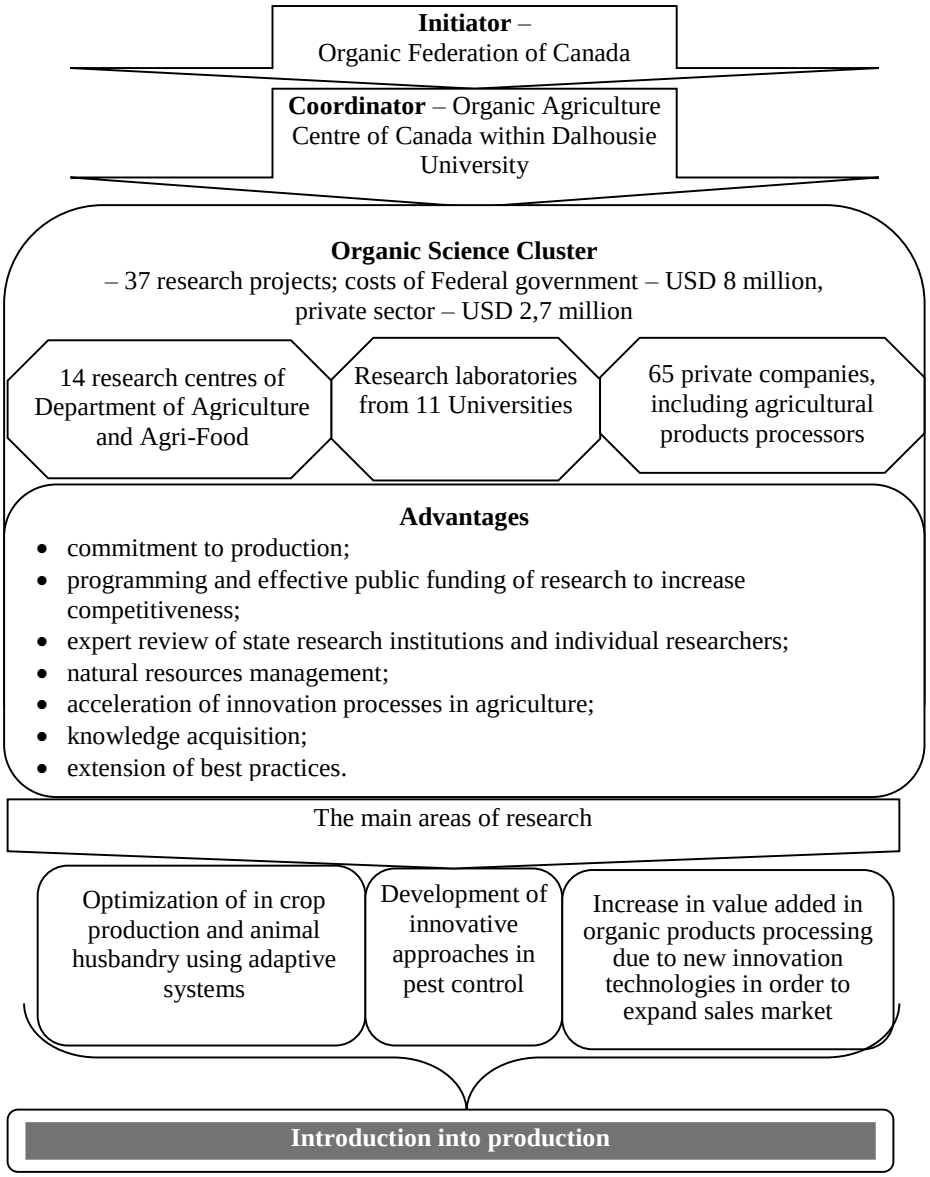

Fig. 3. Canadian model of functioning of "research block" of organic market
Source: generalized and systematized by the authors.

For the development of production, it is traditional to use the organizational and economic mechanism, which we consider as a combination of the system and the purposeful processes of different levels and properties occurring in it, based on the optimal work patterns of all its elements, leading to a synergistic effect. Producers, consumers and the infrastructure of the organic market act as the controlled elements of the system, and the state authorities, administrations and the network of research institutions in organic agriculture act as managers (Figure 4). To develop the main processes that ensure the receipt of the result - preparation and maintenance of production facilities, departments and equipment in accordance with the standard, supply, production, processing, packaging, transportation, storage, sale, import, export (including during the transition period and during parallel production), inspection, certification, identification and labeling of

organic products - it is proposed through the adaptation of classical management methods to the specifics of the issue.

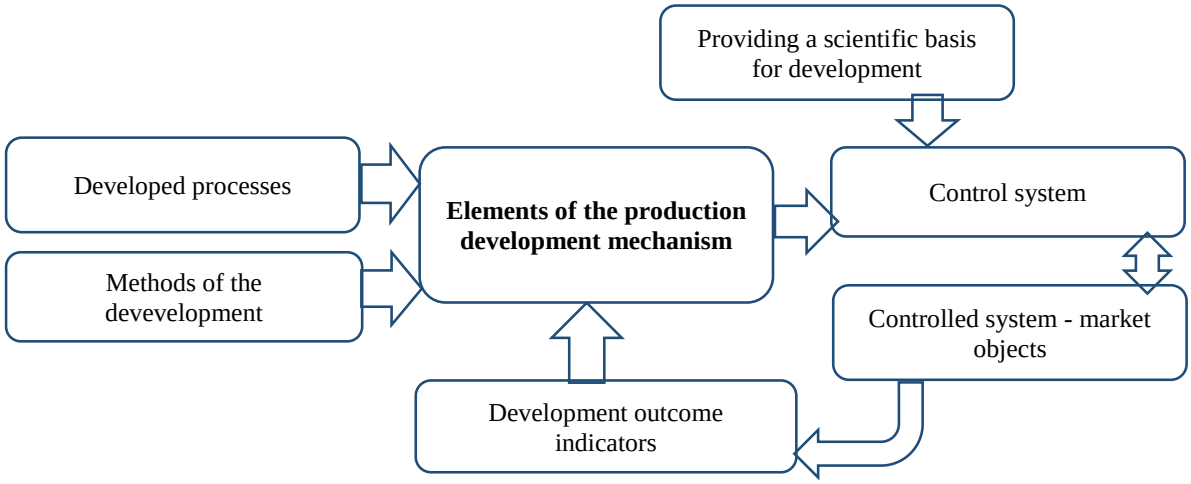

Fig. 4. Scheme of the organizational and economic mechanism for the development of organic production
Source: developed by the authors.

Administrative methods for the development of organic production in the region include, first of all, the implementation of organic food programs for the production and circulation of organic products in order to preserve the environment; update of the Russian standard GOST 33980-2016 "Organic products. Rules of production, processing, labeling and sale" [28] taking into account technical progress and experience in its application; development of a system of authorized state bodies and/or officially recognized certification and/or inspection bodies to supervise the operation of market facilities. Organizational methods should include the introduction into production of relevant scientific developments for organic production, the formation of a system of consumer cooperatives and associations of various types, the development and implementation of integrated labor and product quality management systems (LPQMS), the creation and promotion of a regional brand of organic products, the creation of a supply system organic products from municipal canteens. The system of guaranteed prices (including within the framework of programs) is an effective economic method; long-term cooperation programs between producers, processors, processors, suppliers and consumers; affordable loans and insurance, subsidies for the development of production; optimization of transaction costs. Organizational and technical methods should be formed within the framework of traditional approaches - this is the development of methods for controlling the production of organic products, as well as the development and implementation of methods for its regulation. Indicators of development results should be divided into 4 groups: for producers, processing organizations, infrastructure and social facilities.

CONCLUSIONS

We presented a two-sided approach for the scientific justification of the formation of an effective Russian organic market system based on the study of the existing markets from the perspective of existing trends and patterns, on the one hand, and their institutional structure: mechanisms for development, regulation, control, supervision and interaction, on the other. Using the method of analogy the studied and presented materials on foreign markets of organic products with a high degree of persuasiveness allow forming the scientific basis of market development in Russia as a system of effectively functioning studied elements adapted to national conditions. In particular, it seems appropriate to use:

- cooperative component of functioning model of the farmers' "production block" of Canadian organic market (Ontario);
- "transparent" for producers (sellers) and understandable for buyers (intermediaries) German procedure for quality control, certification and labeling of products;
- clear planning, information-intellectual support and state support for operators of Austrian organic market;
- American effective integrated management approach to this area of agribusiness.

Mechanism for the development of organic production should be based on a combination of systemic and process approaches and that allows linking managed (producers, consumers, infrastructure) and managing (initiators, coordinators, national network of research institutes) systems, improved processes, methods and performance indicators of organic market development.

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THE IMPACT OF THE EVOLUTION OF MACROECONOMIC INDICATORS ON THE SUSTAINABLE DEVELOPMENT OF ENTERPRISES FROM REPUBLIC OF MOLDOVA

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Abstract

The paper studied the impact of the evolution of macroeconomic indicators on the sustainable development of enterprises from Republic of Moldova. The article discusses factors, conditions, indicators and features of the development process. At the same time, structural changes and features of socio-economic development at the level of macroeconomic indicators and sectors of the national economic system were analyzed and highlighted. The research in question has demonstrated the dependence of sustainable development on the evolution of macroeconomic indicators. The paper used a quantitative and qualitative analysis using the correlation coefficient to assess the impact on sustainable development of enterprises in the Republic of Moldova, and especially those in the Transnistrian region. The data on the evolution of macroeconomic indicators are from the database of the national statistical office of the Republic of Moldova and the Transnistrian region.

Key words**:** *sustainable development, agricultural sector, National Public Budget, economic growth*

INTRODUCTION

The content and effectiveness of an economic development policy is the reaction to the acceptance or rejection of this policy by civil society, economic agents, potential foreign investors, and state intervention in specific work. The specifics and general trend of such acceptance or rejection and the spectrum of the economic development process at the national level depend on, and at the same time constitute, public policy. This policy includes, on the one hand, elements of combined social-democratic and administrative development, and, on the other hand, elements of a free - market economy.
The policy of overcoming the economic crisis should reflect the trends of restarting the real sector of the economy as a concentrated expression of economic science and economic theories. In our opinion, the development and implementation of policies for the development of the real sector of economy and the structure of the economic and social system requires the following actions:

- identification and implementation of liberal policy for the development of the real sector of the economy as an integral part of the policy of social-democratic development,
- promotion of innovation,
- technical and scientific factors and the human factor in various activities that are relatively most profitable in an open economy,
- acceleration of structural changes in the real sector of the economy corresponding to a free and developed market economy.

MATERIALS AND METHODS

Research in the field of determining the impact of the evolution of macroeconomic indicators on sustainable development is carried out with the application of the following methods: monographic method, table method, average and relative size method, correlation and regression method. The practical investigations were carried out on the basis of data from agricultural enterprises in the Republic of Moldova.

RESULTS AND DISCUSSIONS

In the structure of this economy, small and medium-sized business should account for about 60-70%, the allocation of more profitable industries for the Republic of Moldova in international trade, which would have a more favorable cost of production, and the introduction of stimulating management policies (monetary, budgetary, tax, customs policies) in these activities, which will strengthen and develop the real sector of the economy. The nature, characteristics and effectiveness of socio-economic development policies are reflected and expressed through a system of macroeconomic and social indicators [5]. Among them, the following parameters play an important role:

- the nominal and real dynamics of GDP in the country and GDP per capita,
- the impact of GDP on overcoming economic imbalances and real growth in the welfare of the population,
- the state of equilibrium or imbalance of the fiscal system, which is reflected in the deficit or surplus of this system;
- structure of the deficit, coverage of the country's deficit and debt, and consequences of non-compliance with strictly necessary social requirements,
- quantitative correlations between nominal and real macroeconomic indicators and their impact on inflation dynamics, structure, and price indices [2, 5, 9].

An important role in the system of socio-economic parameters is played by: fiscal policy and the process of its optimization, reflecting the level of taxes and the amount of money collected from citizens and firms, the marginal rate of the tax burden as a limiting lever or stimulating socio-economic development.

Another group of parameters is:

- dynamics, balance or imbalance of aggregate supply and demand in domestic markets:
- structure and volume of exports and imports, taking into account their volume in GDP;
- the nature of competition and the ability of local companies to withstand the economy and competition in the open market;
- the degree of liberalization or monopolization of the economy and their impact on the cost of production and innovation progress.

The following group of indicators includes:

- the degree of economic system monitoring, expressed in the amount of money in circulation;
- the volume and structure of loans, the speed of money circulation and their impact on economic development;
- structure and specifics of payments and financial transactions balance;
- the structure and relationship of exports and imports that affect economic growth [2, 5, 14].

Finally, a separate group of parameters consists of:

- the specifics of the country's balance of payments, which affects economic development;
- structure and volume of internal and external public debt and private companies,
- dynamics and structure of investments, as well as their impact on the economy,
- employment and unemployment rate [1, 7].

Based on the analysis of macroeconomic indicators and the production function between the "labor" and "capital" factors calculated over the past decade, we can conclude that the efforts made in the national economy were higher than the obtained results.

During this period, labor productivity increased by 45.5%. Gross fixed capital formation increased by 68.2%, average wages increased by 53.3%, and nominal GDP grew at a slower pace and increased by 44% (Table 1).

Negative migration trends and the decrease in the share of business activity from 60% to 40% "weakened" GDP growth from capital and productivity growth, since such large-scale growth is not enough to ensure future sustainable, balanced and convergent dynamic development towards European integration.

Table 1. Main indicators of national accounts, 2014-2018.

Indicators	Years				
	2014	2015	2016	2017	2018
Employed population: mil. people	1.2	1.2	1.2	1.2	1.3
Gross fixed capital accumulation, billion, lei	27.4	35.4	35.7	39.9	46.1
GDP, billion lei	133.5	145.8	160.8	178.9	192.3
Labor productivity, mil. lei	0.11	0.12	0.13	0.15	0.16
Average salary, lei	4,089.7	4,538.4	4,997.8	5,587.4	6,268.0

Source: Own calculation on the basis of data from the NBS of the Republic of Moldova [6].

According to the analysis results, the author came to the conclusion that the specifics of the development policy, based on consumption, have caused inefficient GDP growth by an average of 4.5-5% over the past decade, using and quantitatively changing the existing production capital, which has a significant physical and moral deterioration. Faster growth of average wages and fixed capital compared to labor productivity, which limited the domestic economic potential, "washed away" "financial resources and savings of economic agents and the population, and increased imbalances in the economic and social sectors."

The size of these imbalances is reflected in slow and insufficient growth in terms of social needs of GDP in comparable prices, exports, the number of people employed in the economy, on the one hand, and slow growth in labor productivity, on the other hand, the volume of investment in the real economy, industrial and agricultural production.

At the same time, we are convinced that internal and external public debts, unemployment and poverty increase the price index for essential products, inflation increases and the minimum consumer basket becomes more expensive, and the purchasing power of the LEU decreases (Table 2).

In the conditions of "erosion" of the GDP and resources of economic agents, reduction of exports, remittances and investments, insufficient monetization of the real economy, devaluation of leu, it is impossible to update the entire economic system and implement radical socio-economic changes.

Table 2. The dynamics of socio-economic development of the Republic of Moldova

Indicators	Years				
	2014	2015	2016	2017	2018
GDP, billion lei	133.5	145.8	160.8	178.9	192.3
Industrial production, billion, lei	43.5	45.7	47.6	52.7	56.2
Agricultural, billion, lei	27.3	27.2	30.4	34.1	32.6
NPB revenues, billion, lei	42.5	43.7	46.0	53.4	58.0
NPB expenditures, billion, lei	44.4	46.4	48.5	54.5	59.6
Disposable income (average per person per month) – total, lei	1,770.3	1,956.6	2,060.2	2,244.9	2,383.1
Expenditures of the population (on average per person per month) – total, lei	1,956.3	2,009.2	2,201.5	2,238.9	2,407.9
Budget deficit, billion lei	-1.9	-2.7	-2.5	-1.2	-1.6
Fixed capital, billion, lei	27.4	35.4	35.7	39.9	46.1
Investment in assets, billion lei	21.2	21.1	19.7	23.5	27.5
Employed population: mil. people	1.2	1.2	1.2	1.2	1.3
Monetary aggregate MO billion lei	17.5	15.5	17.3	19.1	21.1
Total loans, MDRl. lei	41.3	42.7	39.5	38.1	39.6
External public debt, billion dollars	2.04				
Average salary, lei	4,089.7	4,538.4	4,997.8	5,587.4	6,268.0
Exports. billion dollars	3.31	1.97	2.05	2.43	2.71
Imports, billion US dollars	6.25	3.99	4.02	4.83	5.76
Trade balance, billion dollars	-3.0	-2.1	-2.0	-2.4	-3.1
Internal public debt, MDRl. lei	7.1	7.225	21.520	22.579	23.058
Unemployment rate, %	4.9	4.9	4.2	4.1	3.0

Source: Own calculation on the basis of data from the NBS and the Ministry of Finance of the Republic of Moldova [4, 6].

As a result, serious economic imbalances are widening and structural reforms are difficult to be implemented.

In order to avoid further critical situation typical for the local economic sector, the author proposes to change radically the investment monetary, structural policy, foreign trade policy for the priority sector of the economy, including the minimum interest rate for the agricultural and agro-industrial sector, and compensate partially the difference in the rate in the program of agricultural subsidies and foreign aid funds.

The characteristics, trends and contradictions of development and ineffective dynamics of indicators determine the specifics of the process and ways to overcome the crisis and economic development, as well as the features of the policy of economic development in the future [11, 13].

The specifics of the development process is characterized by a violation of the ratio of supply and demand; the proportions between the global product and the money supply that drives this product, the imbalance between national costs and incomes, etc.

The large-scale and ineffective nature of the policy of reforming the economic system has a stronger impact on the growth dynamics of the real sector of the economy (Table 2). From these tables, we can see that, on the one hand, the annual growth rates of GDP, agricultural and industrial production in 2014-2018 are lower than the growth rates of investments in long-term production activities than the price index for products, food and non-food products, interest rates on loans, taxes collected in the budget from the real sector and, accordingly, income. At the same time, the National Public Budget increased in 2018 in relation to 2017 by 8.6% and expenses - by 9.4%. The average interest rate on loans in 2018 was about 10%.

The feature of the national economic system is the transformation of this system into a market economy without the necessary financial resources, that is, in the absence of a sufficient amount of "economic blood". Considering that the national currency in 2014-2018 depreciated significantly, it is obvious that the money supply serves an inefficient economic turnover. Taking into consideration that the monetization of the economic system is insufficient, and the purchasing power of the currency is significantly reduced and the interest rate is exaggerated, it is impossible to carry out effective transformations in the economic system. The result is enormous economic imbalances, and the necessary structural changes are problematic. In order to avoid a critical situation typical for the domestic sector of the economy in the future, it is necessary to change the policy of developing the real sector of the economy radically.

The internal public debt of Moldova in 2016 has increased by more than 14.29 billion lei (3 times), reaching at the end of December a record annual amount of 21 billion 519.6 million lei. The growth of this debt in 2016 was due to the increase in the issue of government securities in the primary market by 953 million lei, as well as the issue of government securities in the amount of 13 billion 341.2 million lei for the Ministry of Finance to fulfill payment obligations arising from state guarantees provided to the National Bank for guaranteeing urgent loans provided earlier to three problematic and now liquidated banks: Banca de Economii, Banca Socială and Unibank. In dynamics, the internal public debt had been continuing to grow and in 2018 it amounted to 23,058 billion lei.

At the beginning of 2020, the internal public debt of Moldova amounted 14,914 billion lei. The decrease in the internal state debt to the NBM occurs through the repurchase by the Ministry of Finance of government securities to be redeemed within the limits specified in the Law on the State Budget for the relevant year, or by early repayment.

One of the characteristics of economic policy and the specifics of economic development in the context of the financial and economic crisis of a global and regional scale is determined by the specifics of fiscal policy. The specifics of this policy determines the specifics of the development mechanism in the context of the economic crisis, which regulates factors affecting global demand, structural changes in the economic system, production volumes and price levels,

government revenues and expenditures, the development of activities that have competitive advantages in international exports [13].

GDP per capita (PPP basis) is the gross domestic product converted to international dollars on a purchasing power parity basis, divided by the total population. The international dollar has the same purchasing power as the United States dollar. The purchasing power between two countries, A and B, is the ratio of the number of monetary units of country A required to purchase the same amount of product in a country as one monetary unit of country B can acquire in country B. PPP can be expressed in the currencies of both countries. In practice, this indicator is usually calculated across a large number of countries and expressed in terms of a single currency. The US dollar is commonly used as the base or settlement currency. According to the data from Figure 1. in 2019, the figure was 7,703 (US $ per person, PPP).

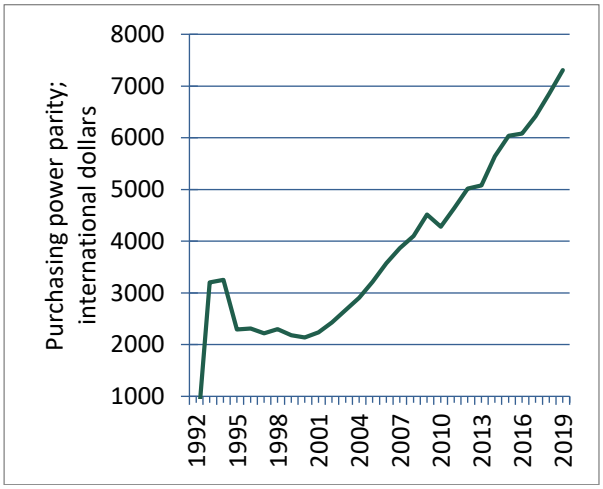

Fig.1. GDP per capita in Republic of Moldova (PPP basis).
Source: IMF: World Economic Outlook (WEO), October 2019 [3].

GDP per capita is the sum of the gross value added, created by all resident producers in the economy plus any taxes on products and minus any subsidies not included in the cost of products. GDP per capita in Moldova in 2018 was USD 3,191.

Agriculture, along with other sectors, is the main factor that ensures sustainable development at the macroeconomic level. GDP is one of the main indicators determining the growth of the country's economy.

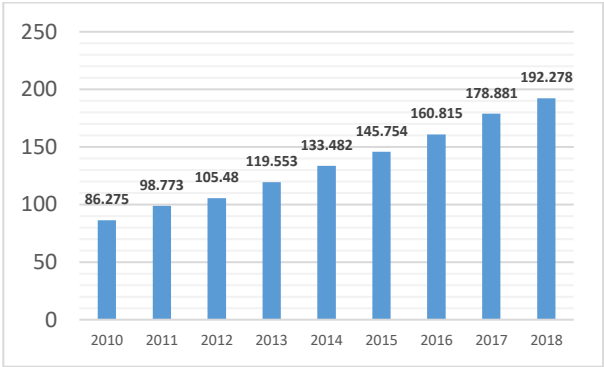

Fig. 2. Dynamics of the Gross Domestic Product (GDP) in the Republic of Moldova for 2010 - 2019, million lei
Source: developed by the author based on data from the National Bureau of Statistics of the Republic of Moldova [6].

Analysis of the data in Figure 2 shows the trend towards GDP growth. Significant GDP growth is observed in 2018 compared to 2010 2.2 times, and in the dynamics of 2010-2018 the average growth rate is determined by the geometric average formula: [11]

$$Rc = \sqrt[n-1]{Nn}/N1 = \sqrt[8]{\frac{192278}{86275}} = 1{,}105 \qquad (1)$$

This demonstrates an average annual GDP growth of 10.5%. For the Republic of Moldova, this growth shows the stability and balance of the economy at the macroeconomic level.

The analysis of the structure of GDP depending on resources, confirms that services and trade in the total amount of GDP is 12-15%, other resources up to 40%, industrial complex - which includes the extractive industry, processing industry, the energy sector, the share reaches 14 %. This is explained by the fact that the limited capacity of the economy does not allow the production of high-quality goods for the domestic and foreign markets.

The share of the agricultural sector in GDP in 2018 was 10.3%, which is at the level of 2012. This is explained by the low productivity of agricultural crops and livestock, which negatively affects the growth of labor productivity.

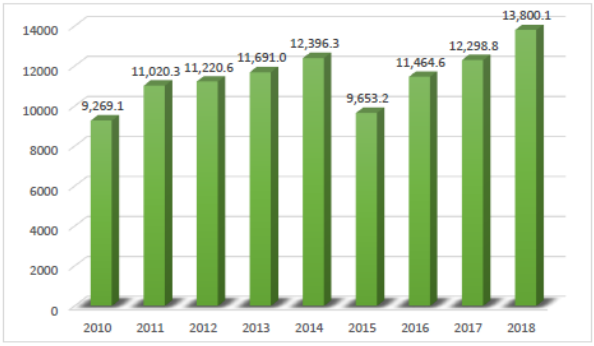

Fig. 3. Dynamics of the value of the Gross Domestic Product (GDP) in the Transnistrian Region of the RM for 2010-2018, million lei.
Source: developed by the author based on [8].

The dynamics of GDP in the Transnistrian region in dynamics for 2010-2018 shows a

$$\overline{Rc} = \sqrt[n-1]{\frac{Y_n}{Y_1}} = \sqrt[8]{\frac{13{,}800.1}{9{,}269.1}} = \sqrt[8]{1.4888} = 1.051$$

certain variation. It is especially distinguished by the low level of GDP in 2010 and 2015 and only in 2018 over the past 9 years; the GDP reaches 13,800.1 million lei in the average for 2010-2018, the GDP of the Transnistrian Region increased by 5.1%.
A more substantiated analysis of the GDP of the Republic of Moldova and the Dniester region in comparison can be judged by the data of the Fig.4.
The analysis of the Fig. 4 demonstrates a very low level of GDP per capita in the Transnistrian region. If in 2010 the difference in comparison with the Republic of Moldova was 7.3 thousand lei, then in 2018 this difference is 24.4 thousand lei already. The average growth rate in the Transnistrian region was 7.3% and in the Republic of Moldova - 10.6%.

$$\overline{Rc}_{RM} = \sqrt[n-1]{\frac{54.2}{24.2}} = \sqrt[8]{2.2396} = 1.106$$

$$\overline{Rc}_{TRANS} = \sqrt[8]{1{,}7633} = 1.0734$$

$$\overline{Y}_{GDP\_RM} = 19{,}258 + 3{,}7817 \cdot x \quad R2 = 99.2\%$$

$$\overline{Y}_{GDP\_TRANS} = 17{,}633 + 1{,}12 \cdot x \quad R2 = 69.99\%$$

The economic growth in the Transnistrian region is at a low level due to an increase in the number of economically inactive population, the number of the working population has decreased by 22%, the production of services has decreased by 6%. There is high shadow activity, rising prices, budget deficits, high unemployment.

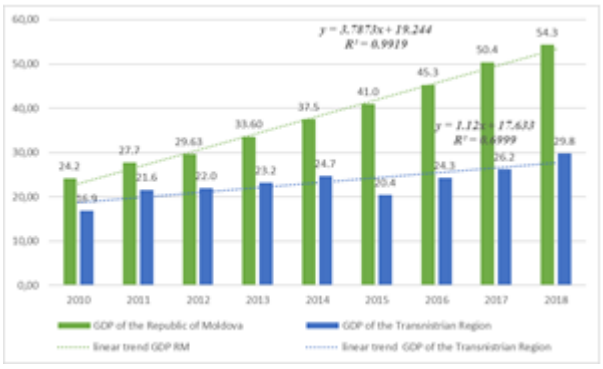

Fig. 4. Dynamics of GDP per capita in the Republic of Moldova and the Transnistrian Region of the RM for 2010 - 2018, thousand lei
Source: developed by the author based on [4, 6, 8].

Intensive economic growth is the only possible key to improving the well-being of both the country as a whole and the region separately.
In 2014-2018, the NBP deficit increased significantly, reaching in 2014 the volume of 1,946.7 million lei, which amounted to 1.8% of GDP. However, the dynamics of this deficit has decreasing and in 2018 the deficit reached 1.6 billion lei (Table 2).
The increase in government revenues and expenditures was not due to the imperatives of intensive development of the real sector, innovation and support for small business. This type of development has increased fluctuations and economic instability. At the same time, the budget surplus policy did not protect the incomes of consumers and producers, and no reserves were created in the process of overheating of the global and national economies. On the contrary, these reserves were spent on increasing pensions, subsidies, benefits, etc. Fiscal policy should stimulate and ensure balanced development, including development that would increase the level of economic activity and efficiency in relation to the dynamics of budget accumulation [12].
The specificity of socio-economic development policy is also determined by the specificity, structure and dynamics of the formation and use of public finances, including the nature and method of

accumulating and using income and expenditures in the national economy [10]. The peculiarities of the formation and use of revenues, expenditures and budget deficits in recent years have had a direct and dominant influence on the development of the real sector of the national economy. The increase in income, spending and deficit in the context of expanded economic growth has simplified and contributed to the imbalance and instability not only of the economic, but also of the social for a relatively long time.

The increase in the budget deficit to a higher level than the "optimal" deficit, the reduction in the potential of the real sector, and the increase in the balance of negative payments created the situation where relations with a socio-economic imbalance prevailed in any economic activity. In other words, the economic system was created with a negative trade balance, with a significant budget deficit and developed inflation, where any economic activity contains, potentially or in reality, economic and social elements associated with a crisis in relations.

The specific features of the socio-economic development policy in the Republic of Moldova are determined by the tax policy. The specifics of tax policy lies in the contradiction of this policy, which, on the one hand, was aimed at ensuring equality between economic agents in relation to the possibilities of each and, on the other hand, at increasing tax pressure and maximizing taxes, fines and administrative sanctions. This policy has widened the geography of economic imbalances and has deepened fiscal and socioeconomic imbalances. This imbalance and economic instability in the real sector depend on the methods of financing the budget deficit. If the budget deficit and the negative balance of payments are largely covered by domestic loans provided by the National Bank, and not by external loans, then social and economic instability increases, and the growth rates of the real sector of the economy decrease.

The increase in lending to the government from the national banking system in 2001-2018 was implemented starting from the communist government. At the same time, government securities were sold, the volume of which in 2012-2014. amounted to about 3 billion lei. In turn, during 2019, the Ministry of Finance organized 49 auctions for the sale of government securities, at which it offered the sale of government securities in the primary market for 11 billion lei [4]. The demand was higher than the supply. As a result, state securities worth 9 billion lei were sold. At the same time, the redemption of government securities for the reporting period amounted to 8.9 billion lei. At the same time, she clarified that in accordance with the Law on the State Budget for 2020, to finance the budget deficit, funds in the amount of 2 billion lei are envisaged through transactions with state securities.

As a result, the Ministry of Finance forecasts to sell state securities in the primary market in the amount of 12 billion lei, as well as to buy out government securities that have reached maturity in the amount of 10 billion lei [4].

Financing the budget deficit and balance of payments from the country's domestic financial resources reduced the money supply required for the development of the real sector. All this led to the decrease in the income of economic agents and the decrease of economic development rate. At the same time, the transfer of capital from the legal sector to the shadow sphere leads to an even greater imbalance in the economic system and differentiates society.

CONCLUSIONS

The problem of optimizing the volume of working capital in the economy is further aggravated by the fact that the structure of the economy is dominated by the agrarian sector, consisting of farmers and the agro-industrial sector, where the turnover of working capital is much slower (we are talking about two turnovers per year) than in industry and trade. The specifics of the structure of the national economy, the lack of working capital, the withdrawal of financial resources from the economy, the increase in domestic public debt, inflation - all this leads to an increase in

cash in shadow circulation in relation to bank deposits. This process contributes to economic instability and capital migration in the country, reducing the possibility of expanding the real sector, since the reduction in current assets in the economy creates conditions that stop the decrease in the effective interest rate on credit resources.

The specificity of socio-economic development is influenced by the inflationary policy of the state carried out during this period. Inflationary processes and their impact on the economic balance and the development of the real sector were different in different transition periods. Notwithstanding there is a direct link between the dynamics of inflation growth or decline and development or economic stagnation. If inflation rises, there will be a process of stimulating economic imbalances in the real sector. The decrease in the inflation rate stimulates economic interest, increases reproduction and leads to the increase in investment and savings in the real sector.

To normalize the financial situation in the economy, change in economic policy, including monetary policy is proposed. The increase in the lending rate to the economy, the decrease in the speed of money circulation and the increase in investments and remittances in priority sectors - all this, together with the reform of fiscal policy and the business and institutional environment, will create conditions for economic growth.

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POSSIBILITIES OF DEVELOPMENT OF THE SLOW TOURISM CONCEPT IN ROMANIA

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Abstract

Slow tourism, slow adventure are new ways to travel, are new ways of life that are addressed to a new generation of tourists, much more concerned with ecology, environmental protection, and who wants to have a relaxing break after life tumultuous it has, which needs both adrenaline, but also immersion in a natural, open space, which will allow them to disconnect from technology. Drawing from these concepts, appeared and developed by specialists from the Nordic countries, as well as from the examples of their good practices, through this paper we set out to analyze the evolution of tourism worldwide during the period 2009-2018, with the purpose of to identify the ways of adapting Romania to these new temptations. The research method consisted of two stages, one of bibliographic study and another of analysis and interpretation of statistical data, on the basis of which conclusions could be formulated and proposals made for the development of slow tourism.

Key words**:** *tourism, slow, adventure, sustainability*

INTRODUCTION

With the economic development that took place worldwide, the hierarchy of the economic branches has changed, the services playing an increasingly important role, especially in the developed countries economy, as a result of the computerization of the society, of the awareness of the role of protecting the environment, of increasing the standard of living of the population, of its urbanization, which contributed to the increase of free time. In this way, tourism has become an important branch of the tertiary sector which has registered increases due to the dependence between tourism and economic growth [3]. Among the beneficial effects of tourism can be listed: tourism is both creative and user of national income; tourism activities are a way of capitalizing on political resources; tourism is a generator of jobs; tourism contributes to the diversification of some branches of the national economy; tourism determines the growth of investments; tourism contributes to lower inflation; tourism contributes to the growth of exports; and so on.

Therefore, tourism can contribute to the stimulation and training of some elements of the tourism industry, but also to other branches of the economy with direct or indirect effect on the economic growth.

Since the second half of the twentieth century, world tourism has recorded continuous growth, not being greatly influenced by the possible economic, natural, political or social shocks that intervene in the world economy on a regular basis.

Not the same thing will happen at this time, starting in 2020, when the COVID-19 pandemic began to cause major damage to the tourism market (economic operators, airlines, etc.).

MATERIALS AND METHODS

The working methodology used in the present work was represented by two stages, one in

which the literature review on the concept of "slow tourism" was performed and a second based on the analysis of the statistical data provided by the domestic and international databases on the evolution of tourism for a period of ten years.
The indicators used were: number of arrivals in international tourism; expenditures for passenger transport items; international tourism, expenditures; international tourism, receipts.
From their analysis and interpretation, conclusions were drawn and proposals were made regarding the possibility of developing the concept of "slow tourism".

RESULTS AND DISCUSSIONS

According to the World Tourism Organization data for the period 2009-2018, the latest data published for this ten-year period, shows that 2018 was the 9th consecutive year of sustained growth in tourism.
In terms of tourist arrivals, of the 1,442 Billion registered worldwide 710 million come from Europe, 348 million from Asia and the Pacific, 216 million from the Americas, 67 million from Africa and 60 million from the Middle East.

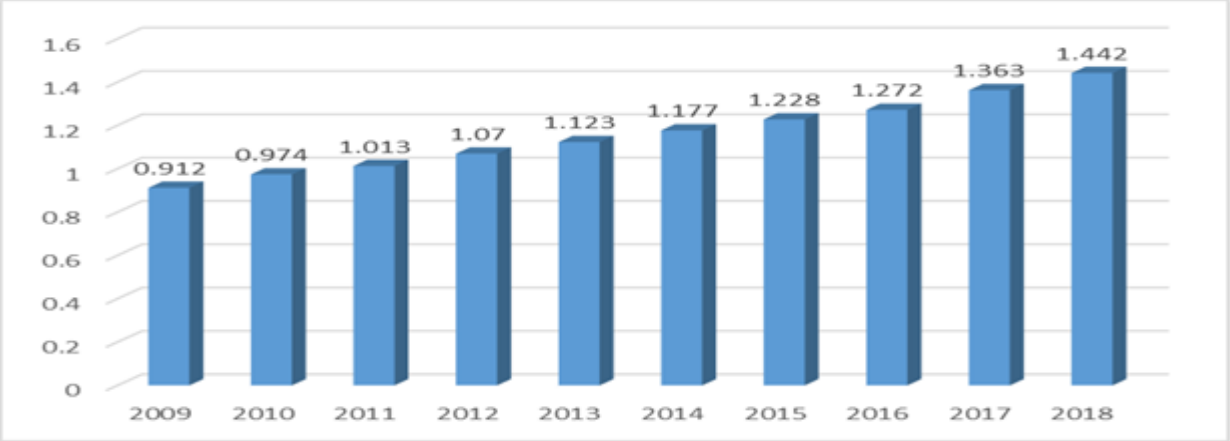

Fig. 1. Number of arrivals in international tourism (Billion $)
Source: own processing [12-21].

As for the increase in arrivals, the largest increase for 2018 was recorded by Asia and the Pacific, with + 7%, but also by Africa, with + 7%, followed by Europe and the Middle East with + 5%, as well as Americas with + 2%.

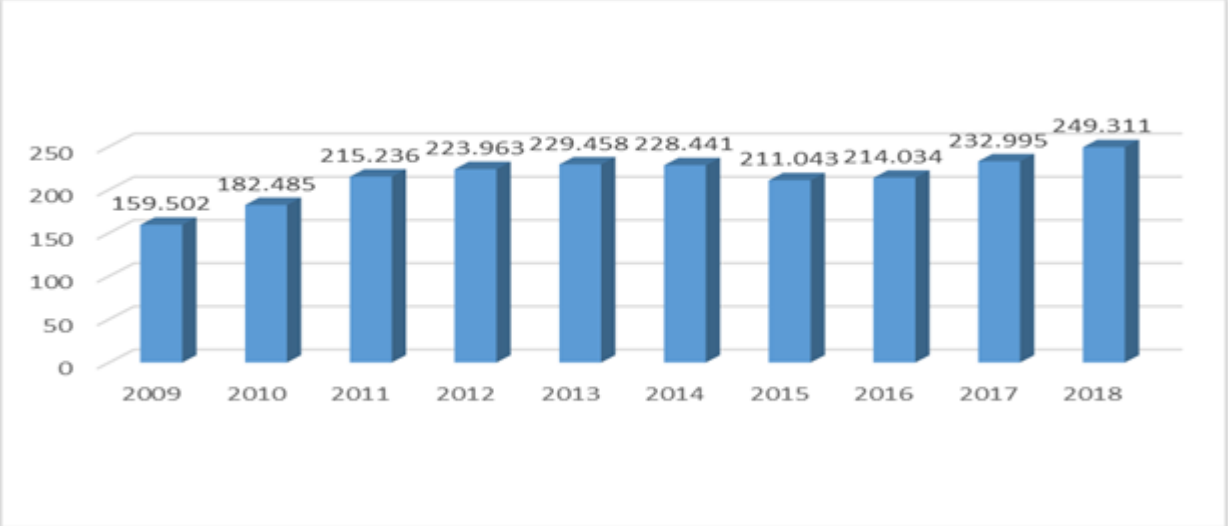

Fig. 2. Expenditures for passenger transport items (Billion $)
Source: own processing [12 - 21].

The expenses for the transport of passengers had the highest value in 2018, with 249,311 Billion $, year in which the trips of leisure, recreation and holidays represented 56% of the total. VFR trips, health, religion accounted for 27%, business and professional trips 13%, the rest for other purposes

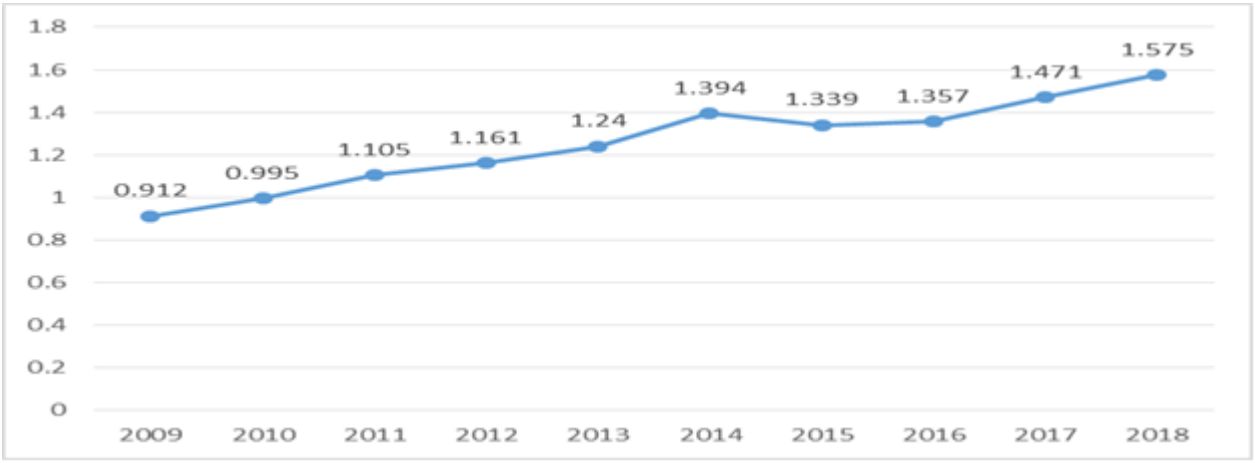

Fig. 3. International tourism, expenditures (Trillion $)
Source: own processing [12- 21].

Analyzing the situation of tourism revenues, we find that they increased during 2009-2018, even if in 2014 and 2015 there was a slight decrease. At the level of 2018, the highest revenues were registered in Europe (39%), followed by Asia and the Pacific (30%), Americas (23%), Middle East (5%) and Africa (3%).

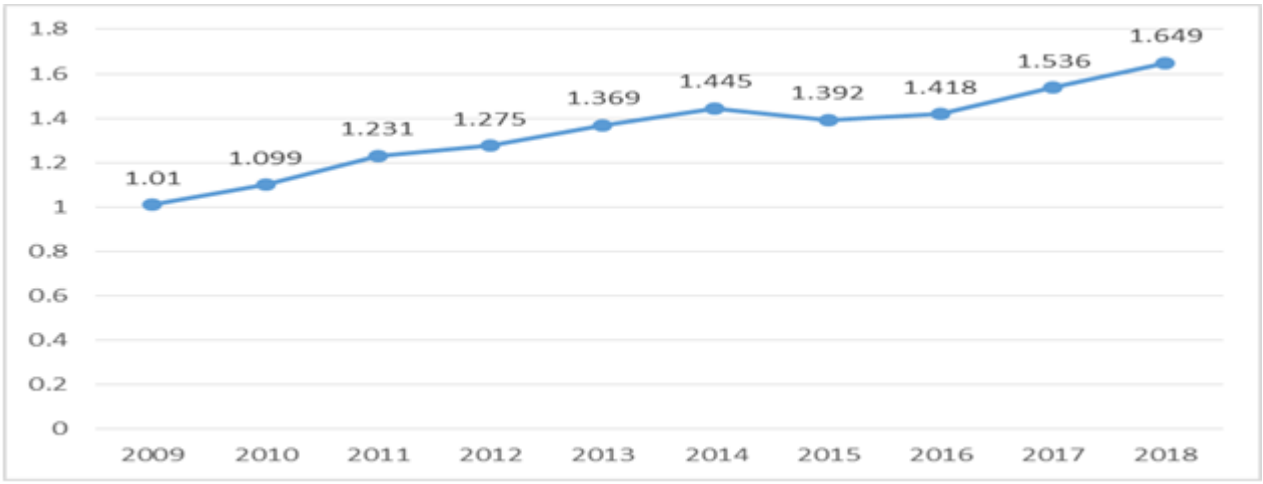

Fig. 4. International tourism, receipts (Trillion $)
Source: own processing [12- 21].

International tourism revenues increased in 2018 compared to the previous year by $ 121 billion.

China remains in first place in terms of the number of tourists traveling abroad, but according to the same statistics, it is found that 4 out of 5 tourists travel in their own region.

The analysis of all these data was intended to show that globally tourism has been growing steadily over the last ten years. Another aspect noted is the fact that tourists have changed the way they spend their free time, becoming more concerned about practicing tourism that protects the environment. Given the fact that the environment is precisely the domain and the object of the tourism activities, a special attention must be paid to its protection, which implies the transition from practicing the classic forms of tourism characterized by an

uncontrolled tourist circulation, by surrealism or by misuse. of the natural resources with negative effects, to more modern forms of tourism, more friendly with the environment, which respond to the modern demands of life.

Let us remember that surrealism created the phobias of the inhabitants regarding tourists. In cities such as Venice, Amsterdam, Barcelona or New York there have been noisy events due to the negative effects such as blocking traffic in cities, invading beaches or increasing housing costs.

Therefore everyone is aware that there is a need for responsible and sustainable tourism. Such a form of tourism is "slow tourism" which involves accommodation and visiting less congested and less known areas, which will relieve the pressure of the overcrowded areas.

This concept of "slow tourism" was the subject of a project developed by the University of the Highlands and Islands', which wanted to be a brand, a movement, through which to be able to develop unique and authentic tourism products, to be a solution of leisure time by the inhabitants of the big cities that have a tumultuous and hectic life and thus could move to a slower lifestyle, by which they can approach nature and experiment with new things [8]. Moreover, the concept of "slow tourism" wants to change the behavior of tourists, wants to make them move from selfies to another life pace, in which to learn new things, to share experiences and to slow down their pace of life.

Varley considers that “slow tourism unfold at human peace, meals take time to prepare; time is spent directly in the effort of journeying and living”[9]. The activities carried out in this way involve smaller groups of tourists who will have a smaller impact on the nature, who need to be accompanied by a guide to supervise their safety, guide them and facilitate them to gain memorable experiences. "Slow tourism” capitalizes on landscapes, traditional food, hospitality, traditions and people.

The advantages of its practice are: development of tourism in rural areas, in a sustainable way, with minimal risks for the environment; increasing revenues for local communities; ensuring stable incomes considering that it is less dependent on seasonality; acquiring unique experiences.

On the other hand, the practice of "slow tourism" in the areas not explored yet, could lead precisely to their destruction, to their pollution, which is why the concept must be very well managed, so as not to reach precisely what was wanted to be avoided. .

Imposing clear rules and continuous monitoring are elements that support the promotion and practice of "slow tourism".

Therefore, for those who want to use this concept, there are a set of criteria that need to be respected, namely: “Human or nature-powered journeys; an inspiring connection with the outdoors; environmental and cultural interpretation; local, wild or slow food; elements of storytelling, to convey the importance of the above elements”[1].

Romania has a natural heritage that allows it to develop a slow tourism. The experience of the Nordic countries, published in the form of examples of good practices, could be a point of reference.

Numerous such activities can be found on the specialized sites in Norway:

• Dogsledding which is a trip with the sled dog Husky; tourists are provided with accommodation in mountain huts without electricity and are offered the opportunity to enjoy the scenery, the meeting with the reindeer living in those areas or the northern lights;

• Another experience is offered by staying in a 5000-star hotel, as it is presented on the site, and which actually offers accommodation in nature, promising to those wishing that the offered landscape will change four times a year, once every season; the meal is provided through local products (trout, reindeer, forest mushrooms, etc.); there are organized camp fires and different activities that bring nature tourists closer;

• Another example is the photo adventure in the mountains of Norway that allows tourists to explore and photograph the flora and fauna of the rugged coasts.

Scotland is also a fan of slow tourism, and among the activities proposed on the specialized sites are:

• Cycling and canoeing, accompanied by tasting of local cuisine, ensuring accommodation in traditional homes; the purpose of the trip is also to provide psychological comfort, the creation of friendship bonds trying to create a new generation of explorers;

• Organizing trips on and around Scottish islands, tasting traditional products, experimenting with specific activities (gardening, weaving, etc.).

Sweden proposes the organization of private hunting parties, with accommodation in wooden cottages that ensures the comfort of a sauna or a "mountain spa", as well as the mass of local products.

In turn, Romania offers such vacations, which fall into the "slow tourism" category. There are numerous pensions or associations that provide hunting tourism services, precisely because Romania has unaltered ecosystems with enviable biodiversity. Beyond the ethical aspects, hunting tourism has many followers, and its practice contributes with important revenues to the development of local communities.

Another example is the transformation of sheep into tourist stalls, where tourists can participate in activities and taste the products with Shepherd specific.

Fishing tourism, which provides trips, walks, but also fishing parties, especially in the Danube Delta, but also in other areas of the country are activities that attract more and more nature lovers.

The ice hotel from Balea Lac is another way of spending the holiday in a unique place, where tourists can enjoy accommodation and meal provided from traditional Transylvanian products. The development of different routes, such as "Road of wine", "Road of salt", "Road of the King" are also ways to promote niche tourism [2, 7], which can be associated with "slow tourism".

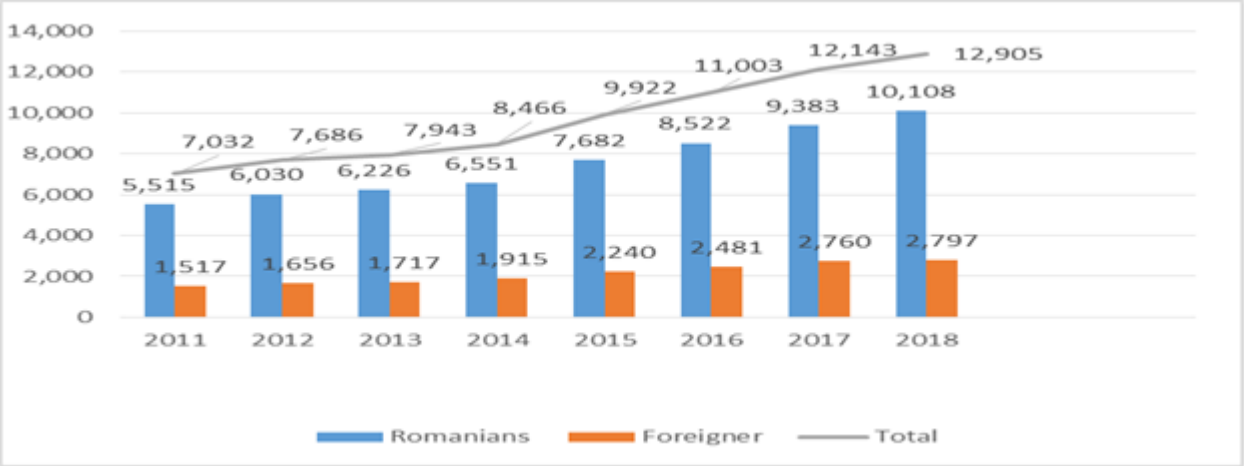

Fig. 5. Tourists accommodated in the establishments of tourists' reception in Romania, 2011-2019 (thousands)
Source: own processing [6].

In Romania, the number of tourists increased in 2009-2018, from 6,141 thousand tourists in 2009 to 12,905 thousand tourists in 2018. As for the increase in the number of Romanian tourists, they increased 2.8 times in 2018 compared to 2009, and the number of foreign tourists increased 2.1 times during this period.

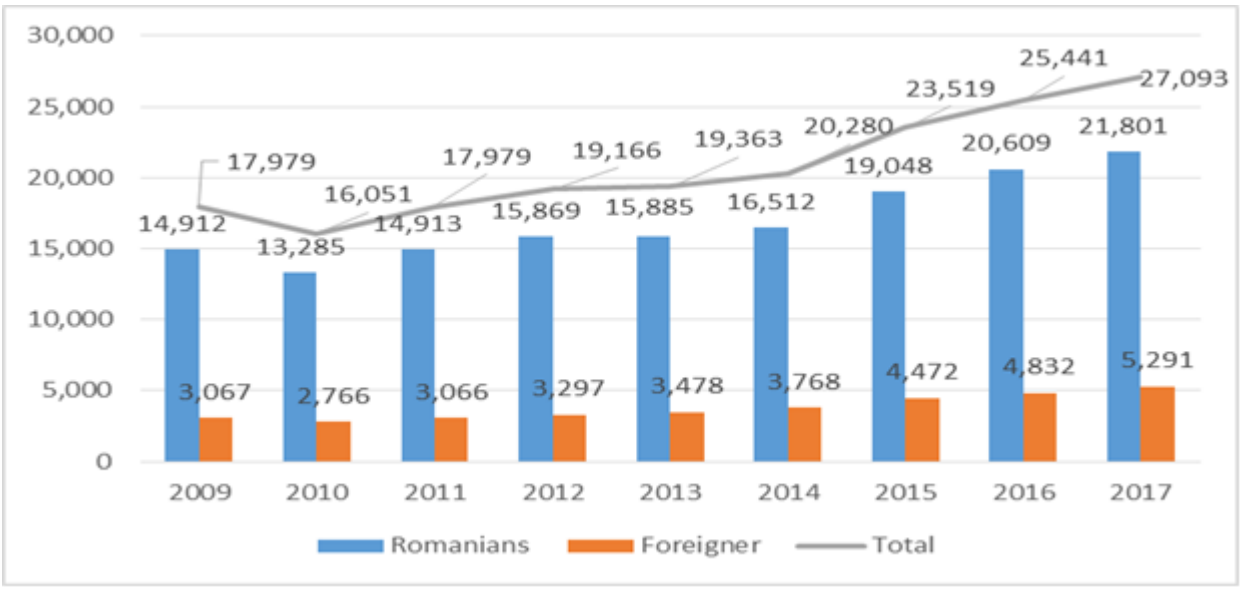

Fig. 6. Overnight stays in the establishments of tourists' reception (thou)
Source: own processing [6].

Regarding the number of nights, they increased from 17,979 in 2009 to 27,093 in 2017. The nights of Romanian tourists increased 1.4 times, and those of foreign tourists 1.8 times in 2017 compared to 2009.

Given these evolutions, Romania is part of the tourism trend that exists globally.

Therefore, although in Romania there are models of practice of "slow tourism", these can be developed in the region and can contribute to promoting the country, attracting tourists, both foreign and Romanian, contributing to the increase of alternative incomes for communities rural.

Romania has benefited from a real promotion through the two projects "Discover Romania Wild" and "Romania Wild" belonging to Dan Dinu and Cosmin Dumitrache in collaboration with the World Wide Fund for Nature, which presents the most spectacular images and areas in the natural and national parks.

More than this, the beauty of Romania as a tourist destination has been definitely promoted by the well known British journalist, Charlie Ottley, who traveled all over the world. He could be named "the ambassador" of Romania, promoting the country over its frontiers in Europe, the Americas and Asia in his wonderful serials "Wild Carpathia" and "Flavours of Romania" [4, 10, 11].

He visited Romania more than ten years being surprised by the beautiful landscapes, mountains and the awesomeness of their peaks, forests, meadows, wild animals, biodiversity, historical and cultural heritage in terms of old villages, houses, churches, fortresses, castles, folk traditions, architecture, music, suits, handicrafts. He considers that this is a valuable heritage which make Romania an unique destination, and that its treasures have to be put in value and known by tourists as an alternative to classic tourism, that he named "a termite- tourism" like in the Prahova Valley where there are too many visitors per square kilometer [4].

The old villages like in the area where Charlie Ottley bought an old traditional house in Sirnea, Brasov County, must be preserved and restored and included among the tourists travels to discover the beautiful and fascinating landscapes and old traditions and culture in architecture, customs, rural population activities, and hospitality [4].

Romania is also a model in which life is running in the most harmonious way between the Romanian people and the large mixture of minorities, based on friendship, mutual respect, understanding and peace.

He considers that "if tourists will be attracted to visit these places far away from the civilization of the cities could stop migration

of the people to the urban localities and the cuttings of the forests" [4].

This is "an alternative to run away from the usual things in the urban areas and come back to the simple life and enjoy living in nature" [4].

But we must not forget that HRH Prince Charles is also an admirer of Romania expressing his love for the wild diversity and charming landscapes: mountains, forests, springs, wild flowers and animals, the Danube Delta, the largest in Europe and natural reservation, and the cultural heritage of various regions: churches, monasteries, villages, which are old for hundreds of years and are unique in Europe and in the world [5].

In his opinion, "these treasures have been preserved by the Romanian people and also must be seen and appreciated by tourists and not only by the local population" [5].

The pandemic with co-vid 19 has deeply affected the classical tourism, and tourists will be obliged to change their habits for spending their spare time in week-ends or holidays looking for unique and healthy destinations where to closer to nature, where there are many places to explore and enrich their spiritual life.

HRH Prince Charles affirmed that" he visited Romania during the last 20 years and this country has a special place in his heart and every time when he return he feels like being at home" [5].

CONCLUSIONS

"Slow tourism" is a necessary movement in this stage where humanity is found and which needs to slow down, to take care of both the health of the planet and the people. The advantages of "slow tourism" are, on the one hand, the fluidization of the classic tourist attractions, and on the other hand the connection of people with nature, offering the opportunity to experience adventure, simplicity, living outdoors, creating social relationships, which will lead to the well-being of all actors involved in tourism.

Not surprisingly, the concept is developed in the Nordic countries that are well known for advocating for a change of pace of life, for eliminating stress and health problems.

Romania can benefit from this concept, the good practices presented by the other countries, so that it can attract a number of tourists in this niche sector, which can contribute to the well-being of the inhabitants of these areas.

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STUDY ON THE DEVELOPMENT OF ADVENTURE TOURISM IN ROMANIA

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Abstract

Today the world faces a lot of problems: an unstable economy that leads to joblessness, population growth, but also to a poor population in some areas of the world, environmental degradation, political instability, etc. All these problems could be alleviated in some countries, and they could be further alleviated through the income generated by tourism development. One form of tourism that does not necessarily require high investments is adventure tourism, which must be practiced responsibly precisely because it is close to nature and because we do not want to destroy this nature that is already in imbalance. This requires responsible behavior and government policies that ensure sustainable tourism. In this paper we intend to analyze the place that adventure tourism occupies among developed countries and developing countries starting from the existing data for the period 2010-2018. We will analyze how this ranking has changed over time, but also the ways in which Romania could develop adventure tourism. The working methodology involved the revision of the specialized literature on the definition of adventure tourism and the way of calculating the Adventure Tourism Development Index, the collection of data from various international databases, their processing, so that based on the analysis we could draw conclusions regarding the development stage of adventure tourism in Romania and its development prospects.

Key words**:** *tourism, adventure, sustainability, globalization*

INTRODUCTION

Adventure tourism began to develop when people wanted more for leisure and how they choose to spend their vacations. Adventure tourism is defined as a journey made outside the environment in which a person lives, for more than 24 hours, but not more than one year in a row. The appearance of this form of tourism was also determined by the tourist profile because it is clear that the profile of the modern tourist has changed. In a material developed within the SkillsOnBoard project - Soft skills for professional skippers in a changing tourism industry, the profile of the modern tourist is presented. Thus, if in the past the tourist was inexperienced, not using complex tourist services, preferring vacations in sunny areas, preferring relaxation, at present the tourist has become more mature, combining different activities for spending the holiday (sightseeing, practicing sports, relaxing, etc.) . Thus, vacations are no longer private just as a way of pausing, leaving the routine, but of continuing life [10]. This is also the case of the millennial traveler who has other goals regarding leisure and whose profile is represented by young people between the ages of 18-34, very social, expect technology to work, who love their phone, who like sharing ideas , passionate about values and crave adventure [4]. Thus, we see how globalization, through its advantages, can contribute to the development of tourism and its quality [5].

To determine the satisfaction of tourists, Khuong and Ngauyen identified a number of factors, classified as follows: cultural and historical attractions; local cuisine - as a factor of differentiation of destinations; the price charged by the tourist; safety and security of the tourist destination; the natural

environment; entertainment and recreation activities; the image of the tourist destination; negative factors of the tourist destination [6]. All this, because the current tourism must find solutions that adapt to the needs of modern tourism [9]. Or adventure tourism is such a form of tourism, niche, that can offer people ways to spend their free time in a way that they want.

If at the beginning the adventure tourism was a tourism that included natural, cultural and physical elements, consisting of activities described in Roman, literature or unique experiences, which would transform or model the tourist's personality, at the moment he means more. It means new things, new experiences, it means going beyond limits and creating sensations. The specialized literature recalls 34 activities that characterize adventure tourism, including: hiking, climbing, speleology, ecotourism, hiking, fishing, hunting, expeditions, camping, cruises, kayaking, rafting, diving, surfing, trekking, safari, sailing, sailing, snowboarding, cultural activities, educational programs, etc. Knowing the preferences of consumers of such services can be a support for those in the field of tourism who will be able to respond as quickly as possible to the wishes of adventure travellers. At the same time, adventure tourism can bring many benefits, economic, social and environmental (Figure 1).

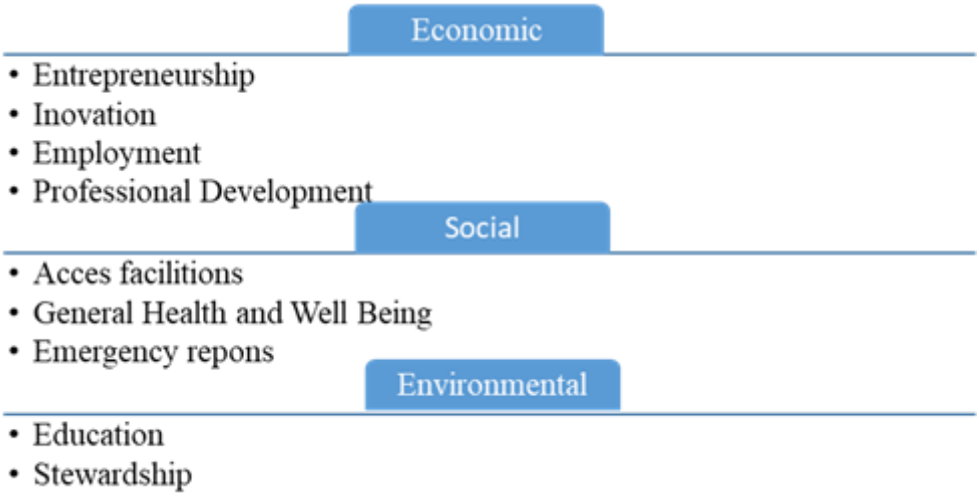

Fig. 1. Benefits of Adventure Tourism
Source: own processing after [11].

Tourism, as a branch of the global economy is the most dynamic sector in the field of services that contributes to the growth of GDP not only at the level of each country, but also at the global level [8]. According to a 2018 World Bank study, Strengthening Tourism Competitiveness in the OECS countries: Market Analysis, although the number of tourists practicing adventure tourism is much smaller than that of Cruise tourists and Overnight package tourists, in this case 65% of revenues remain in the country, compared to 14% in mass tourism. Also, adventure tourism provides 2.6 local jobs for $ 100,000, compared to 1.5 local jobs for $ 100,000 in mass tourism [4].

Worldwide there is The Adventure Travel Trade Association which follows year after year which are the best destinations for adventure tourism. Starting from countries recognized by the United Nations, these have been classified into two categories, namely developed and developing countries.

Starting with 2008 Adventure Travel Trade Association, The George Washington University and Xola Consulting began calculating the Adventure Tourism Development Index year by year, establishing both the method of calculating the indicator and the ranking of countries involved in adventure tourism. The methodology used to determine this index was aimed at developing

models from which the world can see, learn and reproduce [7].

Thus, starting from quantitative data in the form of international indicators, and from data taken from surveys that respect the principles of sustainable tourism development, the index is calculated on the basis of ten elements grouped into three categories that follow: Safe and Welcoming, Adventure and Readiness [1].

In the Safe and Welcoming category are: sustainable development, safety, health and natural resources. In the Adventure category are: the tourism entrepreneurship and resources of Adventure, and in the Readiness category are: humanitarian, infrastructure, cultural resources and image [2018 Report].

The ten elements or pillars based on which the index was calculated are as follows:

(1)Sustainable development policy which, through two indicators, the Environmental Protection Index and the Unemployment Rate, the first must be as high as possible and the second as low as possible, allow the sustainable development of tourism, also supported by government policies.

(3)Safety and security can be assessed on the basis of The Corruption Perceptions Index, Foreign and Commonwealth Travel Warnings and Expert Opinions and which provides information on travel safety, the facilities offered in case of accidents, the appearance of medical problems, the degree of risk related for traveling.

(3)Healthy. This pillar measures the level of social assistance that is provided at the level of a country. A well-developed health system can provide tourists with support in case of need, and the pillars on which to determine the pillar are Hospital beds (per 1,000 people) and Physicians (per 1,000 people).

(4)Natural Resources. This pillar is characterized by four indicators, namely: Urban Concentration, Population Density, Kilometers of coastline and Ratio of coast to total area.

(5)Cultural Resources are one of the important elements that are explored by adventure tourists, and the indicators that characterize this pillar are: UNESCO World Heritage Sites and Protected Area (% of Total Land) because it just indicates the existence of cultural resources.

(6)Adventure activity resources (cycling, climbing, hiking, rafting). This pillar can be assessed on the basis of the following indicators: Threatened Species and Forests, Grasslands, Drylands, which appreciates the quality of the environment and the existence of resources favorable to the adventure tourism.

(7)Humanitarian can be assessed by: Happy Planet Index (HPI), NGO Density and NGO Presence. Life expectancy, ecological footprint, number of NGOs, their density are elements that indicate the degree of development of a country.

(8)Entrepreneurship is closely linked to the economic development of a country and the possibility of practicing adventure tourism. The indicators based on which the barriers for entrepreneurs can be monitored are: Business Freedom, Fiscal Freedom, Trade Freedom, Government size, Investment Freedom, Monetary Freedom, Financial Freedom, Freedom from Corruption, Property Rights and Labor Freedom.

(9)Infrastructure is appreciated both on the basis of hard tourism infrastructure (roads, highways, airports, accommodation structure, etc.), as well as on the basis of soft tourism infrastructure (maps with tourist routes), but adventure tourism is closer to the second category.

(10)A country's Image is a pillar on which to develop its sustainable development.

MATERIALS AND METHODS

The working methodology involved on the one hand the bibliographic study, and on the other hand the collection of statistical data, their systematization and interpretation, which were the basis for formulating the conclusions regarding adventure tourism. The bibliographic documentation was done by consulting the specialized works in the field of tourism in general, and on adventure tourism, in particular. In the process of collecting the information needed for the

research we used data collected from secondary sources, ie data made available by official statistics, such as the World Bank, the World Tourism Organization and which have been processed, analyzed and interpreted and summarized in the tables. We took into account both the national and the global context, the bibliography constituting in particular studies and articles published on the specialized sites. The processing of data and information has allowed us to formulate some views on the evolution of adventure tourism, as well as on the influence of the determining factors on its sustainable development. Although the work has a fundamental character due to the fact that it has analyzed and highlighted theoretical concepts, it is at the same time an applied research because based on the obtained results, conclusions regarding the development of adventure tourism are formulated. Thus, the deductive approach has been tested using existing empirical data, the limits of the research leaving room for future research.

RESULTS AND DISCUSSIONS

The reports published for the period 2015-2018 made a ranking of the countries in which the adventure tourism has developed and in which there are 28 developed countries and 163 Developing/Emerging countries.
The top 10 countries, both from the developed countries category and from the emerging countries category, show that there were some changes in the adventure tourism sector in 2015-2018 compared to 2010 (Tables 1 and 2).

Table 1. Top 10 Developed Countries regarding adventure tourism

	2010	2015	2016	2018
1	Switzerland	Switzerland	Iceland	Iceland
2	Iceland	Iceland	Germany	Switzerland
3	New Zealand	Germany	New Zealand	Germany
4	Canada	Norway	Norway	New Zealand
5	Germany	New Zealand	Switzerland	Norway
6	Sweden	Austria	Canada	Sweden
7	Ireland	Canada	Australia	Canada
8	Norway	Finland	Finland	Finland
9	Finland	Sweden	Austria	United Kingdom
10	Austria	France	Denmark	Australia

Source: own processing after [1, 2, 3].

Following the top of the 10 countries we find that Switzerland ranked 1st for two years, 2010 and 2011, 2nd place in 2015 and 5th place in 2016. Iceland also ranked 1st and 2nd in the years analyzed. What stands out is the rise of Germany, Norway and Ireland and the descent into this top of Canada. Finland had a relatively constant position, and Austria had an oscillating evolution. The entry into the top of France is only seen in 2015, Denmark in 2016 and United Kingdom in 2018.

Table 2. Top 10 Developing Countries in Adventure Tourism

	2010	2015	2016	2018
1	Israel	Czech Republic	Czech Republic	Czech Republic
2	Slovak Republic	Slovak Republic	Israel	Israel
3	Chile	Bulgaria	Estonia	Estonia
4	Estonia	Estonia	Chile	Slovak Republic
5	Czech Republic	Chile	Slovak Republic	Poland
6	Bulgaria	Poland	Slovenia	Chile
7	Slovenia	Israel	Bulgaria	Romania
8	Jordan	Slovenia	Poland	Bulgaria
9	Romania	Korea	Korea	Slovenia
10	Latvia	Costa Rika	Romania	Jordan

Source: own processing after [1, 2, 3].

For Developing Countries, it is noted that the Czech Republic climbed from the 5th position in 2010 to the 1st position in the following years. Estonia also climbed from the 4th position in 2010 and 2015 to the 2nd position in 2016 and 2018. Chile is the country that has descended to the top, and Bulgaria and Slovenia have had oscillating evolutions. The new top countries are Korea, Jordan, Latvia or Costa Rica.

As for Romania, at the beginning of the achievement of these tops, that is, 2008, it is on the 21st position. In 2009 it reached the 11th place, and then in 2010 it reached the 9th place, then in 2016 it was on the 10th place.
In 2018 Romania reached the 7th place. Given this position, we will analyze the factors that determined Romania's position in this top.

Table 3. The pillars of the Adventure Tourism Development Index for Romania in 2010

	Pillar	Value
1	Sustainable Development	8.14
2	Safety	6.33
3	Healthy	3.96
4	Natural Resources	6.34
5	Cultural Resources	5.69
6	Adventure Activity Resources	7.29
7	Humanitarian	3.83
8	Entrepreneurship	7.32
9	Infrastructure	8.29
10	Image	8.86
	ATDI	65.68

Source: own processing after [1, 2, 3].

Starting from the data that were the basis of the ATDI calculation in 2010, it is found that Romania with an index of 65.68 was on the 11th place. from the other countries in the top.
In 2018 Romania ranked 7th among developing countries as a result of improving the values attributed to the 10 pillars. From table 4 we find that the index had value 62, observing the progress made during this period.

Values increased for pillars: Sustainable Development, Safety, Healthy, Adventure Activity Resources and Entrepreneurship. The other pillars, Natural Resources, Cultural Resources, Humanitarian and Image had lower values than in 2010. It is worth mentioning that these values are calculated according to the methodology that changes every two years.

Table 4. The pillars of the Adventure Tourism Development Index for Romania in 2018

	Pillar	Value
1	Sustainable Development	8.34
2	Safety	6.79
3	Healthy	4.24
4	Natural Resources	5.98
5	Cultural Resources	5.32
6	Adventure Activity Resources	8.91
7	Humanitarian	3.75
8	Entrepreneurship	7.67
9	Infrastructure	6.03
10	Image	6.75
	ATDI	62

Source: own processing after [1, 2, 3].

Precisely to show this, we will present the value of pillars and for the other countries that are in the first six places, before Romania (Table 5).

Thus it is found that the first place is the Czech Republic for which the index has the value 33, a place that was assured due to the high values related to Sustainable Development, Adventure Activity Resources and Entrepreneurship. The same indicators also had high values for Estonia and Slovak Republic. For Israel, the best pillars were Adventure Activity Resources and Infrastructure.

Table 5. The pillars of the Adventure Tourism Development Index in 2018

		Country					
	Pillar	Czech Republic	Israel	Estonia	Slovak Republic	Poland	Chile
1	Sustainable Development	8.69	8.24	8.48	8.06	8.20	7.94
2	Safety	6.46	5.44	7.11	6.36	6.74	6.94
3	Healthy	5.21	4.32	4.45	4.63	3.93	1.84
4	Natural Resources	6.23	6.57	6.12	6.12	6.02	7.04
5	Cultural Resources	5.95	5.43	5.19	6.36	6.46	4.70
6	Adventure Activity Resources	8.64	8.94	8.66	8.60	8.67	8.99
7	Humanitarian	4.03	3.82	3.66	3.67	4.08	3.63
8	Entrepreneurship	8.47	8.20	8.89	7.76	8.05	8.93
9	Infrastructure	6.13	6.88	6.62	6.48	5.90	6.35
10	Image	6.33	6.62	6.09	7.35	6.11	7.53
	ATDI	33	38	43	48	52	53

Source: own processing after [1, 2, 3].

Slovak Republic, ranked 5th, registered high values for pillars Image, Infrastructure, but also Adventure Activity Resources. Poland has high values for Adventure Activity Resources, but also for Safety and Cultural Resources.

Chile has the highest value for Adventure Activity Resources, Entrepreneurship and Image, and the lowest values for Healthy, Humanitarian and Cultural Resources.

We find that Romania has climbed to the top of adventure tourism, which can be further developed because it represents an opportunity for our country benefiting from natural resources (Carpathian Mountains, Danube Delta, Transfagarasan, Transalpina, etc.), but also cultural, infrastructure, safety, etc. for its development.

The adventure involves suspense and the unknown in need of increased security, which can be ensured at the present time much easier due to the development of technology that allows faster location, quick access to maps and numerous other information, access to information presented on lovers' blogs adventure activities, the possibility of capturing images in digital format, which amplifies the adrenaline desire of the lovers of this tourism sector, but also the means necessary for its development.

In Romania, more and more tourist agencies or sites have appeared that promote adventure activities, grouped into three categories: air sports (mountaineering, climbing, boating, zip line, airplane flight, balloon flight); water sports (kayaking, kiteboarding, rafting, diving) and ground sports (ATV, horseback riding, mountain biking, paintball, skiing, snowboarding, snowmobile, speleology, shooting bears, archery).

For the development of adventure tourism in Romania, there are a number of factors applied globally that can influence its development, namely: the demographic evolution - the increase of life expectancy influences the way of spending leisure time; employment models - that make people have many more days off or on vacation for leisure; changing the attitude towards retirement - increasing the retirement age and continuing the activity make the population more active and more involved in spending their free time; lifelong education - makes more and more people involved in the education process and wants their personal development, which can be achieved even through travel; consumerism

- there are categories of accessories and clothes for adventure tourism; culture - tourists will want to create their own world and have a sense of belonging to certain values; fitness and health - the world is increasingly interested in a healthy lifestyle, spending free time contributing to the development of adventure tourism. All these elements provide the premises for the development of adventure tourism.

CONCLUSIONS

Adventure tourism is on the rise, being one of the forms of tourism that can contribute to the development of rural communities. It must be practiced responsibly, however, given that irresponsible behaviour could lead to the destruction of the natural environment that was the basis for adventure tourism. Therefore, in addition to their own responsibility, there is also a need for government policies to contribute to sustainable tourism.

Although adventure tourism has developed in Romania lately, with new forms of leisure spending appearing, there are still opportunities for growth in this sector that offers tourists the adrenaline rush they want.

The aspect that should not be neglected, however, is the sustainability and responsibility of adventure tourism, so that the actions taken have a minimal impact on the natural, social or cultural environment.

This is why adventure tourism should be analyzed in more depth because it represents not only a way of increasing the income locally, but also a way of practicing ecological tourism, with minimal effects on the environment.

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USE OF SENSORY ANALYSIS IN ASSESSING THE QUALITY OF BAKERY PRODUCTS

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Abstract

The food industry today faces many challenges as a result of changes in legislation in this area, due to the use of distribution chains that are increasingly complex or the emergence of no ice ingredients tend to replace traditional products. The success of a food company depends on its ability to provide its customers with safe, quality products that meet their expectations, but also respecting specific legislation. In addition to their role in human nutrition due to their nutritional value and the need to cover energy needs, food must also contribute to ensuring psychosensory satisfaction as a result of consumption, in close connection with the structure of the product, its chemical composition and its properties. The way in which the food products satisfy from the sensory point of view the exigencies of the consumers, represents an important condition in the realization of some salable products and therefore, the producers in the food industry must pay due attention to these aspects. This can be achieved through sensory analysis which is also a component of the concept of quality, being a method of examining food using the basic senses: sight, hearing, taste, smell and touch. Through this paper we aimed to analyze consumers' perception of the quality of bakery products using subjective methods, ie assessment methods for consumers and not specialists, namely: the hedonic test and the Likert scale, which were applied to a semi-trained panel of 45 tasters, represented by the students of the Faculty of Management and Rural Development. Based on the study, conclusions were formulated regarding the way in which consumers appreciated the quality of bakery products, resulting in the fact that they orient their purchase of bakery products according to taste and appearance.

Key words**:** *sensory analysis, quality, consumer, bread, bakery products*

INTRODUCTION

Because at one point information on the microbiological and physico-chemical aspects of food could no longer be sufficient in making decisions about their production and marketing, new solutions were sought to help improve these issues. And because the production of new products starts from the study of consumer preferences, we came to study the perception they have about the products they consume, this is done through sensory analysis [6]. Given the fact that the organoleptic properties of food products are for the buyer the most important criterion taken into account in assessing quality, even if they have a fairly high degree of subjectivity, the launch of new products is based on information provided by sensory analysis, which can "characterize and estimate the magnitude of changes in a product due to the addition of certain ingredients, the interactions of several ingredients and their ratios, as well as different technological approaches" [3]. Also, sensory analysis is used in monitoring the life of products and in off-flavor detection, finding that its use can detect those changes that underlie the shelf life of products [7]. By using sensory analysis, it is possible to achieve an easy, fast and cheap control of both the quality of raw materials and products sold [1].

A Puratos survey called Taste Tomorrow and which collects the answers of over 17,000 respondents from 40 countries, highlights the fact that unlike 2015, when the most important aspect taken into account in

assessing product quality was freshness, at the level of the year 2019 the taste was the most important aspect that consumers follow when choosing pastries, bakery and chocolate [11]. In terms of bread, taste ranks 2nd in the ranking after freshness, but before the price. Texture also occupies an important place in consumer choices [11].

"Sensory value is expressed by attributive quality characteristics that in some situations cannot be determined by objective means. That is why it appeals to the consumer's perception which, although it has a high degree of subjectivity, allows us to determine the sensory profile" as affirmed [9].

Bread is one of the main products in Romanian food, the market of bakery products in Romania being a conventional market. Bread consumption has decreased in the last ten years from 9.2 kg / month to 8 kg/ month in 2018. At the level of 2019, the consumption was 95 kg/capita/year, compared to the European average which was 60 kg/capita/year. The quantity consumed is decreasing compared to previous years (96.5 kg/capita/year in 2018 and 98.4 kg/capita/ year in 2017) [8], finding at the same time an increase in consumer preferences towards healthier bread assortments, ie assortments containing different cereal seeds, bread made from wholemeal flour assortments or artisanal bread assortments.

The Packaged Food in Romania report published in 2016 by Euromonitor shows that in 2015 the bakery products market had a volume of 1,775,700 tons, estimating a decrease of 4% for 2020, ie 1,698,550 tons [4].

The way in which the consumption of bread in Romania has decreased in the last 8 years is presented in Fig. 1.

Eurostat data show that Romania has the lowest price of bread in the EU, followed by Bulgaria and Poland. In Romania, the price of bread in 2019 was 47% lower than the average calculated in the EU, while Denmark had a price of bread of 151% compared to the same average.

Along with Romania are Bulgaria with a 31% lower price and Poland with a 30% lower bread price, and along with Denmark are Austria with a bread price of 133% compared to the European average and Luxembourg with 125% [5].

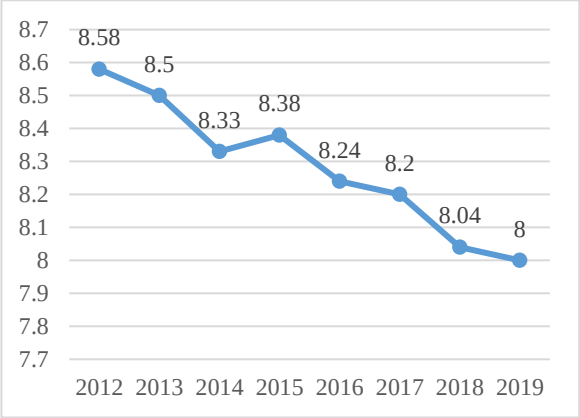

Fig. 1. The situation of bread consumption in Romania kg/capita

Source*:* Own calculation.

MATERIALS AND METHODS

The case study involved performing the sensory analysis of 4 varieties of bread. The panel consisted of semi-trained tasters represented by students of the Faculty of Management and Rural Development, participants in the practical work carried out in the discipline Sensory analysis of food products and familiar with the identification of sensory attributes.

The preparation for tasting involved cutting the bread into slices of equal thickness which were then transferred to plates whose color is white. The samples were numbered, each taster having to appreciate: the general appearance, the smell, the taste, the texture and the general acceptability.

During the tasting, all conditions regarding temperature (23º), humidity (47%) were observed, the test environment was noiseless, the color of the walls was neutral (white), the lighting was natural, there was no communication between evaluators and no disruptors. The tasting was done in groups of 10-12 tasters, between the hours of 10-11; 11-12 and 14-15.

The appreciation of the products was done using the Likert scale, the hedonic test and the rank ordering method, due to the fact that these were the methods applied by the

students in the appreciation of the bakery products.

The Likert scale is a method used in the analysis of the questions asked in the survey of respondents in marketing studies, questions that refer to the characteristics of the analyzed product in order to measure consumer satisfaction. The advantage of the method is that it can measure the degree of difference, but it cannot measure the specific difference between the sizes.

Thus, each feature of the product is assessed based on a set of questions with favorable or unfavorable answers, generally having 5 values (but 7 or 9 values can be used). Each characteristic is calculated a score, and finally the overall score is established.

The scores assigned to the scale levels are between 2 and - 2, and the calculation of the score assigned to each characteristic is determined based on the following formula:

Score $_{characteristic}$ = (No. of attribute opinions 1 x (+2) + No. of opinions attribute 2 x (+1) + No. of attribute opinions 3 x 0 + No. of attribute opinions 4 x (-1) + No. of attribute opinions 5 x (- 2))/No. respondents

To determine the overall score, the formula is used:

Overall score = Score characteristic/no. characteristics.

The hedonic test aims to assess the taste qualities of food products by giving grades between 1-9 to each sample.

The objective of the method is to follow the degree to which a product is rated positively or negatively by tasters, by completing an evaluation form in which preferences are classified as follows: extremely unpleasant, completely unpleasant, semi-pleasant, slightly unpleasant, indifferent, poorly liked, pleasant, very pleasant, extremely pleasant.

Of the 9 levels, the first four (1-4) reflect the positive sensations, and the last four (6-9) reflect negative feelings.

Based on the answers, a “I don't like” percentage is calculated, and the results, through the correspondence made, are analyzed and interpreted statistically.

The overall score is determined as follows:

Global score = (N x 9 + N x 8+ N x 7 + N x 6 + N x 5 + N x 4 + N x 4 + N x 3 + N x 2 + N x 1)/ND,

where:

N - the number of tasters with the same appreciation

ND - total number of tasters

The method of ordering the ranks is used in assessing the complex characteristics of a product. Respondents are asked to make a hierarchy of products analyzed in relation to the criteria that were evaluated [12]. This results in a number of ranks equal to the number of products under analysis, ranks to which values are attached. The weighting factors used were 1 for appearance, 0.5 for color, 0.75 for consistency and 2 for taste. To determine the overall score, the arithmetic mean of the scores calculated for each of the analyzed products is calculated [2].

RESULTS AND DISCUSSIONS

To establish consumers' perception of the quality of bakery products, the study involved analyzing four varieties of bread: white bread, graham bread, multigrain bread and rye bread.

The data published in 2019 show that white bread is at the top of consumption, representing 78% of bread consumed in urban areas and 77% of bread consumed in rural areas, being appreciated by traditional consumers. Graham bread is consumed daily by 14% of urban consumers and 7% of rural consumers. Multi-grain bread is consumed daily by 5% of urban consumers and rarely by 57% of them, while 24% of rural residents consume multi-grain bread. Rye bread is consumed daily by 4% of urban consumers and 2% of rural consumers, while 61% of urban consumers rarely consume this category of bread, compared to 26% of rural consumers [Rompan] [10].

The characteristics pursued in assessing the quality of the bread were: appearance, smell and taste. The Likert scale used in assessing quality had 5 levels of agreement or disagreement, namely: total disagreement, disagreement, indifference, agreement and total agreement.

Characteristics of the first bread assortment, toast bread, were analyzed based on the opinions centralized in Table 1.

Table 1. Distribution of subjects' appreciation for white bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	14	19	7	5	0
Appearance	14	20	4	7	0
Taste	12	17	7	7	2

Source: Own calculation.

The data in Table 1 show the respondents' answers regarding smell, appearance and taste. The scores calculated for each of the above characteristics were 0.93 for odor, 0.91 for appearance and 0.67 for taste. The overall score determined as the ratio between the scores of the 3 characteristics is 0.84.

The second bakery product under analysis was graham bread. The three characteristics and the way of their appreciation by the respondents are presented in Table 2.

The following scores were obtained by processing the data: 0.58 for smell, 0.62 for appearance and 0.31 for taste, resulting in an overall score of 0.50. For multigrain bread the determined scores are presented in Table 3.

Table 2. Distribution of subjects' appreciation for graham bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	10	13	11	5	1
Appearance	12	14	10	8	1
Taste	8	9	19	7	2

Source: Own calculation.

Table 3. Distribution of subjects' appreciation for multigrain bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	12	15	9	6	0
Appearance	14	14	11	6	0
Taste	11	16	13	5	0

Source: Own calculation.

It is thus found that for the smell and taste a score of 0.73 was registered, and for the appearance the score was 0.80. The average score for multigrain bread was 0.80. The assessments regarding rye bread are presented in Table 4. The calculation of the scores resulted in a value of 0.71 for smell, 0.67 for appearance and 0.73 for taste, the average score being 0.70.

Table 4. Distribution of subjects' appreciation for rye bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	14	10	15	6	0
Appearance	13	11	14	7	0
Taste	12	14	14	5	0

Source: Own calculation.

From the affected analysis regarding the consumers' perception regarding the four products, it is found that the highest overall score was obtained by multigrain bread, followed by white bread, rye bread and graham bread (Table 5).

In terms of smell, the highest score was obtained by white bread, followed by multigrain bread, rye bread and graham bread.

In terms of taste, the ranking had the following order: white bread took first place, followed by rye bread and multigrain bread which took second place, with the same score, followed by graham bread. In terms of appearance, the ranking has in the first place the multigrain bread, followed by the white bread and the rye bread with the same score, and on the last place is the graham bread.

The second method used in the sensory analysis of bakery products was the hedonic test.

Based on the calculations performed, it is found that the average score of 6.56 placed white bread on the first place, followed by rye bread with an average score of 6.51, multigrain bread with a score of 6.20, on the last place being graham bread with a score of 5.76 (Fig. 2).

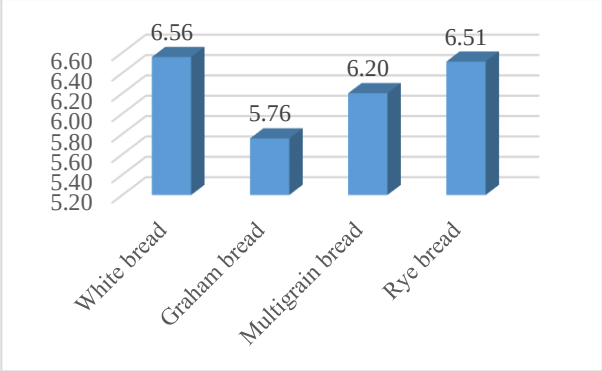

Fig. 2. Overall score (hedonic scale)
Source: Own calculation.

The rank ordering method allows the panel to make a comparison between the analyzed products and their ordering.

Table 5. Degree of appreciation

Degree	White bread	Graham bread	Multigrain bread	Rye bread
Extremely nice (9)	0	0	0	0
Very nice (8)	10	2	9	12
Nice (7)	21	15	19	16
Least liked (6)	4	14	3	3
Indifferent (5)	7	9	7	8
Slightly Unpleasant (4)	0	0	0	0
Half nice (3)	3	5	7	5
Completely Unpleasant (2)	0	0	0	0
Extremely Unpleasant (1)	0	0	0	0
Average	6.56	5.76	6.20	6.51

Source: Own calculation.

The samples were presented simultaneously, and the products were ordered according to rank, appreciating taking into account the appearance, color, consistency and taste.

The way in which the assessment scores of the four characteristics were given by the 45 evaluators are presented in Table 6.

Next, the average scores and the weighted average scores for the four varieties of bread were determined (Table 7).

It is found that based on the information collected from the evaluator, the highest average score for white bread was for taste, followed by appearance and color. The lowest score was given for consistency. The weighted average score held by taste was the highest, followed by appearance. The consistency of the white bread rose from the fourth position to the third position.

For graham bread, the average scores, in descending order, were given for: color, appearance, taste and consistency (Table 8).

Regarding the weighted average score for multigrain bread, the sensory characteristics

were ranked first in taste, appearance, consistency and color (Table 9).

For the third assortment of bread, rye bread, the scores were high for the four characteristics.

The most appreciated characteristic after applying the weighting factor was the taste, appearance, consistency and color (Table 10).

Table 6. Frequency of awarding points for bakery products

Characteristic	Points	White bread	Graham bread	Multigrain bread	Rye bread
Appearance	4	12	10	12	13
	3	14	14	15	11
	2	11	12	12	14
	1	7	8	6	7
	0	1	1	0	0
Color	4	11	11	13	12
	3	12	14	16	14
	2	14	14	9	13
	1	8	6	7	6
	0	0	0	0	0
Consistency	4	6	7	12	11
	3	11	8	19	15
	2	12	16	11	15
	1	6	11	3	4
	0	0	3	0	0
Taste	4	12	8	11	12
	3	17	9	16	14
	2	8	17	13	14
	1	6	9	5	5
	0	0	2	0	0

Source: Own calculation.

Table 7. Weighted average score for white bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.64	2.64
Color	0.5	2.58	1.29
Consistency	0.75	1.93	1.45
Taste	2	2.69	5.38

Source: Own calculation.

Table 8. Weighted average score for graham bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.53	2.53
Color	0.5	2.67	1.33
Consistency	0.75	2.11	1.58
Taste	2	2.27	4.53

Source: Own calculation.

Table 9. Weighted average score for multigrain bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.29	2.29
Color	0.5	2.78	1.39
Consistency	0.75	2.44	1.83
Taste	2	2.73	5.47

Source: Own calculation.

Table 10. Weighted average score for rye bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.67	2.67
Color	0.5	2.71	1.36
Consistency	0.75	2.73	2.05
Taste	2	2.51	5.02

Source: Own calculation.

The scores obtained for rye bread, highlight the fact that the most appreciated characteristics were the consistency and the color. However, the weighting factors brought taste and appearance in the first two places, which, as the studies regarding the characteristics that influence the decision to buy bakery products show, are in the first places in the consumers' choice.
Following the three categories of applied tests, the results obtained are confirmed, the variations between the four assortments being reduced.

CONCLUSIONS

The sensory characteristics of a product are extremely important in the choices made by consumers, being decisive for the choices made. The establishment of the quality classes for the analyzed products was made on the basis of the centralized sheets in which individual scores were registered which were the basis for determining the average scores.
The assessments made by the evaluators who were part of the panel highlighted the following aspects:

- The white bread obtained the highest scores, being appreciated both for appearance and taste
- Graham bread, from the evaluators' point of view, was appreciated for its color and appearance
- Multigrain bread was appreciated by evaluators for color and taste
- Rye bread was appreciated by evaluators for its consistency and color.

In conclusion, taste and appearance are the characteristics according to which consumers shop. The guidance of bakery manufacturers must take these characteristics into account when launching new products.
Sensory analysis is a way to improve the marketing activity of any company, no matter what it produces.

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CONTRIBUTING FACTORS AND RESTRICTIONS TO THE PARTICIPATION OF RURAL WOMEN IN CASSAVA PROCESSING IN ISIUKWUATO AREA OF ABIA STATE, NIGERIA

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Abstract

Women play a crucial role in the Nigerian Agricultural sector ranging from production to processing and marketing. About 80% of small scale cassava clusters in the western part of Nigeria are owned and operated by women. The study sought to analyse the restrictions and factors that contribute to the participation of rural women in cassava processing in Isiukwuato area of Abia State, Nigeria. Multistage sampling technique was employed in the selection of eighty (80) respondents from whom data were elicited. Data were analysed using descriptive statistics and the probit regression model. The result showed that the respondents were young ($\bar{X}$ 44.19), with majority married (78.75%), had a mean household size of ($\bar{X}$ 5.16) persons, attained various levels of education but were small scale farmers with a mean farm size of (1.98) hectares. The probit regression estimate showed that the coefficients of age, education level, farm income, cooperative membership, household size and extension contact influenced the participation of the respondents in cassava processing at varied levels of significance. The model posted a pseudo R^2 of (0.6303). Like every other business, the respondents faced restrictions like poor storage facilities, low quality of cassava roots, discolouration and uncontrolled fermentation, inadequate supply of cassava roots all year round among others. Based on the findings, the study suggested the introduction of contract farming in the area, which will ensure a reliable supply of cassava roots for large scale processing and incorporating gender perspective into all agricultural interventions by the government to ensure equal impact.

Key words**:** *cassava processing, contributing factors, participation, women*

INTRODUCTION

Cassava, a starchy root crop and major source of food security in Africa has the ability to grow in low quality soil, is drought and disease resistant and has a flexible cycle of cultivation [18, 30]. Cassava alongside maize, rice, yam, sorghum and millet has been identified by [22] as the major staple food in Nigeria. It is one of the many crops promoted by the federal government of Nigeria through the Agricultural Transformation Agenda (ATA) initiated in 2011 to boost local food production and is cultivated by over 30 million farmers in the country [12]. According to [13], Nigeria is the world's leading cassava producer, contributing about 21% of the product in the global market. Fresh cassava roots is highly perishable and one of the ways of reducing loss is through processing, which helps to increase its shelf life. Cassava is consumed in processed form, [17] stated that in Nigeria the main traditional cassava products are *garri*, *fufu* and *lafun.* Recently, there has been an increase in *garri* processing because it is seen as convenient, quick and easy to cook and store. *Fufu* and *lafun*, also in their order of importance are gaining popularity because of their ease of preparation and compact packaging. According to [15], the operations involved in cassava processing include peeling and grating, fermentation, dewatering, roasting and frying, drying, cooking and milling. Apart from pressing or dewatering which involves the exerting a lot of energy done by men, other operations are done by women. Women play a crucial role in the Nigerian agricultural sector ranging from production to processing and marketing. [2] observed that about 80% of small scale

cassava processing clusters in the western part of Nigeria were owned and operated by women. However, these clusters suffered from inefficiencies emanating from limited financial resources for both maintenance and business expansion, high land rent, low processing technology, poor access to improved cassava varieties and markets. [15] added other constraints faced by women in cassava processing to include lack of steady supply of roots, drudgery in the traditional operations involved in the process, inadequate storage facilities for both raw and finished products, long processing tie and low returns from product sales [11], ineffective linkages between processors, farmers, transporters and marketers [6]. Hence, to reach the targeted processing capacity and quality for Nigeria, the type of processing technology for small scale processors especially women would have to be improved upon significantly [2]. This background informed the basis for the study. The study was driven by the following objectives, to:

(i)determine the socio economic characteristics of cassava processing rural women;

(ii)analyse the factors affecting rural women participation in cassava processing;

(iii)identify the constraints faced by rural women involved in cassava processing in the study area.

MATERIALS AND METHODS

The study was conducted in Isuikwuato Local Government Area of Abia State in south eastern Nigeria. The Local Government is made up of several villages, with the headquarters at Mbalano Imenyi. The notable landmarks in the area include the Abia state University Uturu and the Uhuchukwu cave in Ahaba-Imenyi. As at the 2006 national census, the local government area had a population of 115, 794 people with a projection of 151, 700 people in 2016 [20].

The coordinates of Isuikwuato are Latitude: 05^0 32’ N and 05^0 53’ N, longitude: 07^0 29’ E and 07^0 48’ E of the Greenwich Meridian and a land mass of 375,000 square kilometres. The area falls within the forest belt region of Nigeria which accounts for rainfall which is heavy for about seven (7) months of the year (April to October with two weeks’ dry spell in August (Break). The harmattan winds blows across the area between November and February. while the daily temperature ranges between 27^oC and 36^oC [1].

The major crops cultivated in the area are oil palm, cashew, yam, cassava, etc including rearing of livestock. The Local Government Area was purposively chosen because it is one of the major food producing areas in Abia State and majority of its Agribusiness ventures such as rearing of animals, processing of cassava, palm oil etc are actively done by women.

Multi – stage sampling technique was used in the selection of respondents for the study. In the first stage, five (5) communities were randomly selected, in the second stage, two (2) villages were randomly selected from each of the previously selected communities to give a total of ten (10) villages. In the final stage, from each of the chosen villages, eight (8) rural women were randomly selected, giving a total sample size of eighty (80) respondents.

Data collected were analysed using descriptive statistics and probit regression model which was employed by [23] in a similar study.

The probit model for the estimation of determinants of rural women participation in cassava processing in the study area is specified thus:

$$P\ (Y = 1/x) = F\ (XB) = 1/\sqrt{2\pi}\int_{-\infty}^{XB} e - \frac{(XB)^2}{2}\ dx \ldots\ldots\ldots\ldots (1)$$

where:

$X = (1, X_1i, X_{2i}\ \ldots\ldots\ldots\ X_ki)$

$B' = (\beta_0, \beta_1,\ \ldots\ldots\ldots\ \beta_k)$

Y = Vector of dependent variable (1 for participated and 0 for non-participated)

X = Vector of explanatory variables (predicators)

$\propto$ = probit coefficients

e_i = random error term

where:

X_1 = age (years)
X_2 = marital status (dummy; married = 1, otherwise = 0)
X_3 = level of education (years)
X_4 = distance of the women's farm from homestead (km)
X_5 = level of farm income (naira)
X_6 = cooperative membership (dummy; 1 = Yes, 0 = No)
X_7 = household size (number)
X_8 = year of experience in farming (years)
X_9 = Extension contact (dummy; 1 = yes, 0 = No)
X_{10} = major occupation (dummy; 1 = farming, 0 = non-farming)
X_{11} = access to credit facilities (dummy; 1 = Yes, 0 = No)
X_{12} = access to subsidiary inputs (dummy; 1 = yes, 0 = No).

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Respondents

To determine the socio economic characteristics of the respondents, simple descriptive statistics were used and the results presented in Table 1.

The result shows that 23.75% of the rural women participating in cassava processing in the study area were less than 31 years old, 25.00%, between the ages of 31 and 40 years, 17.50% were between 41 to 50 years and 51 to 60 years respectively, while 16.25% were above 61 years. The mean age of the respondents was 44.19 years.

This implies that rural women involved in cassava processing were young and energetic and thus capable of withstanding the stress and rigours involved in the business. Age is a primary latent characteristic affecting the participation of rural women in agribusiness ventures such as crop production and processing [7].

Aged rural women participating in agricultural ventures had reduced risk bearing capabilities, are less innovative and may not withstand the strain and stress involved in such ventures as crop production and processing [21, 29]. The result is also consistent with the findings of [27] that women in their early 30s and 40s take active part in food crop production and processing.

Table 1. Socio economic characteristics of cassava processing rural women

Age (years)	Frequency	Percentage (%)	Mean & St. Dev.
Age			
>31	19	23.75	44.19 ± 14.09
31-40	20	25.00	
41-50	14	17.50	
51-60	14	17.50	
61 and above	13	16.25	
Total	80	100.00	
Marital Status			
Single	9	11.25	
Married	63	78.75	
Widowed	8	10.00	
Total	80	100.00	
Household Size			
<4	10	12.50	5.16 ± 1.64
4 – 6	60	75.00	
7 – 9	8	10.00	
10 – 12	2	2.50	
Total	80	100.00	
Education Level			
No formal education	4	5.00	
Primary education	20	25.00	
Secondary education	38	47.50	
Tertiary education	18	22.50	
Total	80	100.00	
Farm Size (Hectares)			
< 1.0	2	2.50	1.98 ± 1.54
- 2.0	66	82.50	
2.1 – 3.0	7	8.75	
> 3.0	5	6.25	
Total	80	100.00	
Farming Experience			
<10	31	38.75	13.11 ± 8.38
10-15	28	35.00	
16 – 20	7	8.75	
21 -25	7	8.75	
26 – 30	5	6.25	
>30	2	2.25	
Total	80	100.00	
Access to Extension Agents			
No	73	91.25	
Yes	7	8.75	
Total	80	100.00	
Membership of Cooperative Society			
Yes	35	43.75	
No	45	56.25	
Total	80	100.00	
Access to Credit			
Yes	11	13.75	
No	69	86.25	
Total	80	100.00	

Source: Field Survey, 2019.

The distribution of respondents according to their marital status shows that majority (78.75%) of the rural women were married, 11.25% were single while 10.00% were widowed. This implies that married rural women have access to extra financial and physical supports from their spouse which positively influences participation in cassava processing. This corroborates the finding of [5], that the preponderance of the married people could create potential for increased labour supply which would positively contribute to rural women participation in agricultural activities.

The distribution of respondents according to household size shows that 12.50% of the respondents had a household size of less than 4 persons, majority (75.00%) of the rural women had household size of between 4 to 6 persons, 10% had a family size of between 7 to 9 persons, while 2.50% had a household size of between 10 to 12 persons. The mean household size of rural women was 5.16 persons. This implies that the rural women had moderate family size which means availability of household labour (if up to labour age) for farming activities. Also, the element of household labour plays an important role in rural women participation in agriculture especially when hired labour or mechanization is inadequate in supply or unavailable. The result is in line with [3], that household size influenced participation in agriculture related activities.

The distribution of respondents according to their educational level shows that 5% of the women in cassava processing in the study area had no formal education, 25% had primary education, 47.50% had secondary school education while 22.5% had tertiary education. In summary, 95.00% of the rural women in cassava processing in the study area were educated at various levels. This indicates that the respondents were literate. Educational level affects the level of participation of rural women in agri-business as education increases the ability of these rural women to obtain, process, and use information relevant to the various agricultural ventures. This agrees with [24] that high level of education had the capacity of influencing farmers and processors to accept new innovations and change their attitude to the desired technology. [9] opined that farmers with high level of education stood to be better informed in production and processing activities.

Distribution of the respondents according to farm size shows that 2.50% of them have farm sizes less than 1 hectare, majority (82.50%) have farm sizes of between 1.0 and 2.0 hectares, 8.75% cultivate between 2.0 and 3.0 hectares , while 6.25% have more than 3 hectares of land. The mean farm size of the rural women is 1.98 hectares . This implies that rural women in the study area are involved in small scale farming (producing at subsistence level) ,which also influenced the quantity processed. This finding is expected. The result also agrees with [9] that agricultural production in South-East Nigeria is generally done by small holder farmers with land holdings of less than 3 hectares.

The distribution of respondents according to their years of processing experience shows that 38.75% of the rural women has processed cassava for less than 10 years, 35.00% had experience of between 10 and 15 years, 8.75% had experience of between 16 to 20 years and 21 to 25 years respectively, 6.25% had 26 to 30 years experience, while 2.25% has been in the cassava processing business for over 30years. Their mean years of experience is 13.11 years. This implies that rural women involved in cassava processing in the study area have acquired enough experience, hence farm resources could be efficiently utilized. [31] recorded that more than 10 years farming experience shows that farmers have garnered ample farming knowledge through experience which could have an influence on their attitude.

The distribution of the respondents according to their access to extension agents shows that 91.25% of rural women had no extension contact, while 8.75% of the rural women had access to extension agent. This implies that the impact of extension agents have not been felt in the study area. Extension agents inform and build the capacity of farmers, increase their knowledge bank and reduce uncertainty

in decision-making. Extension provides information on availability of new technologies and technical skills in farming generally. [32] noted that extension contact enhances farmers' access to information regarding agricultural activities and subsequently impacts positively on farmer's participation in agro related businesses.

The distribution of respondents according to their membership of cooperative societies shows that 56.25% of the rural women in agribusiness do not belong to cooperative societies. However, an appreciable number belonged, meaning that the cassava processors in the study area have begun to see the benefits accrued from joining such associations. The reason for not being members could be due to low perception of the benefits of belonging to such economic groups. The result compared favourably with [27] who observed that 71.67% of women cassava producers do not belong to cooperative societies. Collective endeavour makes necessary arrangements for better inputs supply, adoption of innovations, extension support, credit access, collection of produce, processing and marketing facilities [19].

The distribution of the respondents according to access to credit shows that 86.25% the respondents had no access to credit facilities while 13.75% of them had access to credit facilities. Poor access to credit could be due to the fact that women are rarely considered credit worthy because they have no collateral [33]. Lack of access to credit facilities constitutes a constraint in purchasing raw materials, processing equipment, implements and other farm inputs. Access to credit is regarded as one of the key elements in raising participation in agribusiness. Rural women without cash and had no access to credit will find it very difficult to engage in agriculture [25].

Determinants of participation of Rural Women in Processing of Cassava

To determine the major contributing factors to the participation of the respondent in cassava processing in the study area, the probit regression model was employed and the results shown in Table 2.

Table 2. Probit Regression Estimates of Factors Influencing participation of rural women in cassava processing in Isuikwuato, Abia State

Variables	Coefficient	Std.Err	z-value	P>|z|
Constant	-3.7390*	1.7533	-1.82	0.068
Age	-0.0461**	0.0193	-2.48	0.013
Marital Status	-0.0678	0.3888	-1.06	0.290
Level of Education	0.0342**	0.0745	2.41	0.016
Distance of the farm from homestead	-0.7063	0.2472	-1.32	0.188
Farm Income	5.91e-07**	1.46e-06	2.16	0.031
Membership of Cooperative	0.0927**	0.0792	2.24	0.025
Household Size	0.1004**	0.0187	2.52	0.012
Years of Farming Experience	-0.1072	0.3867	-1.26	0.208
Extension contact	0.0013*	0.0004	1.91	0.056
Major occupation	0.1024	0.0731	0.61	0.544
Access to credit	-0.0788	0.1426	-2.13	0.033
Access to subsidiary inputs	0.1113	0.0183	1.05	0.253
Log likelihood	-41.55389			
LR Chi^2	17.90			
Pseudo R2	0.6303			

Source: Field Survey, 2019.

**, * Significant at 5.0% and 10.0% levels respectively.

The model posted a log likelihood value of -41.55389, *pseudo* R^2 value of 0.6303 and goodness of fit chi square value of 17.90 which was statistically significant at 1.0% alpha level. seven out of the twelve variables fitted into the probit model were significant.

Specifically, the coefficient of age (-0.0461) was negatively signed and significant at 5.0% level of probability. This implies that younger rural women had higher probability of participating in processing of cassava than their older counterparts. The reason is that older rural women are likely to be less energetic and therefore find it difficult to engage in the rigorous activities that characterize cassava processing.`Similar result was observed by [10] that the women participating in agriculture were mostly young.

The coefficient (0.0342) of the educational level of the respondents was significant at 5.0% and positively signed. This means that increase in literacy level will most likely result in an increase in the rural women participation in cassava processing as education is an investment in human capital which is able to raise the skills and qualities of man, narrows his information gap and increase his allocative abilities thereby leading to more productive performance in agribusiness. This is expected and according to [8], formal education helps one to grasp issues better, anticipate and respond to market needs. [26] added that postharvest processors with higher education have better access to information and knowledge that are beneficial to processing operations. Education enhances the potential of rural women to process information and make the best out of any situation hence enable them to minimize risk and face uncertainties in any agribusiness venture [30].

The coefficient of extension contact (0.0013) was sparingly significant at 10.0% alpha level and positively signed indicating that the more the extension contact with the rural women, the higher will be the likelihood of their participation in processing of cassava. This is expected because regular contact with extension agents create favourable environment for information dissemination. The result is in line with [3] who observed that as women get more contact with extension agents, they are likely to learn modern techniques of cassava processing and thus their involvement in them will increase.

The coefficient (-0.0788) of access to credit facilities was significant at 5.0% probability level and negatively signed. This implies that with more credit available to the rural women there is a less tendency to involve in cassava production and processing in the study area. This could be possible where the resources are not used efficiently. Also, with available credit the women may venture into less risky non-farm activities with faster returns on investment [28]. The result negates the findings of [4] that rural women cassava processors who had access to credit may overcome their financial constraints and as such as purchase of cassava processing implements will be feasible.

The coefficient (0.0927) of membership of cooperative societies was positively related to participation in processing of cassava and statistically significant at 5.0% alpha level. This indicates that the more the women belong to cooperative societies, the more their participation in cassava processing because most institutions both extension and research interact more with farmers in groups with the aim of reaching out to many farmers within the shortest time frame with improved innovations, loans etc. women who belong to such associations or groups are likely to access these provisions. This result is consistent with the findings of [14]. that cooperative societies ensure collective production, marketing, enables farmers to access loans, training, ensuring pooling of resources together and reduction of information asymmetry thus reducing transaction costs and ensuring economies of scale.

The coefficient (0.1004) of household size was positive and statistically significant at 5.0% alpha level. The positive sign of the variable implies that rural women with larger the household size, participate more in cassava processing . Large household size is

expected to provide cheap family labour needed for processing of cassava. The availability of substantial family labour may reduce the number of hired farm labours and cost associated with it, thereby increasing the chances of participation in cassava processing by the rural women [16].

The coefficient (5.91e-07) of income was significant at 5.0% alpha level and positively influenced rural women participation in cassava processing. The positive sign of the variable implies that rural women with large income, participate more in the processing of cassava because they will be able to afford the expenditures the process requires. Production and processing activities require money and so an increase in farm income will increase the tendency of the women to be involved in these activities [28].

Restrictions faced by rural women involved in cassava processing

In the bid to analyse the constraints faced by the respondents in the cause of cassava processing, simple descriptive statistics was employed and the results shown in Table 3.

The result shows that the rural women participating in cassava processing ventures were restrained by inadequate supply of cassava roots all year round (62.50%), irregular root size (85.00%), domestic chores (60.00%), tediousness of traditional processing method (92.50%), Inadequate access to productive resources (land and labour) (93.75%), distance from home to farmland (57.50%), poor infrastructural facilities (68.75%), time involved in processing (86.25%), low quality of cassava roots (96.25%), discolouration and uncontrolled fermentation (91.25%), high cost of processing (92.50%), Inadequate access to credit facilities (88.75%), poor storage facilities (91.25%), low output due to weather conditions (86.25%) and Poor extension services (80.00%). [3] enumerated the constraints in cassava processing to include inadequate capital, inadequate land, pre- occupation, cost of transportation, inadequate storage and high cost of materials. [15] identified the following as constraints faced by cassava processors in their study area; ineffective linkages between processors, farmers, transporters and marketers, low processing time, low returns from sales and irregular cassava shape. Summarily, [17] stated the constraints in cassava value chain to include production constraints, fresh cassava value chain constraints and general market constraints.

Table 3. Constraints faced by rural women in cassava processing

Constraints	Frequency*	(%)
Inadequate supply of cassava roots all year round	50	62.50
Irregular root size	68	85.00
Domestic chores (cooking, fetching water and firewood)	48	60.00
Tediousness of traditional processing method	74	92.50
Inadequate access to productive resources (land and labour)	75	93.75
Distance from home to farm land	46	57.50
Time involved in processing	69	86.25
Poor infrastructural facilities	55	68.75
Low quality of cassava roots	77	96.25
Discolouration and uncontrolled fermentation	73	91.25
High cost of processing	74	92.50
Inadequate access to credit facilities	71	88.75
Poor storage facilities	73	91.25
Low output due to weather condition	69	86.25
Poor extension services	64	80.00

Source: Field survey, 2019.
* Multiple Responses Recorded

CONCLUSIONS

Empowering women can cause a tremendous contribution to the food security of their families and the society at large. The study revealed the factors that contributed to the participation of rural women in cassava processing to include; age, level of education, farm income, cooperative membership, household size and extension contact. Like any other business, the women involved in cassava processing encounter some problems

which if not properly handled, the state and country may not reach the targeted processing quantity and quality to achieve the desired food security. In the light of the foregoing, the following recommendations were made.

Introducing contract farming in the area, which will ensure a reliable supply of cassava roots for large scale processing. Contract farming can encourage the formation of associations by farmers which can improve market information and increase in bargaining power. It can also solve the problem of extension services and returns to scale.

Provision of funds through credit programmes that can serve as incentives to encourage women who are into cassava processing, this will enable them procure modern machines to reduce the drudgery that characterizes the business.

Incorporating gender perspective into all agricultural interventions by the government to ensure equal impact.

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TRANSPORTATION SYSTEM AND OUTPUT MARKET PARTICIPATION NEXUS AMONG YAM PRODUCERS IN SOUTHWEST REGION OF NIGERIA

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Abstract

The study assessed the nexus between the transportation system and output market participation among yam producers in Southwest region of Nigeria. A multistage sampling procedure was used to select 180 respondents for the study. Multinomial logit (MNL), Market Participation Index (MPI) and Double-hurdle Regression model were employed for the analysis of data. The MPI result showed that about 87% of the respondents participated in yam market in the area. The most commonly subscribed modes of transportation were pick-up van (55%), motor cycle (26%) and head porterage (7%). The results of the MNL showed that farming experience, extension services, distance, household size and market participation were the factors influencing the preference for the mode of transportation used by the farmers. Again, the results from the double-hurdle regression identified membership of cooperative society, farming experience, access to market information and mode of transportation as the factors that determine the decision to participate and the rate of participating in yam market. Therefore, the study concludes that there is a synergy between transportation system and output market participation which has significant impact on the production and availability of food (yam) in the market.

Key words**:** *double-hurdle, market, multinomial logit, transportation, yam, Nigeria*

INTRODUCTION

Nigeria is naturally favoured in the production of root and tuber crops which makes her the highest producer of cassava and yam in the world [13, 19]. After cassava, yam is the top agricultural product produced in Nigeria with about 47,532 thousand tonnes as at 2018 [19]. Africa produces most of the yam in the world with over 70% of the production from Nigeria [27]. Yam is mainly grown in the central and southern parts of Nigeria [13, 5], with average area of nearly 6 million hectares as at 2018. It is a staple food that has socio-cultural recognition in Nigeria and contains about 21% dietary fibre, rich in carbohydrate, vitamin C, and essential minerals [13, 34]. According to [11, 30], 100g of yam contain 494kj of energy, 27.9g of carbohydrate, and 4.1g of dietary fibre with nearly 200 calories of energy per day per capita. According to [44], yam production has significant relevance in Nigeria's economy in terms of food consumption, sources of earnings, and employment opportunities. Also, yam belongs to the family *Dioscorea* with over 600 species [26], out of which white yam (*Dioscorea rotundata*) is the most socially and economically valued species in most parts of Nigeria [44]. In attempt to convey agricultural products to the markets makes transportation system a key factor in production and marketing stages, most especially in root and tuber crops as a result of their bulkiness. The tasks of transportation and marketing are normally carried out by the farmers and traders [25, 44].

Again, transportation and logistics form integral part of the economy, and these two are the propelling forces upon which industries and societies all over the world function. Transportation is very crucial in trade and commerce and as well help in globalization. It also forms one of the factors that determine competitiveness, efficiency and effectiveness of the commodity pricing and market. Again, it is viewed by [8] as a requisite to economic development most especially in Nigeria and other developing countries. It is a major component of rural

infrastructure which provides accessibility to market and other social amenities such as schools, health services, and institutions [47, 8]. According to [3], sustainable rural development is incomplete without transportation system which serves as a main link for the market of goods and services; movement of people; dissemination of information, and the advancement of rural economy in developing countries. Its importance in agriculture as in the other sectors of the economy cannot be over-emphasized. It is the only way by which input resources can be brought to the farm, and where food and other resources produced in the farm to the market, and various homes [39]. In agriculture, transport is the engine behind market formation most especially in the rural settlements, and also contributed immensely in connecting socio-cultural and geographical areas for economic activities [43, 39]. Again, [28, 4] opined that a good transportation system is not only provided cheap access to market for agricultural products but significantly reduced the cost of the products, and as well create sustainable livelihood to the people.

Moreso, transportation system plays indispensable role in all agricultural value chains, starting from production through processing and marketing to the final consumers. Therefore, market participation can be enhanced through a functioning transport system. Market participation allows producers (farmers) to sell their products thereby bringing the products to the end-users (consumers) and as well accrue better revenue [32]. According to [31, 32], market participation and extent of participation are determined by improved access to markets through good roads and means of transportation. [36] also affirmed that development of effective and efficient agribusiness value chain is a function of market orientation and participation most especially among agricultural producers including yam farmers. Nigeria and other developing countries are still known for the subsistence nature of agricultural production including yam. Most of them have not seen farming enterprise as a business rather as a routine of life. Market participation is pivotal to change farmers' orientation toward farming in the areas of production and marketing of their products. Also, participation in output and input markets will not only cause sustainable productivity and profitability but tremendously reduce rural poverty among the farming households [12, 1]. [32] opined that the overall goal of sustainable agriculture, food security, and poverty alleviation can be achieved through marketing of agricultural products especially among the yam producers being a crop that are highly demanded for in Nigeria.

Problem Statement

Several studies in literature have established the complimentary relationship between transportation system and agricultural sector; yam production inclusive [10, 43, 2, 17, 30]. [42, 29] opined that mobility of agricultural products has been impeded by bad roads and lack of transportation facilities in Nigeria most especially in the rural areas. This has significant effect on the efficiency of the marketing system, productivity, income and level of poverty in these areas [38, 6, 43, 2]. According to [30], yam is a bulky semi-perishable good, and moving it from farm through farm gate to the rural and urban markets needs strong transportation system. Also, the distance to most of the yam farms coupled with rough roads has led to burdensome farm trips, increase in transaction cost, and damage of yam tubers, thereby making farmers to run at a loss [29, 43]. It was also reported by [29, 30] that most crops including yam remain un-harvested or become spoilt once harvested due to inadequate transportation system. The problems have escalated to poor prices, market price instability, consumers' price increase, and decrease returns to the yam farmers. Again, limited accessibility, inadequate rural roads and high transaction cost have constrained farmers from getting important input resources, new technologies, to expand the production scale and as well transport any excess after harvest [39]. Again, to the best of my knowledge, empirical studies on the nexus

between transportation system and output market participation among yam producers appear to be scarce in Nigeria, especially in the Southwestern Nigeria in which Ondo State is inclusive as one of the top yam producers. However, past studies have separately established the relevance of transportation system and market participation in agriculture but little or none has investigated the relationship between the two subject matters particularly among yam producers in Nigeria. Also, most of the studies on market participation failed to investigate the two scenarios of decision-making process: the decision to participate in the market, and the rate or degree of participating in the market using double hurdle regression. Moreso, to the best knowledge of the author, no study has been found examining factors responsible for the choice of mode of transportation used by the farmers in conveying agricultural products to either local or urban markets. Therefore, it is against this background that the study investigates the nexus between transportation system and output market participation among the yam farmers in Ondo State, Nigeria. The specific objectives of the study are to: ascertain the types and condition of roads leading to the farms; examine the modes of transportation; determine factors influencing the choice of transportation modes used by the farmers; and determine the effect of transportation on the decision to market participation and the rate of market participation in the area.

Rationale for the Study

Examining the nexus between transportation system and output market participation is very crucial at a period Nigeria is advocating for a paradigm shift from the sole economy of crude oil. Due to the continual dwindling prices of crude oil in the world market, Nigeria has considered agriculture as the top option for economic diversification. The potential for root and tuber crops in Nigeria is not debatable given the numerous benefits most especially in terms of food consumption and food security. Specifically, yam has various value chains and it can be processed into different forms such as flour, paste, and as well serves as raw material for some industries. Therefore, improved access to market in yam production will open up more entrepreneurial activities and as well encourage more livelihoods. The study will also encourage the yam farmers to be market oriented and increase the proportion of yam supplied to the market. The demand for yam has always be on increase among the common food crops in Nigeria, improving transportation system and level of output market participation will significantly go beyond meeting domestic demand but accrue some foreign earnings as the value of exports is still low [19]. Since the future of yam is economically promising, it will be an eye opener to the policy makers on the best ways to increase farmers' participation in the market with appropriate transport facilities that could reduce damages and transaction costs in accessing markets. This study will also add to the literature by giving information on the factors influencing the choice of mode of transportation used by the farmers, and as well determine the factors responsible for the degree of market participation in the area.

MATERIALS AND METHODS

The study was carried out in one of the States (Ondo State) in the Southwest region of Nigeria. The region is about 32.5 million in population with a land mass area of 76,852 square kilometers. Ondo State was chosen because it is notable for yam production in the region. It is only State in the region that is blessed with the richest forest landscape and large crude oil deposit, therefore making it more economic viable. The State has over 3,441,024 people [48] with land area of nearly 14,793km^2. It lies between longitudes 4^0 30" and 6^0 00" East of the Greenwich Meridian and 5^0 45 and 8^0 15" of the North Equator. The region is an agrarian community which is known for two distinct seasons namely: the dry season which lasts from November to March, and the rainy season which lasts from April to October. The area is noted for both cash and food crops such as yam, cassava, maize, cocoa, oil palm and so on. Primary

data on the respondents were collected for this study through a well-structured questionnaire and interview schedule. The survey was carried out in 2018/2019 production season. A three-stage sampling procedure was adopted as a framework to select respondents for the study. The first stage involved purposive sampling technique of three (3) Local Government Areas (LGAs) based on their preponderance in yam production and proximity to the market. In the second stage, simple random sampling technique was employed to select five (5) communities from the selected LGAs. The third stage involved random selection of 12 yam farmers from each selected community using a simple random sampling technique. Thus, a total of 180 respondents were selected and employed for the study.

Analytical Tools

Descriptive statistics, Multinomial logit (MNL) regression model, Market Participation Index (MPI) and Double Hurdle Regression model were employed for the analysis of data.

Model Specification for MNL

Unordered MNL was employed to determine factors influencing the choice of mode of transportation used by the yam producers in the area. The importance of this model is that it explains the choice of an alternative among a set of exclusive alternatives [33, 46], and also motivated by a random utility model. The idea is that for ith consumer faced with *J* choice, suppose satisfaction derived in *J* is: $U_{ij} = Z_{ij}\theta + \varepsilon_{ij}$

According to [22], if the yam farmer then makes choice *j* in particular, then it is assumed that U_{ij} is the maximum among the *J* satisfactions derived. This can now be statistically written as the probability that choice *j* is made: Prob ($U_{ij} > U_{ik}$) for all other $k \neq j$. Common mode of transportation used in the area was modeled as dependent variable which is denoted as Y_i following [16, 20]. It is assumed that Y_i is a random variable indicating the options chosen by the yam farmers which take on the values {0, 1, 2, …J}, where J is a positive integer, and let X_i represent the independent variables which were socio-economic characteristics, transport facilities and institutional factors. *Ceteris paribus*, the interest is on how changes in *X* will influence the chance of choosing *J* option.

$$P\left(y = {}^{j}/_{X}\right), \qquad j = 0, 1, 2, \dots, J$$

…….. .....(1)

Since the probabilities must be summed up to one, the P(y = 0/X) is determined once the probabilities for *j = 1, 2, …, J* are known.

Let *X* be a *1 x k* vector with first element unity. Therefore, the response probability for the MNL model will be:

$$P\left(y = \frac{j}{X}\right) = \frac{exp(X\beta_j)}{1 + \sum_{i=1}^{J} exp(X\beta_i)}, \qquad j = 1, 2, \dots, J$$

……..... (2)

Where β_j is *k x 1, j = 1, 2, …, J.*

Due to the unity of the probability's response, the equation becomes:

$$P\left(y = \frac{0}{X}\right) = \frac{1}{1 + \sum_{i=1}^{J} exp(X\beta_i)}$$

……..... (3)

When *J = 1*, β_i is the *k x 1* vector of unknown parameters. This gives the binary logit model. According to [46], the partial effects for this model are complicated. For continuous Xk, it can be written as:

$$\frac{\delta P\left(y = {}^{j}/_{X}\right)}{\delta X_k} = P\left(y = {}^{j}/_{X}\right)\left\{\beta_{jk} - \frac{\left[\sum_{i=1}^{J} \beta_{ik}\, exp(X\beta_i)\right]}{g(X,\beta)}\right\}$$

……..... (4)

Where β_{ik} is the kth element of β_i and $g(X,\beta) = 1 + \sum_{i=1}^{J} exp(X\beta_i)$

Again, it is unveiled from the Equation (4) that β_{jk} do not totally determine the direction of the effect. This therefore, leads to the Equation (5) as:

$$\frac{P_j(X,\beta)}{P_0(X,\beta)} = exp\left(X\beta_j\right), \quad j = 1, 2, \dots, J$$

……..... (5)

Where $P_j(X,\beta)$ represents the response probability in Equation (2). Thus, the change in $\frac{P_j(X,\beta)}{P_0(X,\beta)}$ is approximately $\beta_{jk}\, exp\left(X\beta_j\right) \Delta X_k$ for roughly continuousX_k.

It should also be noted that:

$$P\left(y = j\ or\ y = \frac{i}{X}\right) = P_j(X,\beta) + P_i(X,\beta),$$
$$P\left(y = \frac{j}{y} = j\ or\ y = i, X\right) = \frac{P_j(X,\beta)}{[P_i(X,\beta)]} = \forall\left[X(\beta_j - \beta_i)\right] \quad \text{……. .....(6)}$$

where $\forall(.)$ is the logistic function.

Also, the estimation of MNL model is best carried out by maximum likelihood provided the density is specified of Y given X [46]. Therefore, the likelihood can be written as:

$$\mu_i(\beta) = \sum_{j=0}^{J} 1[y_i = j] log\left[P_j(X_i,\beta)\right] \quad \text{……..... (7)}$$

Where the indicator function selects out the appropriate response probability for each observation i. Therefore, β is estimated by maximizing $\sum_{i=1}^{N} \mu_i(\beta)$.

As stated in [46], McFadden has shown the concavity of the log-likelihood function which makes the maximization problem straight forward.

The unbiased and consistent parameter estimates of the MNL model in Equation (2) require the assumption of independence of irrelevant alternatives (IIA) to hold. This means that the probability of using a certain mode of transportation by a respondent needs to be independent from the probability of choosing another mode of transportation. It implies that P_j/P_k is independent of the remaining probabilities, and the IIA assumption is the independent and homoscedastic disturbance terms of the basic model [22, 20].

The MNL coefficients are difficult to interpret, and associating the β_j with the jth outcome is tempting and misleading due to the curvilinear relationship between Yi and Xi. Therefore, marginal effects were derived to interpret the effects of independent variables on the response probabilities [22, 24]. The marginal effects measure the expected change in the probability of a particular choice being made with respect to a unit change in an independent variable [22]. The differential equation is stated as:

$$\Delta_j = \frac{\Delta P_j}{\Delta X_i} = P_j\left[\beta_j - \sum_{i=0}^{J} P_i\beta_i\right] = P_j(\beta_j - \bar{\beta}) \quad \text{……..... (8)}$$

The explanatory variables and measurements were depicted in the Table 1.

Table 1 Description and Measurement of Explanatory Variables Employed for the MNL Model

Codes	Description of explanatory variables	Type and Measurement of variables	Expected sign
Y*	Mode of transportation	1= Head porterage; 2 = Motor cycle; 3 = *Pick-up* van; 4 = others	
X_1	Age of the respondents	Continuous: Measured in years	$\pm$
X_2	Membership of the cooperative society	Dummy: 1= Yes and 0, otherwise	+
X_3	Yam farming experience	Continuous: Measured in years	+
X_4	Access to extension service	Dummy: 1= access and 0, otherwise	+
X_5	Access to credit	Dummy: 1=access and 0, otherwise	+
X_6	Road connect from farm to urban market	Dummy: 1=tared and 0, otherwise	-
X_7	Distance to the farm from home	Continuous: Measured in kilometers	-
X_8	Household size	Continuous: Measured in numbers	$\pm$
X_9	Market participation index (MPI)	Continuous: see equation (9)	+

Source: Author 2019.

Measurement of Yam Output Market Participation Index (MPI):

Market participation is the annual sales share of the total yam produced by the farmer in the area. Following [14], market participation index (MPI) for the yam output is computed as:

$$MPI_i = \frac{\sum_{i=1}^{N} S_{qi}\bar{P}_i}{\sum_{i=1}^{N} Q_{qi}\bar{P}_i} \quad \text{……..... (9)}$$

Where $\bar{P}_i$ is the average price level in each community, S_{qi} is the quantity of yam output q sold by the respondent i[th], Q_{qi} is the total

quantity of yam output q produced by respondent i[th].

Again, it should be noted that most farmers in developing countries including Nigeria are smallholders with total farm size of less than five hectares in which some of them provide mainly for their family without producing for the market [17].

Double-Hurdle Model Specification: The tool was modeled to determine factors influencing decision to participate in the output market and rate of market participation among the yam farmers in the area. The assumption of this study is based on consumer behaviour where a rational yam farmer maximizes his/her utility given a budget line. The rationale behind the adoption of the approach is that yam farmer faces two hurdles in market participation: the decision to participate and the rate of market participation as also noted by [1]. These two decision-making processes allow the use of double hurdle model proposed by [15]. According to [15], double hurdle serves as an improvement over the Tobit regression model. This is because Tobit model is limited by assuming that the decisions to participate in the market and the actual degree or rate of participation are governed by the same process, which argued not to be the same by Cragg [35]. Therefore, the first hurdle is the decision made by the yam farmer on whether to participate in the market or not; while the second hurdle has to do with the rate of market participation. Again, the model distinguishes between the factors determining the decision to participate, and the rate or degree of market participation in sales of yam as two separate stages [9, 45, 7, 37, 1]. In estimating the model, the first hurdle (tier) using binary (probit) regression represents the equation on the decision to participate and presented as:

$$y_i^a = \beta X_i' + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where,

$$y_i^a = \begin{cases} 1, if\ y^a > 0 \\ 0, otherwise \end{cases}$$

y_i^a is a decision made by the yam farmers whether to participate or not in the market (yam producers that participate in the market are scored "1" and those that did not participate were scored "0").

The second hurdle (tier) is a truncated regression model on the degree or rate of yam market participation in the area. The equation is stated as:

$$y_i^b = r_i y_i^a = \beta X_i' + \omega_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where,

y_i^b is the rate or degree of market participation by the yam producers. It is measured by MPI_i in equation (9). y_i^a are the yam producers that participated in the market and r_i stands for the rate or degree of market participation by the producers. ε_i and ω_i are error terms associated with the equations (10) and (11) respectively.

As also stated in [45, 7], if the two decisions are independently made by the individual yam producers, the error terms are assumed to be independently and normally distributed as shown in the above equations as:

$\varepsilon_i \sim N(0,1)\ and\ \omega_i \sim N(0, \delta^2)$, this implied that there is no correlation between the two error terms.

Again, the maximum log-likelihood function is used to estimate independent double-hurdle as modeled by [15]. This is the combination of the univariate probit model and the truncated regression model as stated earlier.

$$LogL = \sum_0 ln\left[1 - \varphi(x,\alpha)\varphi\left(\frac{\beta X_i'}{\sigma}\right)\right] + \sum_{+1} ln\left[\varphi(x,\alpha)\frac{1}{\alpha}\varphi\left(\frac{y_i^a - \beta X_i'}{\alpha}\right)\right]$$

If x, α = 1, it means no zero participation and then we have a Tobit model, which estimates the rate of market participation. X_i' is the vector of explanatory variables that determine the decision to participate or not, and as well as the degree of yam market participation in the area. β is the parameters to be estimated. Finally, the CRAGGIT command was used to carry out the analysis using STATA 13 software.

The explanatory variables and their measurements were defined and presented in Table 2.

Table 2. Description and Measurement of Explanatory Variables Employed for the Double Hurdle Model

Codes	Description of explanatory variables	Type and Measurement of variables	Expected sign
Y*	Tier 1: Decisions for market participation	Dummy: 1= participated and 0, otherwise	
	Tier 2: Degree/Rate of market participation	Continuous: MPI in Equation (9)	
X_1	Age of the respondents	Continuous: Measured in years	±
X_2	Membership of cooperative society	Dummy: 1= Yes and 0, otherwise	+
X_3	Secondary occupation	Dummy: 1= Yes and 0, otherwise	+
X_4	Yam farming experience	Continuous: Measured in years	±
X_5	Access to extension service	Dummy: 1=access and 0, otherwise	+
X_6	Access to credit	Dummy: 1=access and 0, otherwise	+
X_7	Road connect from home to urban market	Dummy: 1= tared and 0, otherwise	±
X_8	Distance to the farm from home	Continuous: Measured in kilometers	-
X_9	Access to market information	Dummy: 1=access and 0, otherwise	+
X_{10}	Mode of transportation	Dummy: 1= *pick-up* van and 0, otherwise	±
X_{11}	Road connect from home to farm	Dummy: 1= footpath and 0, otherwise	-
X_{12}	Frequency of road maintenance	Discrete: Measured in numbers	+
X_{13}	Household size	Continuous: Measured in numbers	±

Source: Author 2019.

RESULTS AND DISCUSSIONS

Information on the Explanatory Variables Used in the Regression Models

Table 3 presents the characteristics of the yam farmers sampled for the study. Based on the Table, it was revealed that the farmers were still in their productive age given the average age of 49.63 years old.

Table 3. Descriptive Statistics of the Variables

Variable	**Mean**	**SD**	**Min.**	**Max.**
Age of the respondents	49.63	13.55	25	86
Sex (Male =1, and Female = 0)	0.79	0.41	0	1
Marital status (Married =1, and unmarried = 0)	0.78	0.41	0	1
Educational status (Educated =1, and uneducated = 0)	0.77	0.42	0	1
Membership of cooperative society	0.31	0.46	0	1
Secondary occupation	0.86	0.35	0	1
Yam farming experience	23.01	13.16	2	70
Access to extension service	0.68	0.47	0	1
Household size	5.66	3.25	1	23
Access to credit	0.46	0.50	0	1
Type of road connect to urban market	0.58	0.50	0	1
Distance to the farm from home	12.21	12.32	1	50
Access to market information	0.96	0.19	0	1
Mode of transportation	0.51	0.25	0	1
Type of road connect to farm	0.57	0.50	0	1
Road physical condition	0.68	0.50	0	1
Frequency of road maintenance	2.44	1.50	1	5
Market Participation Index (MPI)	0.67	0.25	0	1

Number of observations = 180; SD = standard deviation, Min. = minimum value; Max. = maximum value

Source: Field Survey, 2019.

The majority of them were male, married and educated with at least primary school education. Again, few (0.31) of them belong to cooperative society with an average yam farming experience of about 23 years.

Many (0.68) of them had access to extension services, while a few (0.46) of them had access to credit with an average household size of nearly 6 persons.

It should be noted that the average output market participation index (MPI) was 0.67 where about 13.3% of the sampled respondents were not participate in the marketing of yam, while 86.7% of them participated in yam marketing in the area. Again, it is important to mention that the variables on transportation system were recoded into dummy form for easy interpretation.

Examining the Transportation Facilities in the Study Area

Table 4 showed that many (53.3%) of the respondents reported that footpath was the main type of road connecting the farmer's farms from home or settlement, while nearly 24.2% of them reported that road connecting the farm was farm track.

The average distance from home to the farm was about 12.21km with many (34.5%) of them trekked a distance between 1 and 5km daily before they could get to their farms. Majority (57.2%) of the roads connecting to urban markets from home were tarred.

The roads connecting the farms of the yam farmers were mostly maintained once in a year (37.8%) by the farmers or the government depending on the road type. Again, the results in the Table also revealed that *pick-up* van was the most (55%) commonly used mode of transportation by the yam farmers.

It was further observed that motorcycle (25.5%), head-porterage (6.7%), minibus (6.1%), and truck (2.2%) were also used in transporting yam tubers to the market by the farmers.

The reason for the use of these modes of transportation is because of the bad condition of the roads leading to the farms.

Table 4. Distribution of the Respondents based on Transport Facilities

Variable	Frequency (n = 180)	Percent
Road connects to farm from home		
Footpath	96	53.3
Farm track	43	23.9
Feeder road	39	21.7
Tarred road	2	1.1
Road connects to nearest urban Market from home		
Tarred	103	57.2
Untarred	77	42.8
Farm distance(km)		
1-5	51	28.3
6-10	45	25.0
11-15	62	34.5
16-20	7	3.9
Above 20	15	8.3
Frequency of road maintenance		
Once in a year	68	37.8
Twice a year	45	25.0
Once in 2years	17	9.4
Once in 3 years	19	10.6
Once in 4 years	31	17.2
Mode of transportation	Frequency	Percent
Head porterage	12	6.7
Motor cycle (*Okada*)	46	25.5
Bicycle	3	1.7
Tricycle	2	1.1
Taxi/Minibus	11	6.1
Truck	4	2.2
Pick-up van	99	55.0
Hilux	3	1.7
Total	180	100.0

Source: Field Survey 2019.

Factors Influencing Yam Producers' Preference for Mode of Transportation Used in the Area

The MNL results in the Table 5 present the factors that influence the choice of mode of transportation mainly employed by the yam farmers in the area. At this point, it is imperative to state that eight modes of transportation were first subjected into the model but failed to give desirable results in terms of significant level. Thus, restructured into 4 related groups to get a satisfactory result as depicted in the Table. Motor cycle, bicycle and tricycle were merged and named as "Motor cycle"; while truck, hilux, and taxi/minibus were merged and named as "Others". Therefore, the dependent variables set for the restructured MNL model were:

Head porterage, Motor cycle, *Pick-up* van and Others. Several variables both endogenous and exogenous were also included in the model but some were later dropped as a result of their undesirable behaviour with the dependent variable which was also observed in the studies of [23, 16, 20]. The parameter estimates of the MNL showed that the model exhibited a strong explanatory power giving the likelihood ratio statistics as indicated by the χ^2 value of 75.67 with a significant level of 1%. The coefficient of marginal effects of the MNL was used in the interpretation and discussion of this study. From the Table, it was unveiled that independent variables were statistically significant at different levels and magnitudes under each mode of transportation. Therefore, out of nine predictors incorporated into the model, 3, 5, 7 and 4 variables were significant under the head porterage, motor cycle, *pick-up* van and others, respectively as transportation modes.

Membership of cooperative society has a positive and significant association with the probability of using *pick-up* van mode at 10% level. This indicates that yam producers that belong to cooperative society are more likely prefer *pick-up* van mode to transport yam tuber to the market with a magnitude of 1.3%. The probable reason was that most of the *pick-up* van owners are members of the cooperatives therefore they encourage their members to patronize them. Again, some of the yam producers are smallholders that their output per harvest could only be accommodated by the pick-up, therefore, going for modes less or greater than *pick-up* van mode can lead to shortage in terms of cost incurred. The coefficient of yam farming experience was positive and significant at 5% and 1% levels in influencing motor cycle and *pick-up* van modes, respectively. This implies that a year increase in the farming experience by the yam producers will likely increase the likelihood of choosing motor cycle and *pick-up* van modes by 2% and 3% respectively. It can be deduced that experienced yam farmers would have more knowledge of the road terrain couple with the costs and benefits attached to the choice of mode of transportation used in transporting yam tubers to the market. Experienced farmers are expected to be aware of changes in weather, market behaviours, transportation system and quantity of production which will lead to accurate decision on the most efficient mode of transportation to be used [1]. The access to extension services had a negative and significant relationship with head porterage at 10% level but a positive and significant association with *pick-up* van and others modes of transportation at 5% and 10% levels, respectively. This shows that the more a yam farmer has access to extension services, the more the probability of choosing *pick-up* van and others means of transportation by 4.2% and 4.0%, respectively but reduce the chance of choosing head porterage by 1.1% in the area. The result is expected because extension agent will guide the farmers against drudgery and inefficient activities, but because of the size of the yam tubers, location, culture and poverty in the system, some farmers might still result in using head porterage in transporting yam to the market in the area. The coefficient of access to credit was positive and significant under motor cycle and other modes of transportation with a probability of 5% apiece. It can be interpreted that the more a farmer has access to credit, the more the likelihood of using motor cycle and other means in transporting yam tubers to the market by 7.7% and 7.4% respectively. Access to credit might encourage some of the yam farmers to have their own mode of transportation such as bicycle, motor cycle, tricycle, and mini-bus. This is because most farmers accessed their farms through motor cycle but not necessarily used to convey harvested yam to the market most especially for the farmers with large volume of output. The coefficient of the type of road connecting farms to urban markets was only positive and significant at 10% level with *pick-up* van mode. This shows that a tared road connecting farm to the urban market will increase the chance of choosing *pick-up* van to transport yam tubers by 6.4%. With the average quantity of yam that could be harvested per time and coupled with the labour involved,

the size of *pick-up* van might likely be the best option to convey yam tubers to the market. This is because, apart from truck and hilux, *pick-up* van is the most common and roomy mode that can do the work effectively in the area. The distance from home to the farm has negative but statistically significant relationship with all the means of transportation in the area. It was shown that a kilometer increase in the distance from home to the yam farm will decrease the chance of choosing head porterage, motor cycle, *pick-up* van and other modes of transportation by 2.3%, 0.7%, 0.8% and 0.8% respectively in the area. The probable reason for the results is that urbanization and civilization have made farm land to be far away from the living areas. Other lands that are close to the living areas are over-used and not fertile to give optimal yield. Similarly, inherited and communal nature of land sharing has denied many of the yam farmers the opportunity to get a sizable farm land until they get to the far away areas. Apart from other modes of transportation, the coefficient of household size was positive and statistically significant in influencing all the transport options/choices in the model. This implies that increase in the numbers of family size will likely increase the probability of choosing head porterage, motor cycle and pick-up by 2.9%, 1.1% and 1.1% respectively in the area. Despite the ambiguity in the interpretation of household size in the literature [41, 21], it can still be deduced that household size as a proxy for labour availability may influence any of the options at the farmers' disposal since it reduces the labour constraints [18]. [1] argued that a larger family size increases the likelihood of participating in the market as they played a speedy role in the commercialization's process. The coefficient of market participation had a positive and significant relationship with the mode of transportation except under the head porterage mode. This implies that the more a yam farmer participates in the market, the more the chance of using motor cycle, *pick-up* van and other means of transportation by 17.5%, 22.7% and 20.8% respectively in the area. The volume of production could be the main reason for choosing the means of transportation in the area. A rational yam producer will want to be at margin by minimizing cost of transportation to the market. This study shares similar view with [36, 32, 30, 1] who argued that there is a positive relationship between mode of transportation and the market participation which could lead to increase in farmers' productivity and returns.

Table 5. Results of Multinomial Logit Regression on the Modes of Transportation in the Area

Variable	Head porterage		Motor cycle		Pick-up		Others	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Age	0.008	0.129	0.003	0.126	0.003	0.126	0.003	0.162
Cooperatives	0.037	0.744	0.012	0.777	0.013*	0.075	0.014	0.732
Experience	-0.007	0.193	0.002**	0.042	0.003***	0.006	0.003	0.272
Extension	-0.109*	0.065	-0.040	0.225	0.042**	0.013	0.040*	0.087
Credit	-0.181	0.112	0.077**	0.018	-0.064	0.123	0.074**	0.050
Road connect to urban market	0.171	0.127	0.059	0.160	0.064*	0.098	0.064	0.134
Distance	-0.023**	0.036	-0.007*	0.097	-0.008**	0.014	-0.008**	0.020
Household size	0.029*	0.071	0.011**	0.050	0.011**	0.045	0.011	0.136
Market participation	0.587	0.208	0.175*	0.090	0.227**	0.039	0.208*	0.062

Log likelihood = -166.41; LR chi2 (27) = 75.67***; Number of observations = 180
*, **, *** means significance at 10%, 5% and 1% levels respectively
Source: Author's Computation, 2019.

Effect of Transportation System on the Decision for Output Market Participation and the Degree/Rate of Market Participation in the Area

The results of double-hurdle regression are presented in the Table 6. According to the parameter estimates, the sigma value of 0.008 was strongly significant at 1% probability level which indicates that the presence of

heteroskedasticity was corrected for in the model, while the value of Wald χ^2 of 24.43 was also significant at 5% which implies that the model is well fitted given the variables used in the model. Thirteen explanatory variables gave desirable results in the Table, out of which nine were statistically significant and four of them were inclusively significant under the two hurdles.

First Hurdle: Decision to Participate in the Output Market

It was shown from the Table that membership of cooperative society, farming experience, market information, and modes of transportation had significant and positive association with the decision to participate in the market of yam business in the area. However, type of road connecting home to the nearest urban market, and distance to the farm had negative but significant relationship with the decision to participate in the market. Therefore, being a member of cooperative societies may likely increase the chance of participating in the market of yam by 182%. As also reported by [39], cooperative societies always buy agricultural products in large quantity including yam during the on season with the expectation of selling it during the off season. Added to this, some farmers do collect inputs from the cooperatives with the agreement of selling their yam tubers to them at the end of production year. Therefore, this might be the probable reason for participating in the market of yam business in the area. Farming experience in yam production influences the decision to participate in yam market at 10% level of significance. The result indicates that farmers with more years of yam production experience are more likely to participate in the market, *ceteris paribus*. It is expected that experienced farmers must have known the nitty-gritty of the business which could make them take a decision of participating in the market. This is consistent with the findings of [36] who also observed positive and significant association between experience and market participation among cassava farmers in Central Madagascar. Having access to right market information influenced decision to participate in yam market in the area by 3.3%. The likely reason might be because having access to rightful information most especially on the market prices will make the farmer to sell at the market that give the highest pay/revenue considering the cost incurred in transporting the yam tubers. *Ceteris paribus*, those farmers that choose *pick-up* van as a mode of transportation had the likelihood of participating in the market by 29%. Considering the smallholding capacity of the farmers, *pick-up* van is spacious enough to convey their products to the market per harvest. This is because the farmers always harvest yam either to eat or sell. Due to poor storage facilities, hardly will one see farmers harvesting for the purpose of storage; that is why the product always floods the market during the peak season. Again, not harvesting on time might endanger the products to pilferage, pests and diseases, and other post-harvest problems. On the other hand, the coefficient of type of road connecting home to the nearest urban market is negatively related to the probability of participating in the market at 1% level of significance. The reason might be because of the challenges of damages of tubers and hike transport fare experienced as a result of bad roads in the area. The coefficient of distance to the farm had a negative association with the participation in the market at 5% level of significance. This shows that a unit increase in the distance to the farm will decrease the likelihood of participating in the market by 4.2%. It can be deduced that farmers living far away from the farm might be facing difficulty in conveying both inputs into the farm and as well output out of the farm due to poor road condition in the study area. Thus, affecting their decision to participate in yam marketing negatively. This finding is in conformity with [39].

Second Hurdle: Degree of Output Market Participation

The second tier of the analysis revealed the factors influencing the rate or degree of market participation in the area. As presented in the Table, age of the farmers, membership of cooperative society, secondary occupation,

yam farming experience, access to extension services, access to market information, and mode of transportation were the significant factors identified by the model. All things being equal, a year increase in the age of the farmers might likely reduce the rate of market participation by 0.2%. It might be that aged farmers might not be able to face the rigours of marketing considering the long distance of the farm to the market locations and the dilapidated conditions of roads connecting farms either to their homes or the markets. This study disagreed with the findings of [40, 1] who found out positive relationship between age of the farmers and rate of market participation, and as well stated that greater output comes from aged farmers. Again, the membership of cooperative society has positive relationship with the rate of participating in yam market. It implies that being a member of a cooperative society will increase the likelihood of the degree of participation in the marketing of yam by 3.6%, *ceteris paribus*. The ready market through cooperative societies might encourage the producers to sell a substantial portion of their produce into the market. Secondary occupation has a negative relationship with the rate of market participation. It indicates that having other occupations reduced the probability of the rate of market participation in the area. This can be explained that having other occupations might not allow full concentration in the market and can also make the producers easily relent in the business each time there is a challenge when compared with those that have yam business as a sole occupation. Farming experience has a positive association with the probability of the degree of market participation in the area. It means that the number of years engaged in the yam production will likely increase the chance of participating in the market by 0.2%. The long-stay in the business is an indication that the farmers have good knowledge of the business. All things being equal, increasing participation in the market might be as a result of higher returns earned which could enhance their decision making on the rate of market participation in the area. Access to extension services also has a positive relationship with the rate of market participation in the area. Farmers that have access to the extension services may likely participate more in the marketing of yam than those that do not have access in the area. The presence of extension agent might influence the rate of market participation.

Table 6. Results of Double Hurdle Model

Variable	**Tier 1: Decision for Market Participation**		**Tier 2: Rate of Market Participation**	
	Coefficient	P>/z/	Coefficient	P>/z/
Age	-0.015	0.401	-0.002***	0.003
Cooperatives	1.816***	0.000	0.036**	0.047
Secondary occupation	-6.833	0.970	-0.033*	0.091
Experience	0.031*	0.094	0.002*	0.057
Extension	0.241	0.502	0.031*	0.054
Credit	-0.431	0.288	-0.048	0.103
Road connect: home to urban market	-1.130***	0.005	-0.020	0.166
Distance (km)	-0.042**	0.018	0.001	0.347
Market information	0.033*	0.080	0.040**	0.020
Mode of transport	0.290***	0.001	-0.003**	0.027
Road connect: home to farm	0.224	0.593	0.059	0.001
Road maintenance	-0.130	0.307	-0.000	0.945
Household size	0.076	0.294	0.040	0.131
Constant	9.894	0.956	0.767	0.000
Sigma			0.008	0.000

Log Likelihood = -124.15239; Wald chi2 (13) = 24.43**; Number of observations = 180;
*, **, *** means significance at 10%, 5% and 1% levels respectively
Source: Author's Computation, 2019.

This is because it will allow the farmers to benefit from extension education and trainings on agribusiness and innovative information that could increase productivity, efficiency and market prices of the yam in the area. The positive relationship between access to market information and the rate of market participation caused a likelihood of about 3.1%.

This supported the assertion of [40] who stated that having access to current market information improves selling price and also helps producers to analyze the price difference among different marketing channels for optimal returns.

Therefore, having access to market information is one of the factors for business sustainability and continuity in the market as it might determine the proportion of yam in the market. Mode of transportation showed a positive and significant relationship with the rate of participating in the market. This implies that the use of *pick-up* van increases the probability of the rate of participating in the market by 0.3%. The reason might be because *pick-up* van is the most subscribed means of transportation and it is more accessible, rugged and adaptive to the condition of the roads compared with the other modes.

CONCLUSIONS

The study empirically assessed the nexus between transportation system and output market participation among yam producers in Ondo State, Nigeria. From the study, it was concluded that many of the farmers are young, married and educated with a better knowledge of yam production in the area. Most of the farms are linked either by footpath or farm track and farmers trek several kilometers before they could get to the farm. Tarred roads can only be found in some areas that are closed to the urban markets and road maintenance is mostly carried out once in the area. *Pick-up* van, motor cycle and head porterage are the common means of transporting yam tubers to the market and this has linked to the bad roads and poor transportation facilities in the area. It was also concluded that variables such as membership of cooperative society, farming experience, access to extension services, access to credit, road connecting urban markets, distance to the farm and market participation are the main significant factors responsible for the choice of means of transportation used by the producers to convey yam tubers to the market. Again, the study ascertained that most of the farmers participated in the market despite the challenges encountered as a result of transportation system. The study also established that membership of cooperative society, farming experience, access to market information and mode of transportation are very germane and vital in influencing the decision to participate and as well as the rate of participating in the yam market in the area. On this note, the study recommends that an urgent improvement in transportation system most especially means of transport and road conditions will cause a significant increase in yam production and in turn the rate of market participation. Government should train extension agents on how to disseminate market information to the farmers and probable create accessible markets close to the farm settlements. This will reduce spoilage, waste and transportation cost. Government should put the roads in good and motorable condition to help farmers convey inputs into the farm and output to the markets. This will surely bring positive change on farmers' productivity and income vis-à-vis their standard of living. Farmers should be encouraged to join cooperative societies so as to promote market participation and as well use the group to jointly repair and maintain the roads that lead to their farms.

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THE REGIONAL VARIATIONS AND PECULIARITIES IN THE STRUCTURING AND DEVELOPMENT OF RURAL AREAS IN BULGARIA

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Abstract

This article is dedicated to the problems of rural areas in Bulgaria. The article focuses on municipalities that need to implement regional policies in rural areas. Reducing the rural population is a serious challenge to the potential of the rural labor force. Labor supply restrictions apply to municipalities with an unfavorable demographic structure and a growing population over working age. Social problems are related to the aging population and vulnerable social groups. In order to identify groups of problems close to other countries in Southeast Europe, we need to take a closer look at rural development in Bulgaria.

Key words**:** *rural development, space, modeling, management, rural population, labor force*

INTRODUCTION

The approach to the development of the settlement and especially the inhabited territories outside the cities can define as rural areas included municipalities (LAU 1), in which there is no settlement with population over 30,000 people. According to 232 out of a total of 265 municipalities in Bulgaria are classified as rural. They cover 81.16% of the territory and 39% of the population. Rural areas are the municipalities on whose territory there is no city with a population over 30,000 people and the population density is less than 150 inhabitants per sq. km. Population in the villages in the rural areas is seriously decreasing in in the following years they may be depopulated. Internal and external migration, low birth rate, economic disparity in the development of regions are factors that lead to a change in the number and structure of the population of the settlements on the territory of the country. Depopulation is mainly in villages that are in rural areas. In practically all municipalities in rural areas, settlements are grouped around the municipal center (usually a small town or a larger village). The institutions providing basic services are in the municipal center for the population - educational, health, administrative, cultural and information centers, bank offices and shopping centers. The investments are mainly in the municipal center (the largest city in terms of population) and access and the quality of services is better than in the settlements outside the municipal one center in which the technical infrastructure is in poor condition, health and social service is of poor quality.

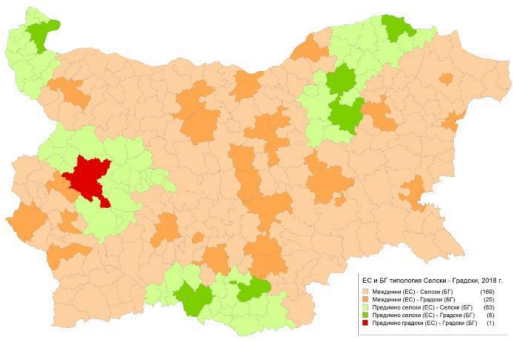

Fig. 1. The structure of settlements and their differentiation into rural and urban by 2019
Source: NSI - Bulgaria [9].

MATERIALS AND METHODS

The purpose of this exhibition is to bring to the fore the rural areas in Bulgaria, which are in fact the object of regional policy. In

practice, in Bulgaria, in addition to the Ministry of Regional Development and Public Works and the Ministry of Agriculture and Food, as the main managing authority of the rural development program, it turns out to be an essential factor for the implementation of regional policy in Bulgaria. Thus, from a methodological point of view, it is important to illustrate processes and phenomena related to rural areas that are consistent with cohesion policy and rural policy. The analysis is related to the assessment of the territorial capacity and the possibilities for implementation of integrated policies and investments with territorial dimension, which should be focused on local and regional problems [1]. As a method for data collection and analysis, it is based on the institutional approach and evaluation of the policy framework at the regional level. Our study aims to show the spatial structuring of large areas designated as rural areas, but with the need to conduct targeted regional development policies. An important method of research is the demographic analysis of the territory.

Table 1. Condition of rural areas in Bulgaria

Basic data for the rural areas of Bulgaria, 2018. Type of region		**Areas**	**Population**	
square kilometers	title	number	proportion	
All of Bulgaria, according to the European classification (NUTS level 3)				
intermediate	84,654.4	76.7	4,766,622	68.1
Mostly rural	24,387.9	22.1	905,297	12.9
Total rural areas	1,329.4	1.2	1,328,120	19.0
Total for Bulgaria	**110,371.7**	**100.0**	**7,000,039**	**100.0**
Rural areas by national definition (LAU level 1)				
intermediate	68,882.7	77.1	2,040,957	77.3
Mostly rural	20,438.9	22.9	600,117	22.7
Total rural areas	**89,321.6**	**80.9**	**2,641,074**	**37.7**

Source: NSI - Bulgaria [9].

RESULTS AND DISCUSSIONS

In a sufficiently long period of time rural population was crucial for the overall development of the country. From Liberation to the first years after World War II, Bulgaria retains the agricultural character economic development of Bulgaria as its dominant importance is agriculture population. During the same period, there is rapid growth of its cash lasted until the mid-twentieth century. The imbalance in the territorial distribution of the population is deepening. As of December 31, 2019, 5,125,407 people, or 73.7%, live in the cities, and 1,826,075 people, or 26.3% of the country's population, live in the villages. The settlements in Bulgaria are 5,257, of which 257 are cities and 5,000 are villages. There are 171 settlements without population. The largest number is in the districts of Gabrovo, Veliko Tarnovo and Kardzhali - 63, 58 and 11, respectively. Half of the country's population (50.4%) lives in the Southwest and South Central regions, and the smallest in population is the Northwest region - 728 thousand people, or 10.5% of the country's population. Along with the aging of the population, the migration processes within the country continue, accompanied by depopulation of small settlements. At the beginning of 2011 the following ratio was established between urban and rural population: 5,339,001 people, or 72.5% of the population in the country live in cities with - 2,025,569 people, or 27.5% in the villages. Here it should be borne in mind that the migration process "village - city" does not lead to an increase in the population of cities as a whole, but only the largest of them. At the census in 1946 the rural population reaches its absolute maximum of 5,294 thousand people, which compared with Census in 1887, representing a doubling of its numbers. This requires searching a look of important strategic dependence of the structure of the population and rural areas in the administrative and territorial unit of Bulgaria. Practically rural areas are areas that are not urbanized. They are low-density population and typically much of the land is occupied with agriculture. After the start of the accession of Bulgaria to the EU is to create strategies and modernization of existing contracts and accepting programs of territorial development. In this regard EEC/EU pursues a policy of rural development for all member states. Rural areas in the EEC/EU occupy more than 90% of the territory and are home

to approximately 60% of the population. Policies pursued by the EU Rural Development aims to support a significant proportion of the rural population of the Community. Many of these areas are facing major social, economic, environmental and infrastructural challenges. Business activities and operating enterprises, employment in rural areas, agriculture and forestry are still not sufficiently competitive [5].

By 2011, the country and in other countries in EU rural areas were selected on a single indicator, namely the population of the main village not exceed 30 thousand residents. In the same year introduced a new, more complex methodology requiring digitization in the country and the determination of geographical population density on territorial cells.

In literature the term "rural areas" is considered individually by given their specialization aimed at developing activities related to the agrarian economy. The formation of rural areas is carried out under the influence of certain factors: location, agro-climatic, ecological, socio-economic, geo demographic, policy formation, infrastructure and others. These areas are in a continuous process of change and development depending on their location, proximity to large social and economic center, metropolitan areas, availability of technical and social infrastructure and others. In terms of terminology and the formation of "Rural areas", there are various explanatory and opinions. We share the view that rural areas can be defined as those areas in which the agricultural sector (agricultural workers) occupy a relatively high share of the population and live in them and the rural way of life predominates or the main activity is agricultural. According to the latest typology of the EC for the regions, the only urban center is the capital Sofia. The number of municipalities defined as intermediate rural is 169, intermediate urban are 25, and 63 municipalities fall into the typology of mostly rural. These areas are described as areas with less developed technical and social infrastructure, lack of capital, low labor productivity, deteriorating social services and a lower standard than the national average. The role of municipal center has been successfully implemented in each village or a small town in the administrative unit determined by regulations. Other authors define rural areas as: smaller administrative territorial units that are part of the regionalization of the country [7]. This population is engaged in agricultural activities typical of rural life. The economic activities have reduced performance compared to the national average, technical and social infrastructure in their territory is underdeveloped. These areas are the smallest in the administrative territorial structure of the country.

The aspects of European Rural Policy

In the European Union for rural areas adopt territorial units have a population density of 100 people per km² or share of agricultural employment equal to two times higher than the Community average for any year after 1985. Developments in socio-economic objectives of a particular EU country affects the overall development of rural regions. The most general by the term "rural area ... means: certain small administrative units that have population below the threshold for urban area [6]. This threshold varies too widely EU than 200 residents of Sweden to 10,000 Italy or Germany. The European Commission in 1988. in his post: "The future of rural society" provides a definition of rural areas: rural areas are shaped by socio-economic and environmental structure. Those entities may include villages, towns, regional centers and other places. Based on this conclusion, the EC determined that rural areas occupy 80% of the territory of 12 states and they live ½ of the population of the EEC/EU.

Cork Declaration, adopted at the European Conference on Rural Development (ECRSR) in 1996, defined these territories as areas covering 80% of EU territory and they live in 25% of the population, characterized by a unique culture, economic and social structure unusual combination of economic activities and varied landscape (forests, farmland, natural areas, villages, towns and small

industries). In the Declaration of Cork for the first time rural areas are defined as a source of public goods outside the sector of agricultural development, they are autonomous regions, which are not only a source of food resources and habitats forming its own appearance and development on the basis of a developed landscape, natural resources, cultural heritage, geo-demographic potential and others [8]. A new element in rural development is to overcome the socio-economic differences. It appears as a new European base for development of this type of development. Parallel Assembly of the Council of Europe (PACE) adopted Recommendation №1296/ 1996 on the European Charter of rural areas. In this document the rural area is defined as follows: "... internal and coastal areas, including villages and small towns where most of the land is used for: 1) agriculture, hunting, fishing and forestry; 2) economic and cultural activities of the population in these areas; 3) development of non-urbanized areas into areas for leisure or reserves; 4) for other needs such as residential areas [2].

A look at the framework for setting rural priorities

Rural areas generally have an agricultural function which said social and economic influence in the development of the area. It is important to create acceptable living conditions in rural areas in terms of all economic, social, infrastructural, ecological and ethno-cultural aspects. Distinguished areas are located near large administrative center or near agglomerations to those located on the periphery of region. In areas for development must consider the specific way of life of local people and landscape protection. With this type of territories it is needed for additional construction and development of infrastructure facilities social and economic type [12]. The transformation in agriculture and raising its competitiveness will be determined by diversifying economic activity in rural areas; the development of the service sector is a preservation of rural communities as a source of labor force and a prerequisite for the realization of those employed in agriculture. The criteria for classification of rural areas must be considered essential links between these regions and urban centers. On this basis, there are two methods: one is developed by the OECD, (OECD - Organization for Economic Co-operation and Development) and the second from Eurostat (European Statistical Office). Both classifications are useful in survey and analysis of rural areas in the EU. The OECD method is applied on two levels, locally and regionally. Local municipal level method of OECD (2006) defines rural areas as: Municipalities with a population density of less 150 people per km². The population density between rural and urban areas is the most used criterion, but in itself is not sufficient for final definition of rural areas. At the regional level the OECD method includes widely administrative units according to their "rural" level, depending on what share of the region's population lives in rural areas. With this type of criteria to distinguish between three types of areas: predominantly rural areas; intermediate areas and predominantly urban town areas.

Eurostat method is based on the degree of urbanized in Europe regions, and may be used the following criteria. Densely populated areas - these are groups of contiguous, close to each other municipalities, each with a population density of over 500 people per km² and a total population of the area at least 50 thousand people. Intermediate areas - these are groups with dense populations over 100 people per km² not belong to densely populated areas. The total population of the area should be at least 50 thousand people or must be adjacent to densely populated areas. Sparsely populated areas - these are groups of municipalities, which are not classified nor as densely populated or intermediate. Municipalities or series of municipalities that have not reached the required level of density, but accounted density area near the foregoing is considered as such. If they placed between densely populated and intermediate areas are considered intermediate. It can be assumed that such groups of municipalities must have a minimum area of 100 km².

Structuring of Bulgarian rural areas and support mechanism for them

For Bulgaria the national definition that applies fixes for rural areas is as follows: rural areas - municipalities (LAU1), where there is no village a place with a population of over 30,000 people. This definition is used and applied in programs and development strategies of the country and rural areas. As a EU member Bulgaria complies with the concepts and rules for forming network rural and equates its law on regional development to that of the Union as follows: 1. EC Regulation 1698/2005. On support for rural development by European Fund for Agriculture and Rural Development; 2. National Strategic Plan for Rural Development – NSP (2007, 2014, 2020); 3. Program for Rural Development (2007, 2014, 2020); 4. Program for Rural Development (2014 ÷ 2020 and program 2021-2027).

Each Member State should establish a national network for rural areas that will unite all organizations working in this field. The concept of development must contain the following elements: Overview of existing prerequisites for rural development in the country; research on attitudes description of existing areas and needs the creation of new ones; Structure of the National Network, assumptions and targets; Viewing relationships between the National Network for Rural Development of Bulgaria and that of the EU and administrative-territorial unit with low population density, the municipal center can be village or city. Horizontal goals related to the common rural economic policies are mitigating the effects of climate change and on adaptation to it, as well as for sustainable energy; promoting sustainable development and effective management of natural resources such as water, soil and air. These goals predetermine to support resource-efficient economically activities. Includes three main areas: Development of competitive agriculture and forestry, The application of new technologies in the food industry [10]. Promotion of population employment and development of non-agricultural activities rural areas.

Development rural and socio-economic status of the population is an important element by agrarian socio-economic policy. Information on the population of Bulgaria and rural areas of South Central Region is based on information of the National Statistical Institute (NSI). Population in ES39 for 2011 is 503,492,041 people, more than half the population of the 27 states arise (through 2015 Member States with the 28th Croatia). Rural areas cover 90% of EU territory and approximately 60% of the population lives in them. According to the last national census in the country which is made to 01.02.2011 the population of the Republic of Bulgaria is 7,364,570 thousand people (in 2013, population was in Bulgaria is 7,245,677 and in rural areas of South Central region the populations is 686,491 people. On the other hand, in 2011 the number of cities was 255 and the villages were 5047. The functioning municipalities are 264, of which 231 belong to the rural areas and represent 87.5% of all municipalities. Since 01.01.2015, the municipality of Sarnitsa has received the status of an independent administrative unit. Rural areas in Bulgaria cover 90,371 km² or 81% of the territory and 43% of the population (which is 3,166,755 people).

The average population density in the rural areas of Bulgaria is 40 people per km², with an average density of 74.6 people per km² in other regions of the country. For example, in rural areas of the South-Central region, the average population density is 38 people per km², which is below the national and EU averages. In 186 settlements or 3.7% of total settlements, no persons counted as 21% of the urban population is 50 people, while 36% of urban population is 100 ÷ 500 people. The European Commission dealing with rural development in the period (2007 ÷ 2012). defines the territory of the country: 15 of the areas they are "predominantly rural areas", 12 "intermediate areas" and one as "urban area" Sofia. In research and analysis for rural areas need to identify their weaknesses/strengths and to adopt strategic programs their future development. The problems in rural areas can be summarized in a few aspects: negative geo-

demographic indicator in their territories; difficulty development in the construction of technical and social infrastructure; no new technology and capital [3]. Lack of information about the development of business projects will or no access to information technology, financial, legal, software nature; Weak sectoral specialization and lack of competition and development in only the primary sector in most areas and poor preparation of bureaucracy when dealing with European programs and documents. The definitions and interpretations of "rural" vary widely for Europe [11]. For some of the EU countries in their setting as rural areas the main indicator is the number of inhabitants. About main criterion is the density population (people per km²), because 60% of the EU population live in those areas where geo-demographic factor negative natural growth or missing values are minimum. In 1996, ECRSR accepted definition of rural areas as autonomous regions, emerging industries and activities other than agriculture sector. Using the methodology of the OECD definition of rural areas based on population density (people per km²) and the proportion of population in the region living in rural areas. The methodology of Eurostat also based on population density (people per km²). The country average density in rural areas is below the average. For Bulgaria the definition of rural is defined in the RDP and we adhere to the national definition of rural areas [13]. The villages that fall within the boundaries of municipalities with populations over 30,000 people drop formulation of rural areas, although eligible for such socio-economic, infrastructural, ecological and geo-demographic plan. Several types are determined on the territory of Bulgaria through regional analysis rural municipalities - developed municipalities, catching up municipalities, developing and lagging municipalities. The analysis showed that the municipalities in the rural areas are not homogeneous, but there are some significant differences in terms of economic activity, potential of labor resources, labor productivity and income of the population. To achieve economic cohesion between rural municipalities is needed purposefully and cost-effective financing [14].

On the territory of Bulgaria 4 types of rural municipalities are formed, which can be described as developed municipalities, catching-up municipalities, developing municipalities and lagging municipalities. The analysis showed that municipalities in rural areas are not homogeneous, and there are significant differences between them in terms of economic activity, labor potential, labor productivity and income. Targeted and cost-effective financing is needed to achieve economic cohesion between rural municipalities [4]. To accelerate the development of the rural economy, it is necessary to invest in innovative products, which would lead to better positions of micro-enterprises, small and medium-sized enterprises in the local and international market. In this regard, the introduction of digital technologies, innovative business processes are solutions to improve the profitability of economically active people to develop the local economy [9].

CONCLUSIONS

New concepts have been outlined in rural policy, for example Smart villages with a focus on helping rural communities address problems related to developing new features and services improved, through digital, telecommunication technologies, innovation and better use of knowledge for the benefit of society and business. Digital technologies and innovations can support quality of life, higher living standards, public services for citizens, better use of resources, less impact on the environment and new opportunities for rural value chains in terms of products and improved processes. The integrated territorial approach allows further targeting of program resources to territorial needs and a combination of support from various sources and funds. The programs and policy instruments of convergence can encourage smart villages to build strategic ones transport and digital networks. Cohesion policy (2021-

2027) emphasizes the need to apply an integrated territorial approach. Specific tools are integrated specialization strategies integrated Territorial Investment (ITI) and Community Led Local Development (CLLD). Territorial integration is based on integrated strategies use a functional approach that promotes territorial economic interaction between urban and rural areas. The exploitation of local potential corresponds to the goals: One Europe closer to citizens by promoting sustainable and integrated development of urban, rural and coastal areas and local initiatives and with a greener, low-carbon Europe, by promoting a clean and equitable energy transition, green and blue investments, circular economy, adjustment to the change of climate and risk prevention and management. Analysing the distribution of the sample depending on gender, age and origin we observed that most of the respondents have been males, the majority of respondents were included in the age interval of 18 and 25 years, taking into consideration the origin of the population interviewed it was observed that the majority came from the urban area. Rural policy outlines new concepts, such as Smart Settlement with a focus on helping rural people solve problems, connect with the development of new opportunities and services, similar, through digital, telecommunications technologies, innovation and better use of knowledge for the benefit of society and business.

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INFLUENCE OF MARINE PROTECTED AREAS ON FISH CATCH PRODUCTIVITY AMONG SELECTED FISHERS IN LEYTE, PHILIPPINES

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Abstract

The study aimed to examine the catch productivity of selected fishers in Leyte, both from fishing grounds nearby Marine Protected Areas (MPAs) and those far from MPAs. Descriptive analysis, nonparametric statistics, and regression analysis were the analytical tools used. Using data from 266 respondents, results showed that the average time spent per fishing day was 6.43 hours while the total travel time from the shoreline to fishing area per fishing trip was 1.41 hours. The average daily fish catch was 2.86 kg with a daily gross economic yield of PHP 476 (USD 9.46). Non-MPA fishers statistically took longer fishing days than MPA fishers. Controlling for several socio-economic variables and fishing characteristics, results of multiple regression analysis showed that fishing grounds near MPA sites have higher catch than fishing sites far from MPAs. Three regression models displayed a consistent positive influence of MPAs on fish catch rates. This outcome supports the fish spill over effect which influence high fish yield in adjacent fishing grounds to MPA sites. The results suggest for the establishment of more properly managed MPA sites to maintain healthy fish stocks and also increase catch among fishers.

Key words**:** *small scale fishers, fish spillover, rural Philippines, marine protected areas*

INTRODUCTION

Fish is a food of excellent nutritional value, providing high-quality protein and a wide variety of vitamins and minerals, including vitamins A and D, phosphorus, magnesium, selenium, and iodine in marine fish [4]. In developing countries, there are an estimated 20 to 30 million small-scale fishers. They play a vital role in contributing directly to food and livelihood security, poverty reduction, wealth creation, foreign exchange earnings and rural development [5].

The Philippines ranked among the top fish producing countries in the world [7]. The fishing industry provided employment to about one million Filipinos or around three percent of the country's labor force in 1998 [17]. There are about 1,614,000 fishers involved in municipal waters extending up to 15 km offshore, while 16,500 fishers are involved in commercial fishing operations in waters beyond 15 km [6]. It was confirmed that due to the domestic increase of pollution, abusive fishing techniques worldwide and illegal, unreported and unregulated fishing, catches have been shrinking and fish stocks are often declining at alarming rates [3]. Coastal fish resources have been overexploited [13] and there have been doubts being raised about the long-term sustainability of certain fisheries [14].

The rising of the environmental threats to the marine and coastal biodiversity had led to the creation and development of the marine protected areas (MPAs). A marine protected area (MPA) is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, managed through legal or other effective means [12]. It contributes to the restoration and replenishment of resources for social,

economic, and cultural enrichment [23]. MPA is essentially a space in the ocean where human activities are more strictly regulated than the surrounding waters [18]. The MPAs consist of well-delineated areas that either by decree or legislative action prohibit certain activities [22]. A well-managed MPA will increase the population size, the number of species, and the reproductive output of marine animals and plants [11]. However, there are concerns about how fishers will benefit from MPAs if these areas are off-limits [10].

Fish spillover is defined as the active movement of fish swimming out of MPAs into adjacent areas by the movement of the eggs, larvae and juvenile fishes out of protected areas [16]. To investigate the relevance of fish spill over in locally managed MPAs, this study aims to examine fishing productivity in areas near MPA and compare fish catch in areas or fishing grounds far from MPA. If fish spillover is evident, it is expected that fish catch productivity is higher in fishing grounds adjacent to a designated MPA. Thus, it is imperative to collect empirical evidence that will serve as a support to better fishing in areas adjacent to MPA. The findings of this study will be useful in helping fishers, policymakers and private sectors make informed decisions and rationally organize their resources in order to make fishing more sustainable. In addition, results of the study will add to the literature on investigating the effect of MPAs on human well-being. Rasheed (2020) shows that empirical studies that quantify the contributions of MPAs are scarce [19].

MATERIALS AND METHODS

Study site

MPAs are increasingly used to protect threatened habitats [1]. In the Philippines, there are over 1800 MPAs. To evaluate the influence of MPAs on the fish catch productivity of small scale fishers, this study covered both fishing grounds adjacent to MPAs and those which are far from MPAs (Fig.1). The municipalities with fishing grounds far to the MPAs are the municipalities of Hilongos and Albuera. On the other hand, the municipalities with fishing grounds that are near from MPAs include the municipalities of Matalom, Inopacan, and Baybay. We are using the case of Leyte to investigate the influence of marine protected areas on fish catch productivity.

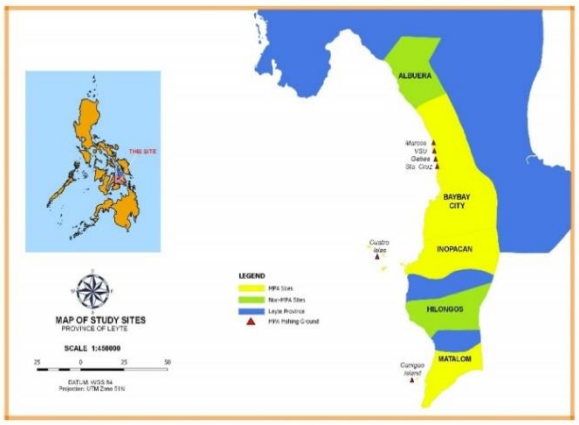

Fig. 1. Map of study sites in Leyte Island, Philippines
Source: [15].

Sample Size Determination

The sample size was estimated using a 95% confidence interval with a Z-value of 1.96. The population variance was estimated using proportions. It was assumed that the proportion is 0.5 since there is limited information available. For the margin of error, a modest 6% assumption was used. The bigger the margin of error, the lower is the sample size. The estimated sample size for the study areas was computed using Eq.1:

$$n_o = \frac{Z^2_{\alpha/2}(p)*(1-p)}{e^2} \qquad \text{(Eq. 1)}$$

The computed number of respondents was 266.

Nonparametric Test

The Mann-Whitney U test is a nonparametric alternative to the t-test for independent samples**.** This nonparametric test does not require the population's distribution to be denoted by specific parameters. The test is mainly based on the differences in medians [21]. To determine the influence of MPA establishment using the selected fishing variables, the following hypotheses were tested:

Null hypothesis: There is no significant difference between fishing grounds distant and nearby MPAs.
Alternative Hypothesis: Fishing grounds distant from and near to MPAs vary significantly.

Empirical Model

Regression analysis was used to investigate the influence of MPAs on fish catch productivity. The dependent variable was fish catch, measured in kilograms, while the independent variables were fishing variables, a dummy variable for MPAs and other socio-economic characteristics. Three different models were postulated to examine the effect of MPA establishment on fish catch productivity. Model 1 captures the socio-economic variables. Model 2 displays the fishing variables while Model 3 is a combination of both socio-economic and fishing variables (Eq. 2). After conducting regression analysis, appropriate diagnostic tests were conducted to further evaluate the empirical results.

$$Yi = \beta_0 + \beta_1 age_i + \beta_2 married_i + \beta_3 hh\_size_i + \beta_4 heduc_i + \beta_5 spouse\_work_i + \beta_6 fishing\_hrs_i + \beta_7 boat\_own_i + \beta_8 motor\_boat_i + \beta_9 org\_member_i + \beta_{10} num\_comp_i + \beta_{11} fishing\_costs_i + \beta_{12} traveltime_i + \beta_{13} MPA_i + e_i \quad \text{(Eq. 2)}$$

where:
Y_i = captures the average daily fish catch in kilograms;
age_i = age of a fisher respondent;
$married_i$ = a dummy variable, 1 if married, 0 if non-married;
hh_size_i = number of family members in a household;
$heduc_i$ = a dummy variable that represents educational attainment, 1 if at least high school education and 0 if primary level of education;
$spouse\_work_i$ = a dummy variable that captures the employment of spouse, 1 if spouse is working and 0 otherwise;
$fishing\_hrs_i$ = total number of fishing hours;
$boat\_own_i$ = a dummy variable for the ownership of fishing boat, 1 if owned and 0 otherwise;
$motor\_boat_i$ = type of boat being used, 1 if motorized boat, 0 if non-motorized boat;
org_member_i = 1 if member in fisher's organization and 0 for non-member;
num_comp_i = number of companions in fishing activity;
$fishing\_cost_i$ = daily variable costs measured in Philippine peso (PHP);
$travel\_time_i$ = travel hours from shoreline to the fishing area;
MPA_i = a dummy variable that represents location, 1 if fishing grounds nearby MPA and 0 otherwise; and
e_i = remaining error term

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Respondents

Table 1 shows the socio-demographic characteristics of the respondents. Results show that the youngest respondent is 15 years old and the oldest is 89 years old, with an average age of 45 years old. The majority of fishers are married (80%), with an average household size of five (5) members. More than half (52%) have attended at least a high school level of education. Thirty percent (30%) of the respondents reported that their spouse is working. The average monthly income in fishing is PHP 475.10 (USD 9.44) but their incomes were supplemented by other sources, which averagely reached up to PHP 10,477.77 (USD 208.23) in a month.

In terms of fishing related characteristics, on average, they spend 6.43 hours fishing. Half of the respondents (50%) owned the boats they used in fishing and a third of the respondents (36%) used motorized boats in fishing. About 37% of fisher-respondents were members in any organization for fishers. For fishing companions, there were eight (8) fishers, on the average, but it varies depending on fishing methods employed. Furthermore, the total daily fishing costs reached up to PHP 279.80 (USD 5.56), while the total amount of

time it takes to reach the fishing area from the shoreline was 1.41 hours.

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Table 4. Descriptive statistics of the characteristics of the fishers

Variables	Mean	Min	Max
Age	45.378	15	89
Married fishers	0.8	0	1
Household size	5.03	1	13
At least high school level of education	.52	0	1
Spouse working	.3	0	1
Monthly income in fishing (in PHP)	475.10	25	1,800
Monthly income in other sources (in PHP)	10,477.77	240	84,050
Fishing hours	6.43	1	16
Boat ownership	0.5	0	1
Use of motorized boats	0.36	0	1
Membership to fishing organization	0.37	0	1
Fishing companion	8.34	0	60
Daily fishing cost	279.8	5	1,690
Time hours to fishing area	1.41	0	6
Fishing grounds nearby MPA	0.51	0	1

Source: Authors' own calculation and analysis (2020).

Comparison of Fishing Grounds Near (MPAs) and Distant from MPA (non-MPA)

The respondents adjacent to MPAs and far from MPAs were compared based on selected fishing variables using the Mann Whitney U test. Mann Whitney U test is a nonparametric alternative in comparing two independent groups when the normality of data cannot be confidently assumed. Table 2 shows the comparison of means between MPA and non-MPA using selected fishing indicators. Results show that there was no statistically significant evidence showing that non-MPA fishers allotted longer hours in fishing activity than MPA fishers. On the number of companions, it depends on the method of fishing used by fishers. There were methods that would require the involvement of several fishers, specifically haul seine (fishing method that uses long net for commercial fishing) which was mostly used in non-MPA fishing grounds. Method like hand line fishing (a technique in which a line with a hook, usually baited, is lowered into the water from a drifting, anchored or moving boat while waiting for a fish to take the bait), which was dominant in MPA fishing sites requires only a few individuals or none. In terms of net income, there is no statistical evidence showing a significant difference in net income per fishing between MPA fishers and non-MPA fishers. The fishers' income is largely dependent on the kind of fish species caught and this makes sense because different species have their corresponding prices. However, in terms of average daily catch, results show that fishing grounds in the nearby MPA had a statistically greater catch than fishing grounds distant from MPA (MPA= 3.02, non-MPA= 2.69).

Table 2. Comparison of means between MPA and non-MPA by selected fishing indicators

Variables	Non-MPA	MPA	Difference
Daily catch (kg)	2.69	3.02	0.33***
Revenue (PHP)	428.8	521.03	92.23***
Daily fishing cost (PHP)	214.84	341.90	127.06***
Travel hours from shoreline to fishing area	1.11	1.72	0.61***
Fishing days in a week	6	5	1**
Daily fishing hours	7	6	1
Companions in fishing	9	7	2
Daily net income	214.04	179.13	34.91
No of respondents	130	136	

Note: *** significant at 1%, ** significant at 5% and * significant at 10%

Source: Authors' own calculation and analysis (2020).

This result supports the claim on fish spill over effect by Friedlander (2013), Forcada et al., (2009), Di Lorenzo et al., (2020) which reflects higher fishing catch or yield in fishing grounds adjacent to marine protected areas (MPAs) compared to fishing grounds far from MPAs [9] [8] [3].

Influence of MPA establishment on fish catch productivity

To evaluate the influence of MPA on fish catch productivity, regression analysis was performed controlling for several socio-demographic variables (Table 3). With catch rates as the dependent variable and a dummy variable for MPA coded as 1 for fishing grounds adjacent to MPA and 0 otherwise as the main explanatory variables. The impact of fishing grounds adjacent to MPA was captured across the several regression models to test the consistency and robustness of estimates. Socio-economic factors were the control variables in model 1, fishing characteristics for model 2 and a combination of both socio-economic factors and fishing characteristics for model.

In model 1, a high level of education and fishing grounds nearby MPA showed to have a positive influence on catch rates, which were both significant at 5% and 10% levels, respectively. Fishers with a high level of education or at least with high school educational attainment have 48.8% higher catch than those who are not. On the other hand, fishing grounds nearby MPA have 32% higher catch than those that were far from MPAs. Other socio-economic variables such as age in years, married as civil status, household size and spouse working are not statistically significant.

For model 2, fishing hours showed a significant positive influence on the catch at a 1% level. Longer hours in fishing activity result in increasing catch rates. This result suggests that an additional hour spent fishing per day increases fish catch by 0.0828 kg. Results also indicate that the usage of motorized boats showed a positive and significant influence on catch productivity at a 10% level. This suggests that fishers who are using motorized boats have 45.5% higher fish catch compared to non-motorized boat users. The main variable, which is fishing grounds nearby MPA, is not statistically significant. However, the coefficient is positive, indicating that it correlated to increasing fish catch.

The results of model 3 combine the socio-economic characteristics with fishing variables. Of the variables included, the significant predictors of fish catch are high level of education, amount of time per fishing trip, use of motorized boats, and fishing grounds nearby MPA. Results have consistently shown that having an advanced level of education is associated with higher catch among fishers. It can be inferred that fishers with at least a high school level of education have 48.2% higher fish catch than others. This implies that possessing knowledge and information increases catch productivity. A positive relationship with fish catch was evident because people with a higher level of education are usually more aware and exposed to employing appropriate practices. Increasing hours per fishing trip posted a positive relationship with fish catch. Results showed that every additional hour per fishing trip would increase the catch by 0.0833 kg. This happens because as more time was allotted in fishing activity, there would be greater chances of obtaining abundant fish catch with a variety of species. In addition, the use of motorized boats requires the operator to possess skills specific to the type of boats they are using. Motorized boats were fishing vessels that were powered by engines. Stroke mechanics, vessel maneuvers, reading water conditions, and self-rescue were some examples of skill areas that fishers must be competent when fishing.

Table 3 shows that the use of motorized boats among fishers showed positive and significant influence to fish catch.

The fishers who were using boats powered by engines had 43.7 % higher catch than those who were using non-motorized boats.

This is because motorized boats can go beyond the reef and allow taking heavier load compared non-motorized.

On the contrary, fishers with non-motorized boats might find it harder to fish offshore, particularly in bad weather

Table 3. Influence of MPA on fish catch productivity

Variables	Model 1: Socio-economic factors	Model 2: Fishing variables	Model 3: Socio-economic and fishing variables
Age	0.00203		0.00252
	(0.00775)		(0.00763)
Married fishers	-0.0138		0.274
	(0.264)		(0.271)
Household size	0.0237		0.0207
	(0.0455)		(0.0451)
High level of education	0.488**		0.482**
	(0.199)		(0.200)
Having a working spouse	0.124		0.107
	(0.218)		(0.215)
Time spent on fishing (hours)		0.0828***	0.0833***
		(0.0277)	(0.0280)
Boat ownership		-0.108	-0.287
		(0.246)	(0.256)
Membership in a fishers' organization		0.114	0.106
		(0.210)	(0.212)
Number of companions during fishing		0.00798	0.00865
		(0.00709)	(0.00710)
Daily fishing cost		0.000316	0.000394
		(0.000352)	(0.000354)
Time travel from shoreline to fishing area		0.180*	0.171
		(0.105)	(0.105)
motorized boats		0.455*	0.437*
		(0.258)	(0.258)
Fishing grounds nearby MPA	0.320*	0.320	0.389*
	(0.199)	(0.211)	(0.217)
Constant	2.208***	1.616***	0.941*
	(0.460)	(0.331)	(0.562)
Observations	266	263	263
R-squared	0.036	0.087	0.116

Note: ***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.
Robust standard errors in parentheses. The regression models are significant at a 99% confidence level because the value of significance F was less than 0.01. Diagnostic tests further suggest that multicollinearity within predictors is not problematic and further tests showed no existing model specification problem.
Source: Authors' own calculation and analysis (2020).

The main variable of interest is the fishing grounds near marine protected areas. Results consistently show that there is a significant difference of catch between fishing grounds near MPAs and those that were far from MPAs (Table 3). Fishing grounds nearby MPA sites tend to be more abundant in terms of the fish catch than those sites that were distant from non-MPA fishing grounds. Fishers near MPAs more likely have higher catch by 38.9% than those fishing far from the MPAs. This is reasonable because fishing grounds nearby MPA sites benefited through the fish spillover effect, as hypothesized in the study. Our results are similar to what Forcada et al. (2009) reported that fish catch where significantly higher near the borders of MPAs [8]. In no-take MPAs, fishing activities were restricted/prohibited and fishes were able to mature to larger sizes and improve their reproductive output since they were left undisturbed. With this, fishes left due to overcrowding and the high competition of food and shelter. This will result in fish abundance to fishing grounds surrounding protected areas, making them available to fishers. This is an evidence of "fish spillover" where fishers benefit when fish become mature and abundant inside an MPA that some move out of the MPA where they become available to recreational and commercial fishers. The sustainability of MPAs will be beneficial to the livelihood of coastal communities who have been threatened by various adversities including climate change [20].

CONCLUSIONS

The determinants that significantly influence fisher's catch include a high level of education, amount of time per fishing trip, use of motorized boats, and fishing grounds nearby MPA. Across the three models, the fishing grounds near MPA displayed a positive influence on fish catch productivity. This provides empirical evidence of fish spillover effect, which appears to play a significant role in increased fisheries yield in adjacent unprotected areas. This outcome is in

parallel to the study of Friedlander (2013), Forcada et al., (2009), Di Lorenzo et al., (2020) as empirical evidence of fish spillover where fishers benefit when mature fish move out of the protected areas where they become available to local fishers [9] [8] [3]. Thus, higher catch rates near the protected areas were more likely to occur due to this spillover effect. With these robust results, we suggest that there should be enabling policies and support from the local government units and other organizations for the establishment of more MPA sites in order to improve the overall fisheries productivity in Leyte, Philippines. Additionally, management policies to safeguard newly established MPA sites should also be implemented for sustainability. There must be institutional coordination in support of MPA establishment since the design, implementation, and monitoring of MPAs require effective institutional structures at the local level of management. According to Di Franco et al. (2020), employing good governance processes involving stakeholders may rapidly generate local support for conservation and maximize the effectiveness and enhance support towards the sustainability of marine protected areas [2]. The potential benefits of marine reserves and protected areas will not be realized without a sufficient commitment to enforcement and monitoring. It is necessary that sufficient regulatory authority and funds for enforcement, research, and monitoring be provided to implement management plans in maintaining public support for protected areas.

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VARIATION OF THE MAIN AGRICULTURAL CROPS YIELD DUE TO DROUGHT IN ROMANIA AND DOBROGEA REGION IN THE PERIOD 2000-2019

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Abstract

The research was focused on yields dynamics of the main agricultural crops: wheat, maize, barley, oats, sunflower and rape recorded in Romania and especially in Dobrogea region in =order to identify in what measure they were affected by climate change, mainly by drought in two decades: 2000-2009 and 2010-2019. For this purpose, there were calculated the negative deviations of yield in each year from the average of each decade, and also the differences between the average decade yield in Dobrogea region and at the country level. The results proved substantial negative deviations for almost all the crops compared to the decade averages, and a smaller production performance in Dobrogea region versus yield level in Romania. All these differences were caused by the change in climate factors: the increased air temperature, low of lack of precipitations, low or lack of water resource into the soil, which characterize the severe and strong droughts with which Romania, and mainly Dobrogea region were facing during the last 20 years. In order to reduce the economic, social and environmental impact of droughts, the authorities have to develop sustainable strategies in order to support agriculture with irrigation systems and other measures of protection (financial aid to cover losses, tax exemption, extending the terms of repayment of the debts etc), and farmers have to continue their efforts for adapting the technologies cultivating high production potential varieties and hybrids resistant to drought, diseases and pests, choosing the right moment and depth for sowing, fertilization level and plant protection. Only in this way, farmers could obtain a production performance able to cover costs and assure profitableness of their business.

Key words**:** *agricultural crops, yields, climate change, drought impact, Dobrogea region, Romania*

INTRODUCTION

Crop production depends on a large range of factors among which the most important are: crop type, variety and hybrid, soil type and its fertility level and water reserve capacity, applied technologies systems (irrigated or not), climate factors.

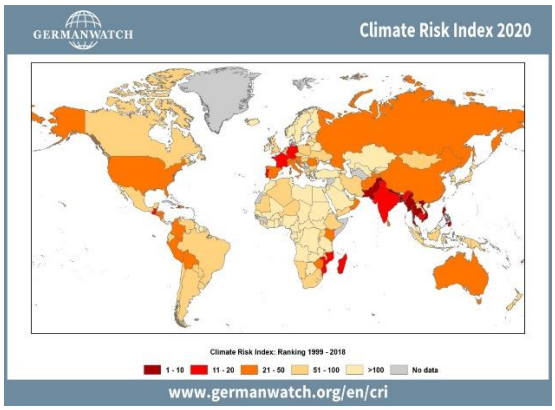
If all the technological factors are assured but weather conditions are not favorable, agricultural yield could register deviations from the crop potential with damages and losses for farmers' business.

If weather conditions are not suitable to each crop at the key moments of the year, they could affect plant development along various vegetation stages and production.

Heavy spring frosts at blossom time, spring and summer droughts of high intensity and length, heat waves, strong winds, strong storms, heavy rainfall, hail, and floods during the period of vegetation and harvesting could diminish or destroy agricultural production, produce damages and economic losses [10].

At the global level, climate change is more and more visible affecting both the emerging economies, and the developed ones, people's life and environment. The Global Climate Risk Index (CRI-2020) presents the actual situation of the countries where climate

extreme phenomena like heat waves, severe droughts, huge rainfalls and floods, storms and tornados etc have had a deep influence (Map 1) [4].



Map 1. Climate Risk Index 1999-2018
Source: [4].

That is why all the countries are interested to set up strategies with clear objectives, activities and measures destined to adapt to climate change, to reduce its negative economic, social and environment impact.

Grace to the technical progress in studying the weather events and providing forecasts, agro-meteorological information has become an useful tool to prevent farmers to adapt the agricultural technologies to climate change so that damages and losses to be at minimum or to be completely avoided [5].

By its geographical position, Romania is exposed to extreme weather conditions like heat waves, drought, floods, storms, hail etc which cause huge losses and damages in agriculture, but also in human life, affect vegetation and animal resources, ecosystems and seasons.

About 30-50% of agricultural production has been lost from 7 million ha representing 48% of 14.87 million ha agricultural land in Romania during the last decade [33, 5].

The most affected parts of Romania are South West Oltenia, South Muntenia, South East and East, where climate change, mainly droughts are strong and severe, and a trend of aridity and desertification has been noticed in many regions, but mainly in Oltenia and Dobrogea where the fluctuation of the climate factors has led to the variation of the agricultural production from a year to another.

During the last decades, high air temperatures, reduced rainfalls, a high deficit of water reserve into the soil in summer season and even in autumn have become more frequent, affecting the vegetation phases and crop productions, making farmers who have not irrigation systems to be aware that they will harvest a low output which will not cover costs by selling their products, and debts to banks and leasing companies. Also, the deficit of production will affect food security of the population and increase imports to cover the consumption needs [6].

The expectations for the future for Romania are similar to the forecast for Europe, that in 2020-2029 horizon, the deviation of temperature will range between $+0.5^0$C and 1.5^0C and for 2090-2099, it will vary between 2^0C and 5^0C [2].

Also, the precipitations are expected to decrease by 20% in the period 2090-2099 horizon compared to 1980-1990 [33, 6].

These scenarios are an "alarm bell" or a "red flag" for any country to set up strategies for adapting to climate change.

During the period 1901-2019, Romania was facing an increasing trend regarding the annual average temperature and a decreasing trend concerning the annual average precipitations, and this was noticed especially in the South, South East and East regions during the last 35 years.

The frequency of severe droughts and for longer periods has increased affecting almost year by year agricultural production performance.

The year 2015 was considered the warmest year with an increase of $+1.96^0$C compared to the average temperature during 1961-1990.

In the period 2000-2015, based on the average level of temperature, the hierarchy of the years with the highest temperature is the following one: 2015, 2007, 2014, 2012, 2013, 2009, 2008, 2000, 2002, 2010,2001, 2011, 2004, 2006, 2003 and 2005 [11].

The deviation of the average temperatures ranged between $+1.35^0$C, the lowest one, registered in the year 2002 and $+1.96^0$C, the highest one, recorded in the year 2015 (Table 1).

Table 1. The additional air temperature to the annual average temperature registered in the period 1901-2015 in Romania

	2015	2007	2014	2012	2013	2009	2008	2000	2002
Average air temperature ^{0}C	11.6	11.5	11.5	11.1	11.1	11.1	11.1	11.0	11.0
Deviation ^{0}C	+1.96	+1.87	+1.86	+1.54	+1.52	+1.48	+1.46	+1.39	+1.35

Source: [11].

The extreme droughts were registered in the following years of the period 2000-2020: 2000-2001, 2001-2002, 2002-2003, 2006-2007, 2008-2009, 2011-2012, 2014-2015, 2016, 2018, 2019 and 2020.

The year 2019 was completely different, and considered by the experts "the warmest year since measurements are made in Romania, that is during the last 140 years since 1900 till present" [11, 10, 12].

Agricultural drought is characterized by the increase of temperatures, the decline of rainfalls and by the deficit of soil water, this phenomenon lasting usually for a longer period than two weeks. However, the period of drought, the size of the affected surfaces, the temperature and precipitations level vary from a region to another, a country to another, In 2019, the drought started in spring and continued in summer and fall, and even in winter, then in spring, summer and autumn of the year 2020 as never before [12].

Dobrogea region has a high level of drought risk as in this part of Romania, the annual average temperature is over 11^{0}C and the rainfalls vary between 351 and 450 mm/year in average, while Moldova and Muntenia regions have a medium risk of drought as the rainfalls here vary between 451-600 mm/year. Oltenia, Crisana, Transilvania and Banat have a low risk of drought level as the precipitations range between 601-800 mm/year, while Maramures is the only region with the lowest risk of drought as here precipitations exceed 800 mm per year (Table 2).

Table 2. Annual average rainfalls and risk drought level in Dobrogea compared to other regions of Romania during the period 1981-2010 (mm)

Region	Average annual precipitations (mm)	Deviations in Dobrogea compared to the other regions		Precipitation level (mm)	Risk drought level
		(mm)	%		
Dobrogea	412	-	-	351-400	High level
Moldova	575.9	-163.9	-28.5	451-600	Medium level
Muntenia	575.7	-163.7	-28.5		
Oltenia	645.8	-233.8	-36.3	601-800	Low level
Crisana	668.4	-256.4	-38.4		
Transilvania	680	-268	-39.5		
Banat	737.8	-325.8	-44.2		
Maramures	829.1	-417.1	-50.4	Over 800	Very low

Source: Own calculations based on [11].

In this context, the paper objective was to analyze the evolution of agricultural yields during the last two decades, 2000-2009 and 2010-2019 and to identify the absolute deviation of production caused by climate change, especially by drought which is the main climate factor which affects agricultural production. The yield produced in each year of the chronological series was compared with the decade average to quantify the variation of production both at Romania's level and in Dobrogea region, which is the most affected area by drought in the country. Also, the average yields carried out in Dobrogea region for the two decades 2000-2009 and 2010-2019 for wheat, maize, barley and oats, as well as for sunflower and rape were compared to the average yields at the national level in order to assess the decrease or losses of production.

MATERIALS AND METHODS

The study is based on the available data picked up from the National Institute of Statistics, Tempo Online data base for the period 2000-2019, and also from the Statistical Divisions of Constanta and Tulcea Counties for the year 2018 available on their sites.

The period of research was chosen to include the warmest years as mentioned by [11, 12].

The main agricultural crops for which yield levels were studied in the warmest years have been: wheat, maize, barley, oats, sunflower and rape.

The main indicators calculated in this study have been the following ones:

(i) The average of crop yield for the decade 2000-2009 and 2010-2019 in Romania;

(ii) The average of crop yield for the decade 2000-2009 and 2010-2019 in Dobrogea region

(iii)The absolute difference between yield level in n year (n= 1,2,...10) and the average yield determined for the decade 2000-2009, and respectively for the decade 2010-2019 in Romania;

(iv)The absolute difference between yield level in n year (n= 1,2,...10) and the average yield determined for the decade 2000-2009, and respectively for the decade 2010-2019 in Dobrogea region;

(v)The difference between average yield registered in the decade 2010-2019 and in the decade 2000-2009 in Romania;

(vi) The difference between average yield registered in the decade 2010-2019 and in the decade 2000-2009 in Dobrogea region.

The formulas used in this study have been:

The average value of agricultural crop in each decade was determined based on the formula:

$\bar{y} = \frac{\sum_{t=1}^{n} yt}{n}$

Absolute differences between crop yield and the decade average, $\Delta = y_n - \bar{y}$

Mean at the decade level, $\bar{Y} = \frac{\sum_{1}^{n} y_i}{n}$

The differences between the average level of yield in the decade 2020-2019 and the average level of yield in the decade 20020-2009 were determined as follows:

$\bar{y} = \bar{y}decade\ 2020 - 2019 - \bar{y}\ decade\ 2009 - 2000$

The results were illustrated in tables and graphics, being accompanied by comments and finally the main conclusions have been drawn.

RESULTS AND DISCUSSIONS

Romania's agriculture - A brief statistical overview in 2019

Romania is situated in the Eastern part of Europe and has a harmonized territorial structure from a geographical point of view characterized by three relief forms with a shape of amphitheater distributed in the same proportionof 33% between mountains, hills and plains.

Romania's surface is 238,390 km^2, and its climate is a temperate continental one with a few Mediterranean influences.

Agricultural land is 14.63 million ha, representing 61.36% of the country surface, while an arable land which accounts for 8,737,275 ha representing 93,34% of the cultivated area.

The main agricultural crops cultivated in Romania are cereals, which occupy 5.57 million ha, representing 63.8% of the total cropped area, oil seeds plants which cover 1.80 million ha (20.5%), forage plants which are cultivated on 0.9 million ha (10.3%), vegetables are cultivated on 0.23 million ha (2.63%), leguminous plants on 0.12 million ha (1.36%) and other crops.

Romania produces a large variety of agricultural products both of vegetal and animal origin (from cattle, pigs, sheep, goats, poultry), but mainly cereals and oil seeds.

Of the 5.57 million ha cultivated with cereals, maize comes the 1st with 2.68 million ha (48.11%), followed by wheat with 2.17 million ha (38.95%), barley and two-row barley 0.45 million ha (8.07%), oats 0.16 million ha (2.87%) and the remaining others (Sorghum etc) [18, 21, 22, 25, 30].

Of the 1.8 million ha cropped with oil seeds plants, 1.28 million ha are represented by sunflower (71.11%), 0.35 million ha by rape

(19.44%) and 0.16 million ha by soybean (8.88%) [16, 17].

Agricultural production is mainly represented by cereals which achieved 30.41 million tons, of which maize grains 17.43 million tons (57.31%), wheat 10.3 million tons (33.87%), barley and two- row barley 1.88 million tons (6.18%) [26, 23].

Also, oil seeds production accounted for 3.57 million tons, of which sunflower seeds 3.57 million tons (74.53%), rape seeds 0.80 million tons (16.7%), and the remaining soybean seeds [27, 28, 29].

Also, Romania produced 3.53 million tons of vegetables.

In 2018, agricultural production value accounted for Lei 86,349 million, of which vegetal production Lei 61.22 million (70.89%) and animal production Lei 23.9 million (27.67%).

Of 8,634.7 thousand persons occupied population in Romania, 1,919.6 thousand are dealing with agriculture, forestry and fishing, representing 22.23% [19, 21].

Agriculture contribution to GDP was Lei 37 billion in 2017, meaning 4.3% of Romania's GDP (Lei 857.89 billion) [24, 13].

In 2019, Romania achieved Lei 1,059.9 billion GDP, to which agriculture contributed by 4.2% [15].

In 2019, Romania's GDP accounted for Euro 223 billion, contributing by 1.6% to the EU-27 GDP (Euro 13,900 billion), for which Romania comes on the 14th position among the members states [3].

Variation of yield for the main agricultural crops in Romania in the warmest years during the last two decades (2000-2019)

In the period 2000-2019, *wheat yield* registered the highest level of 4,888 kg/ha in the year 2017 and the lowest one of 1,429 kg/ha in 2003. However, in 2019, wheat yield was 4,749 kg/ha 2.07 times higher than in the year 2000. Looking at the chronological series, it is easily to identify the decline of yields in the years: 2003, 2007, 2002, 2000, 2009, 2012, 2010, the decreasing hierarchy of these years being established in accordance with the production deviation compared to the average yield in each decade, 2000-2009 and, respectively, 2010-2019. The decline of yield was considered due to climate change and especially to drought (Fig. 1).

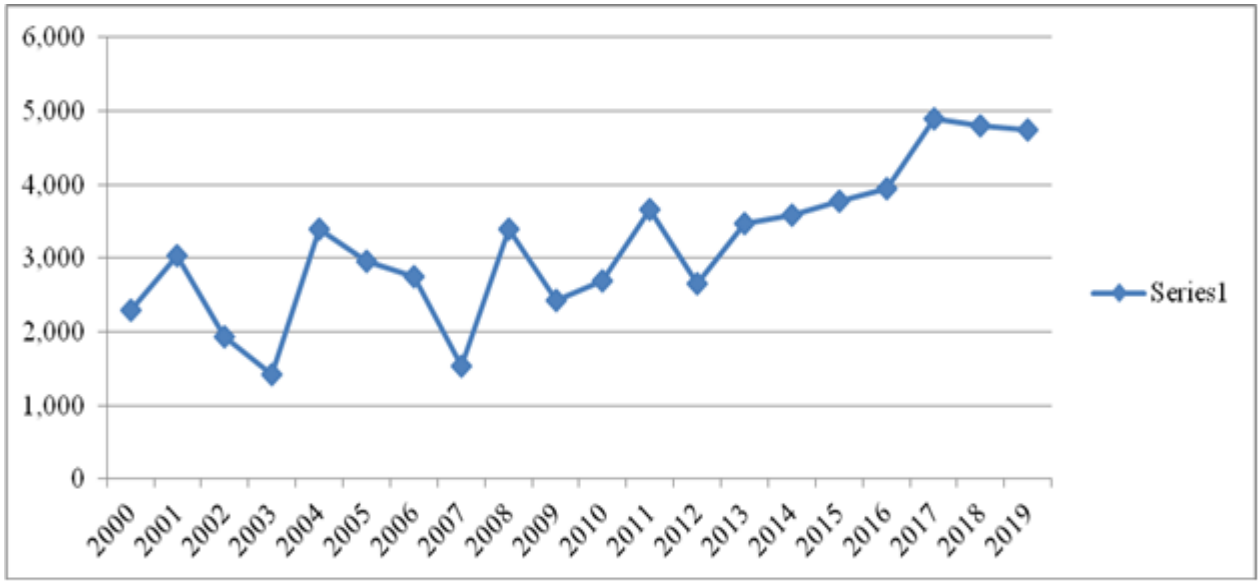


Fig. 1. Dynamics of wheat yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

In the analyzed interval, *barley and two-row barley yield* varied between 1,461 kg/ha in 2007, the lowest level, and 4,417 kg/ha in 2018, the highest level. In 2019, barley produced 4,188 kg/ha, that is 1.98 times more than in the year 2000. The years with the decline in barley yield according to the intensity and length of drought, in the

decreasing order of production decline, were: 2007, 2003, 2002, 2000, 2009, 2012, 2010 (Fig. 2).

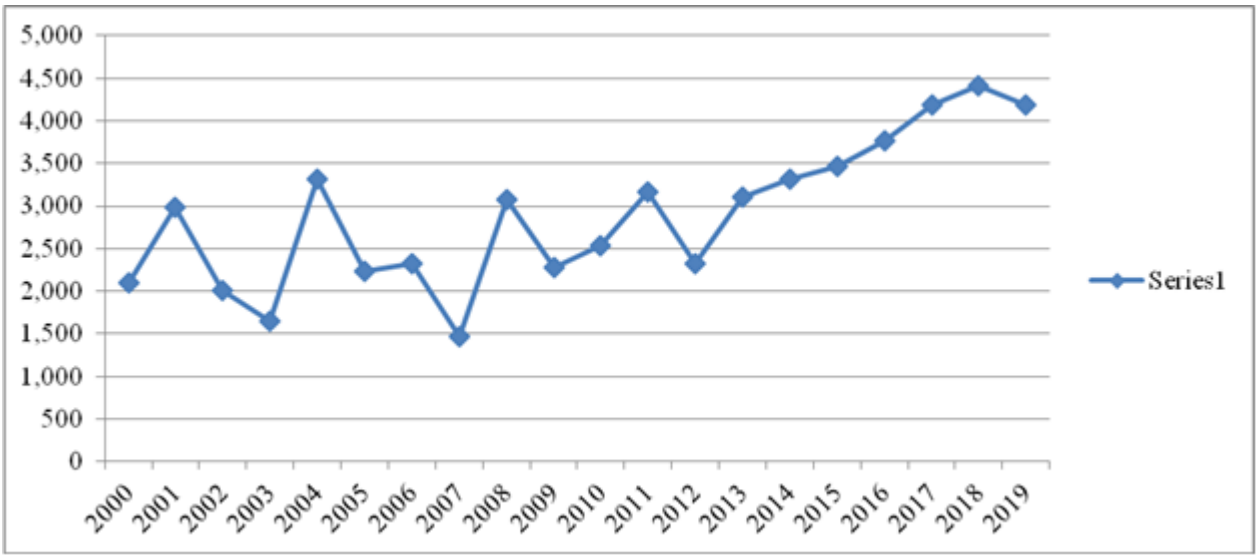


Fig. 2. Dynamics of barley and two-row barley yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

In case of *oats*, yield ranged between 1,050 kg/ha in the year 2000, the lowest level, and 2,460 kg/ha in the year 2017, the highest record. In 2019, oats yield accounted for 2,243 kg/ha, meaning 2.13 times more than in the year 2000. The most critical years when drought affected oats performance have been in the descending order: 2000, 2007, 2003, 2002, 2009, 2010 and 2015 corresponding to the ascending loss of production (Fig. 3).

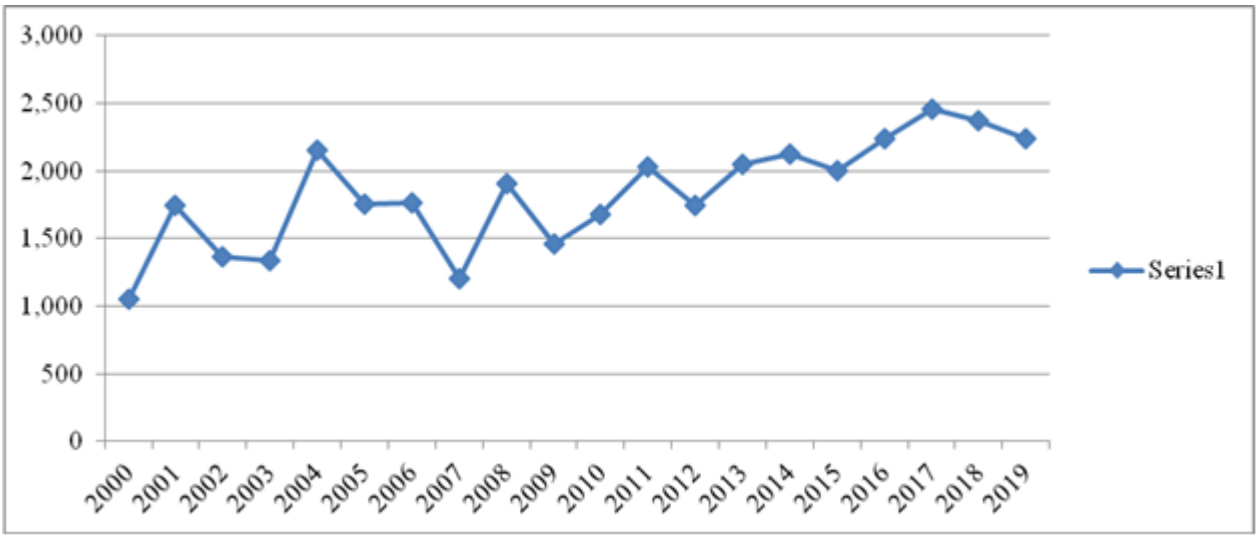


Fig. 3. Dynamics of oats yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Maize registered the lowest yield, which accounted for 1,526 kg/ha in the year 2007, and the highest one of 7,644 kg/ha in 2018. But, in 2019, maize produced 6,502 kg/ha by 1,142 kg less than in the previous year, but 4.05 times more than in the year 2000. The most difficult years for maize crop, when drought caused a deep decline of production, were: 2007, 2000, 2012, 2002, 2003, 2015, 2019, the years being arranged in the increasing order of the yield loss (Fig. 4).

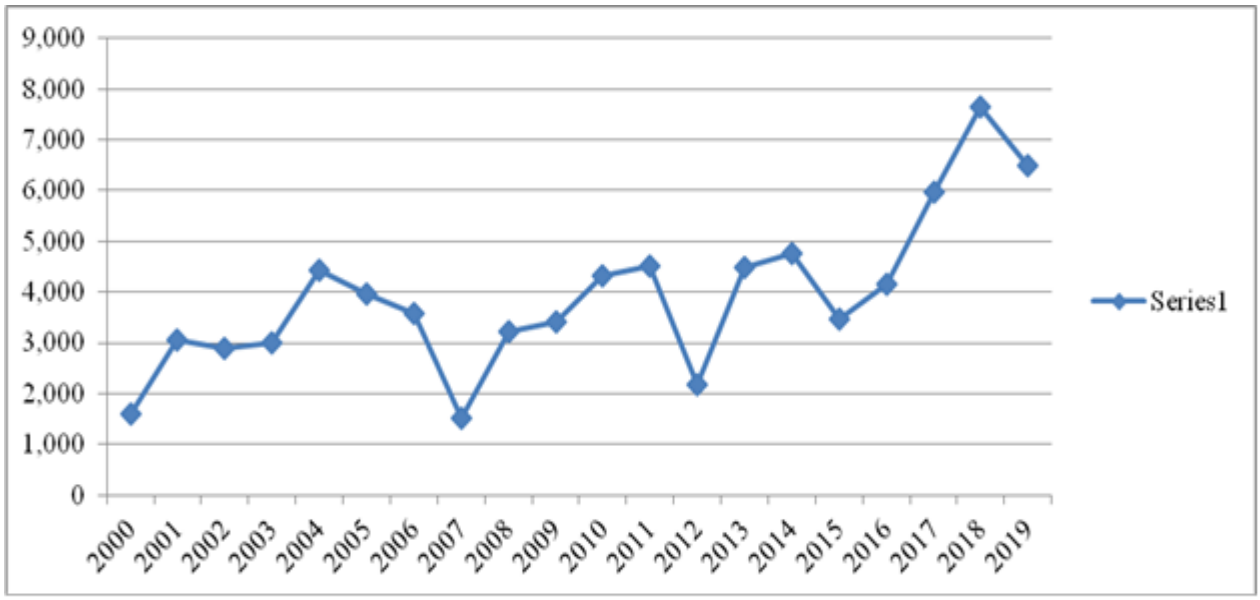


Fig. 4. Dynamics of maize yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Sunflower registered the lowest production level per surface unit, 654 kg in the year 2007 and the highest one, accounting for 3,041 kg/ha in the year 2018. In 2019, sunflower yield was 2,783 kg/ha, 3.38 times higher than in the year 2000. The droughty years 2007, 2000, 2001, 2002, 2012, 2010, 2015 and 2019 were considered responsible for the loss of production (Fig. 5).

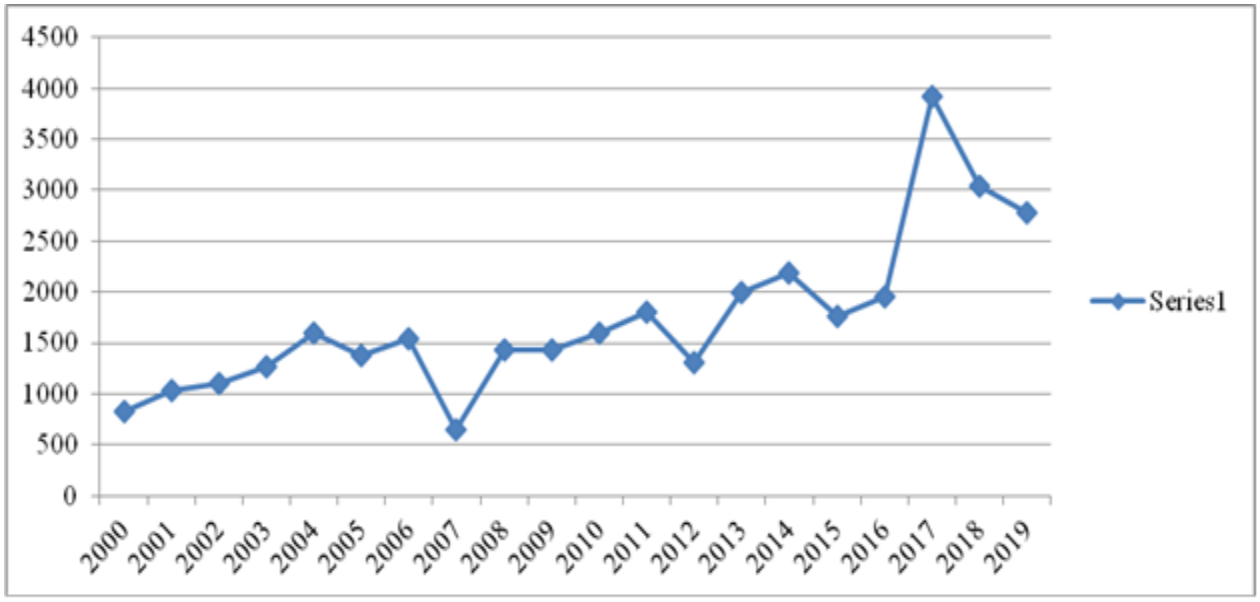


Fig. 5. Dynamics of sunflower yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Rape yield ranged between 473 kg/ha, the minimum performance registered in 2003 and 2,835 kg/ha, the highest level recorded in the year 2016. In 2019, rape produced 2,264 kg/ha, 2.03 times more than at the beginning of the analyzed period, that is in the year 2000. The most droughty years for rape crop, arranged in the increasing order of the loss of production, were: 2003, 2002, 2007, 2000, 2012, 2010, 2019 and 2015 (Fig. 6).

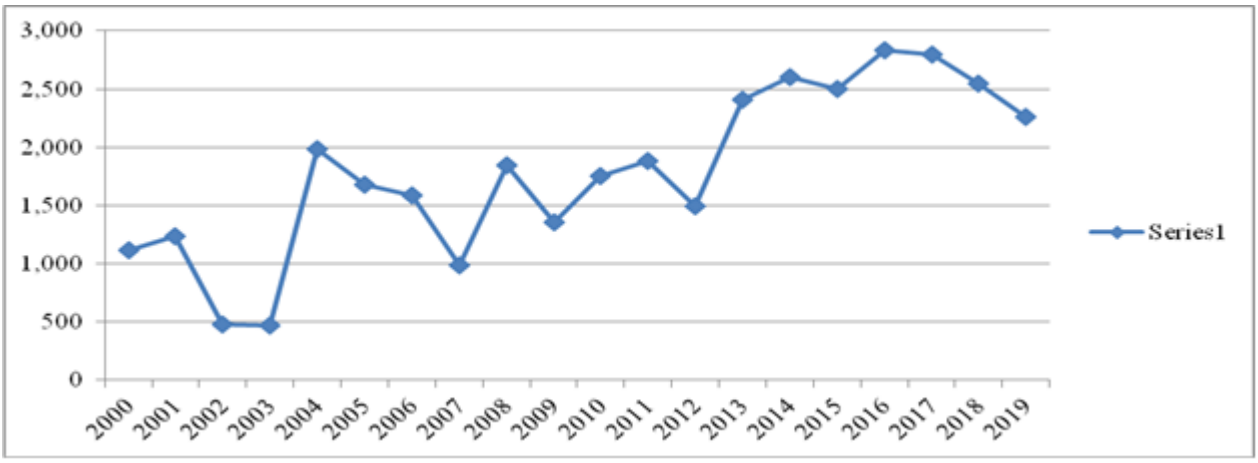


Fig. 6. Dynamics of rape yield in Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

The evolution of yields and the losses of yields due to the droughts are presented in Table 3 and 4.

Table 3. The evolution of cereals yields and of the yield losses due to the droughts in Romania in the decades 2000-2009 and 2010-2019 (kg/ha)

Year	Yield (kg/ha)				Yield deviations from the average yield in the decade 2000-2009 (kg/ha)			
	Wheat	Barley and two-row barley	Oats	Maize	Wheat	Barley and two-row barley	Oats	Maize
2000	**2,286**	**2,105**	**1,050**	**1,603**	+12.5	-237.3	-524	-1,464.2
2001	3,038	2,988	1,743	3,066	+764.5	+645.7	+169	-1.2
2002	**1,924**	**2,005**	**1,368**	**2,902**	-349.5	-337.3	-206	-165.3
2003	**1,429**	**1,641**	**1,334**	**2,993**	-844.5	-701.3	-240	-74.2
2004	3,403	3,312	2,154	4,441	+1,129.5	+969.7	+580	+1,373
2005	2,965	**2,227**	1,757	3,952	+691.5	-115.3	+183	+884.8
2006	2,746	**2,331**	1,763	3,565	+472.5	-11.3	+189	+497.8
2007	**1,541**	**1,461**	**1,206**	**1,526**	-732.5	-881.3	-368	-1,541.2
2008	3,403	3,069	1,906	3,215	+1,129.5	+726.7	+332	+147.8
2009	2,421	**2,284**	**1459**	3,409	+147.5	-58.3	-115	+341.8
Average decade yield	**2,273.5**	**2,342.3**	**1,574**	**3,067.2**	-	-	-	-
	Yield (kg/ha)				Yield deviations from the average yield in the decade 2010-2019 (kg/ha)			
2010	**2,688**	**2,542**	**1,679**	4,309	-1,133.5	-907.2	-247.3	-490.8
2011	3,663	3,170	2,028	4,525	-158.5	-279.2	+101.7	-274.8
2012	**2,652**	**2,325**	**1,743**	**2,180**	-1,169.5	-1,124.2	-183.3	-2,619.8
2013	3,468	3,111	2,051	4,488	-353.5	-338.2	+124.7	-311.8
2014	3,590	3,319	2,124	4,770	-231.5	-130.2	+197.7	-29.8
2015	3,780	3,461	1,999	**3,462**	-41.5	+11.8	+72.7	-1,337.8
2016	3,944	3,773	2,239	**4,159**	+122.5	+323.8	+312.7	-640.8
2017	4,888	4,186	2,460	5,959	+1,066.5	+736.8	+533.7	+1,159.2
2018	4,793	4,417	2,376	7,644	+971.5	+967.8	+449.7	+2,844.2
2019	4,749	4,188	2,243	6,502	+927.5	+738.8	+316.7	+1,702.2
Average decade yield	**3,821.5**	**3,449.2**	**1,926.3**	**4,799.8**				

Source: Own calculation based on the data from [13].

Table 4. The evolution of oil seeds yields and of the yield losses due to the droughts in Romania in the decades 2000-2009 and 2010-2019 (kg/ha)

	Yield (kg/ha)		Yield deviations from the average yield in the decade 2000-2009 (kg/ha)	
	Sunflower	Rape	Sunflower	Rape
2000	**821**	**1,113**	-405.3	-161.9
2001	**1,029**	**1,235**	-197.3	-39.9
2002	**1,105**	**481**	-121.3	-793.9
2003	1,268	**473**	+41.7	-801.9
2004	1,595	1,984	+368.7	+709.1
2005	1,381	1,681	+154.7	+406.1
2006	1,540	1,590	+313.7	+315.1
2007	**654**	**991**	-572.3	-283.9
2008	1,437	1,844	+210.7	+569.1
2009	1,433	1,357	+206.7	+82.1
Average decade yield	**1,226.3**	**1,274.9**	-	-
	Yield (kg/ha)		Yield deviations from the average yield in the decade 2010-2019 (kg/ha)	
2010	**1,597**	**1,755**	-537.6	-553.7
2011	**1,798**	**1,882**	-336.6	-426.7
2012	**1,310**	**1,496**	-824.6	-817.7
2013	**1,993**	2,408	-141.6	+99.3
2014	2,187	2,604	+52.4	+295.3
2015	**1,765**	2,499	-369.5	+190.3
2016	**1,955**	2,835	-179.6	+526.3
2017	2,917	2,798	+782.4	+489.3
2018	3,041	2,546	+906.4	+237.3
2019	2,783	**2,264**	+648.4	-44.7
Average decade yield	**2,134.6**	**2,308.7**		

Source: Own calculation based on the data from [13].

However, in the last two decades, the general trend of the yields in case of all these crops is an ascending one at the country level, reflecting the positive impact of the strategies of agriculture development in Romania, mainly after its accession into the EU, and the EU support for sustaining this sector (Table 5).

Table 5. Comparison between the average yields for the main agricultural crops in the period 2010-2019 and the period 2000-2009 in Romania (kg/ha)

		Wheat	Maize	Barley	Oats	Sunflower	Rape
1	Average yield 2010-2019	3,821	4,799.8	3,449.2	1,926.3	2,134.6	2,308.7
2	Average yield 2009-2010	2,273.5	3,067.2	2,342.3	1,574	1,226.3	1,274.9
3	Difference 3= 1-2	+1,548	+1,732.6	+1,106.9	+352.3	+908.3	+1,033.8
4	2010-2019/ 2000-2009 (%)	+68	+56	+47.2	+22.3	+74	+81

Source: Own calculation.

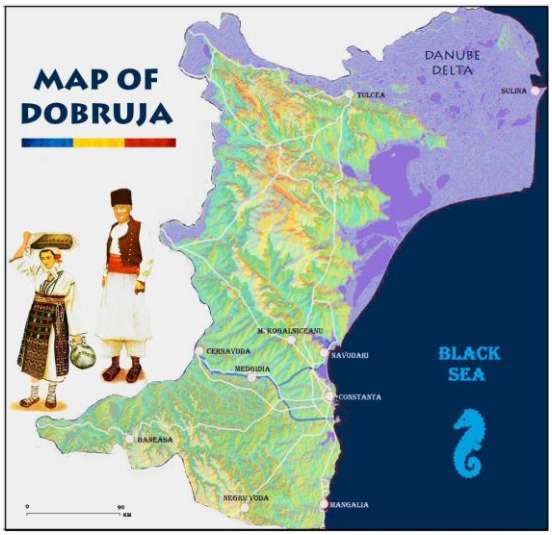
Dobrogea's agriculture - A brief statistical overview

Dobrogea region consists of two counties, Constanta and Tulcea. Its surface is 15,570 km^2, of which 7,071 km^2 (45.4%) Constanta County and 8,499 km^2 (54.6%) Tulcea County.

The population of the region was 997,792 inhabitants on January 1st, 2020, of which 763,549 inhabitants (76.5%) in Constanta

county and 234,243 inhabitants (23.5%) in Tulcea county.

The soils in Dobrogea are in general represented by chernozem, clay, sandy, and alluvial soils.



Map 2. Dobrogea map
Source: [1].

Dobrogea region is included in the warm and droughts 1st agro-climate zone, characterized by high temperatures and low precipitations compared to other regions of Romania.

Average annual temperature is over 11^0C, sun radiation ranges between 128-136 kcal/cm^2/year and the length of sunshine varies between 2,275-2,350 hours/year.

The amount of precipitations is low, usually varying between 350-400mm/year and their incidence is commonly noticed at the end of Spring and the beginning of Summer.

Dobrogea climate is an accentuated continental climate with hot and dried summers and winters with strong winds.

During the last decades, Dobrogea region is more and more affected by drought of high intensity and long length with a negative effect on agricultural productions. Even a tendency to aridity was also noticed during the last five decades [31, 32].

The year 2019 was characterized by a long period of drought which lasted from spring 2019 and continued along the whole year till late in autumn. The low precipitations in winter and spring season 2020 have led to an extreme pedological drought for the depth 0-100 cm into the soil. The water reserve in the soil layer of 0-20 cm was missing, so that winter crops were compromised in the farms lacked of irrigation systems. In the agricultural year 2019-2020, the pedological drought affected in different proportions cereals and other crops in this part of the country, but also at the national level [14].

Agriculture is one of the main economic sectors in Dobrogea region, grace to its surface suitable for this purpose, accounting for 922,145 ha, representing 59.2% of the region area. However, in Constanta County, agricultural land is 558,204 ha with a share of 78.9% in the county surface, while in Tulcea County, agricultural land is only 363,841 ha, representing 42.8% of its surface, as the county includes the Biosphere Reservation of the Danube Delta, the largest in Europe and belonging to the UNESCO patrimony.

The arable land in Dobrogea region is 778,991 ha, of which 484,103 ha in Constanta County (62.1%) and 294,888 ha (37.9%) in Tulcea County.

The cultivated surface is 741,538 ha at Dobrogea level, representing 95.1% of its total surface. In Constanta County, 474,343 ha and in Tulcea County 267,195 ha are cultivated.

The main crops are: cereals: wheat, maize for grains, barley and two-row barley, oats, oils seeds crops: sunflower, rape, soybean and their share in the cultivated area is 79.46% in Dobrogea region, 80.19% in Constanta County and 78,15% in Tulcea County (Table 6).

Cereals occupy the top position in agricultural production. In 2018, Dobrogea region achieved 2,722,333 million tons cereals, of which 66.18 in Contanta county and 33.82% in Tulcea county.

Wheat comes the first among cereals, its output accounting for 1,406,343 tons at Dobrogea level, of which 72.38% was registered in Constanta County and 27.62% in Tulcea County. Wheat has the highest share among cereals: 51.6% in Dobrogea, 56.5% in Constanta county and 42.17% in Tulcea county.

Maize for grains comes on the 2nd position as importance in Dobrogea region which obtained 887,220 tons, that is 32.52% of the total cereal production. In Constanta county, maize accounts for 25.37% in cereal production, while in Tulcea county for 46.71%.

Barley is ranked the third, contributing to cereal production of Dobrogea region by 14.57%, by 16.92% in Constanta county and by 9.96% in Tulcea county (Table 6).

Table 6. Dobrogea region- a brief statistics of agriculture

	Dobrogea region	Constanta County	Tulcea County	Share in Dobrogea region (%)	
Agricultural land (ha)	922,145	558,204	363,941	60.5	39.5
Arable land (ha)	778,991	484,103	294,888	62.1	37.9
Value of agricultural production (Lei Million), of which:	4,753,629	2,929,186	1,824,443	61.6	38.4
Value of vegetal production (Lei Million)	3,777,967	2,377,863	1,400,104	62.9	37.1
Share of vegetal production in agricultural production value (%)	79.5	81.1	76.4	-	-
Cultivated area (ha)	741,538	474,343	267,195	63.9	36.1
Share of cultivated area in agricultural land (%)	80.4	84.9	73.4	-	-
Cultivated area with the main crops (ha)					
Wheat (ha)	260,649	175,998	84,651	67.5	32.5
Barley (ha)	88,173	65,088	23,085	73.8	26.2
Maize (ha)	106,803	58,045	48,758	54.3	45.7
Sunflower (ha)	133,712	81,318	52,394	60.8	39.2
Share of the crops in the cultivated area (%)					
Wheat	35.14	37.10	31.68	-	-
Barley	11.89	13.72	8.63	-	-
Maize	14.40	12.23	18.24	-	-
Sunflower	19.03	17.14	19.60	-	-
Total crops	79.46%	80.19	78.15		
Crop production (tons)					
Cereals (tons)	2,722,333	1,801,684	920,649	66.18	33.82
- Wheat and rye	1,406,343 (51.6%)	1,018,032 (56.5%)	388,311 (42.17%0	72.38	27.62
-Barley and two-row barley	396,791 (14.57%)	305,018 (16.92%)	91,773 (9,96%)	76.87	23.13
-Oats	21,297 (0.80%)	18,184 (1.00%)	3,613 90.39%)	83.42	16.58
-Maize for grains	887,220 (32.52%)	457,152 (25.37%0	430,068 (46.71%)	51.52	48.48
-Sunflower	477,329	296,518	180,811	62.12	37.88
-Rape	164,462	102,463	61,999	62.30	37.70

Source: Own calculations based on the data from [34, 35].

Oats is ranked the 4th, its contribution to cereal production being small, just 0.80%.

Sunflower is the most important oil seeds crop, its production being 477,329 tons, of which 62.12% being produced in Constanta County and 37.88% in Tulcea County.

Rape production accounted for 164,462 tons at Dobrogea level, of which 62.3% in Constanta county and 37.7% in Tulcea county (Table 6).

Therefore, the share of the main crops cultivated area in Dobrogea in the cultivated area in Romania is: 12.31% for wheat, 4.37% for maize for grains, 20.82% for barley and 13.27% for sunflower.

The contribution of Dobrogea region to agricultural production in Romania is 13.86% for wheat and rye, 20.89% for barley and two-row barley, 4.75% for maize, 5.55% for oats, 15.58% for sunflower and 10.20% for rape,

and this reflects how important is Dobrogea region in Romania's agriculture.

Variation of crop yield in Dobrogea region in the warmest years in the period 2000-2019

Wheat yield varied between 296 kg/ha in 2003, the year which affected the most this crop in Dobrogea, and 3,477 kg/ha, the highest production level registered in the year 2008, which was the most favorable year in the decade 2000-2009.

Other decreases were recorded in 2007, 2009, 2001, 2002, years in which yields were below the average yield in this decade.

In the decade 2010-2019, compared to 3,713.4 kg/ha average yield recorded in this period, wheat yield achieved lower performances in 2012, 2010, 2013, 2014, considered the unfavorable years for this crop (Fig. 7).

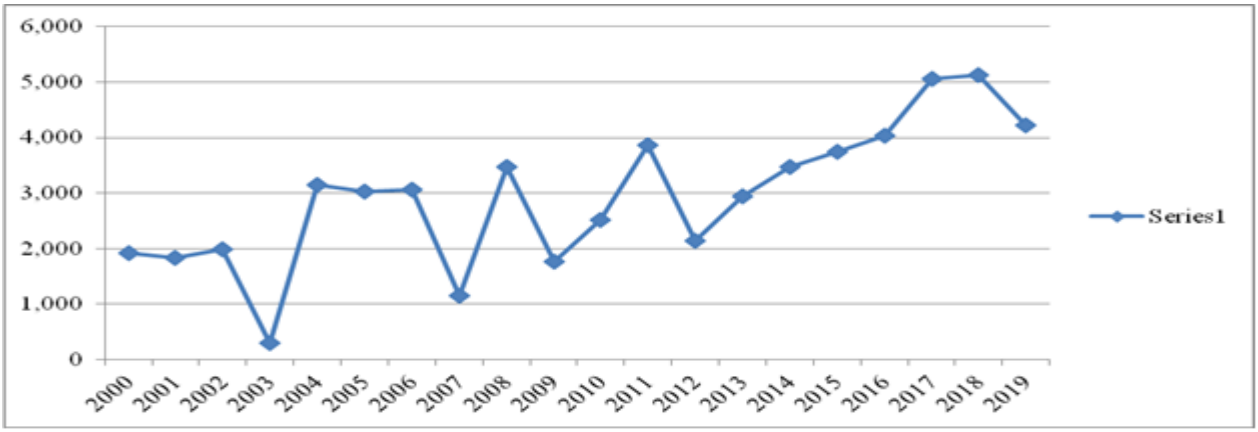


Fig. 7. Dynamics of wheat yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Barley and two-row barley registered an average production of 1,952 kg/ha in the decade 2000-2009, yield levels ranging between 932 kg/ha in 2007, the smallest production, and 3,030 kg/ha in 2008, the highest one. The unfavorable years for this crop, taking into account the hierarchy of the losses, were 2007,2003,2005,2000.

In the decade 2010-2019, the average production was 3,281 kg/ha with variations between the lowest level, 1,651 kg/ha in 2012 and 4,366 kg/ha, the highest level, in 2018.

The highest decreases of yield were registered in the years 2012, 2010, 2013 and 2019 (Fig. 8).

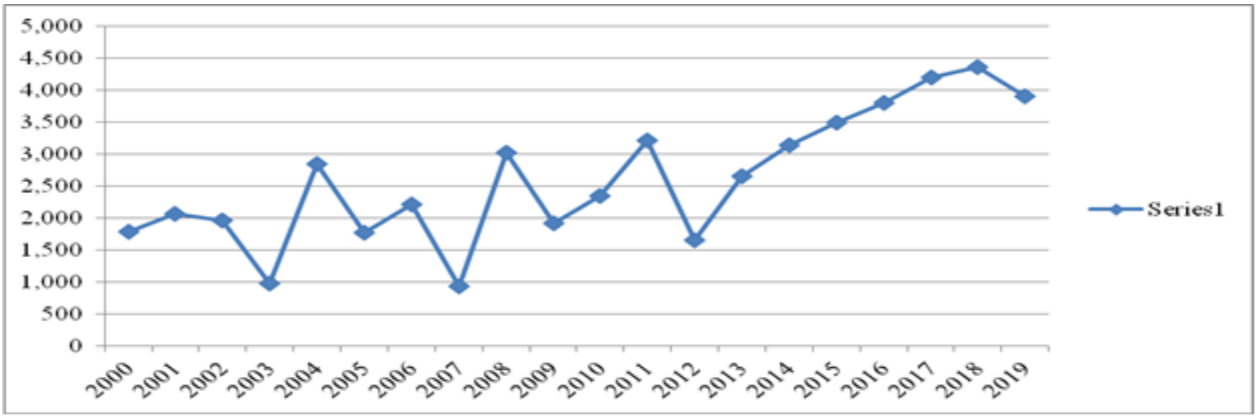


Fig. 8. Dynamics of barley and two-row barley yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Oats yield accounted for 1,210.5 kg/ha as the decade 2000-2009 average. In this interval, it ranged between 474 kg/ha, the minimum yield, registered in 2007, and 1,681 kg/ha, the

maximum level, in the year 2008. The unfavorable years for this crop were 2007, 2003, 2000, 2009, 2002, 2001, when yield was lower than the decade mean.

In the decade 2010-2019, oats yield registered an average level of 1,950 kg/ha, the variation thresholds being 1,354 kg/ha in the year 2012, the lowest performance, and 2,438 kg/ha, the highest one, in 2019.

The most unfavorable years for oats crop in this decade were 2012, 2010, 2013, 2014 and 2015 when production was below the decade mean (Fig. 9).

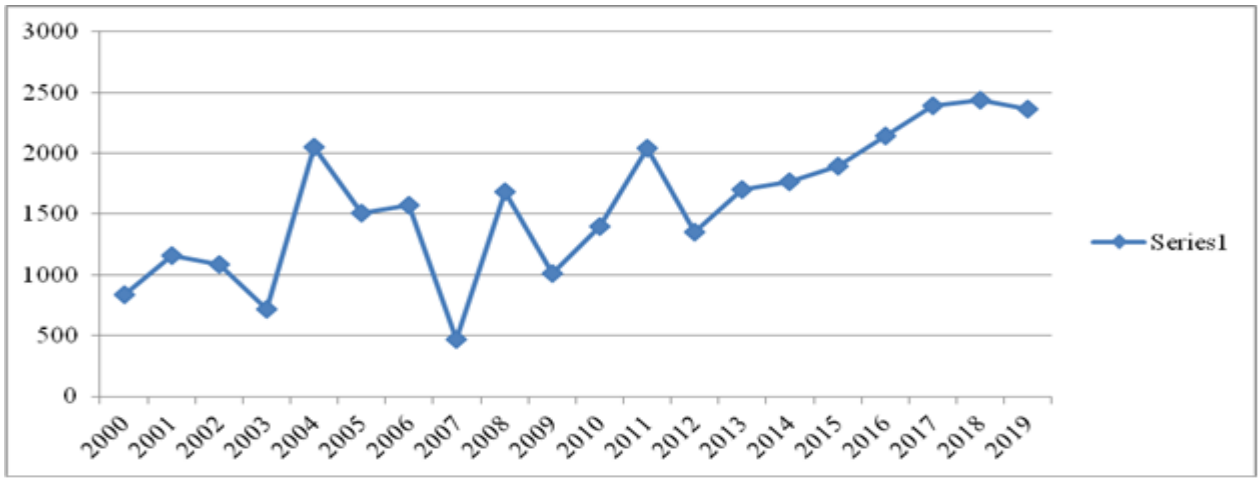


Fig. 9. Dynamics of oats yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Maize for grains registered an average yield of 2,549 kg/ha in the decade 2000-2009. The highest performance was 3,881 kg/ha carried out in the year 2004, and the lowest one, 480 kg/ha, was noticed in the year 2007. The most unfavorable years for maize crop in this decade, when production decreased below the decade average were 2007, 2001, 2000 and 2002. In the second decade 2010-2019, maize yield registered a mean of 4,483.8 kg/ha. The performance ranged between 1,374 kg/ha, the minimum level in 2012, and 8,472 kg/ha, the maximum level achieved in the year 2018.

Maize yield registered levels below the decade average in the following years: 2012, 2015, 2016, 2013, 2014, 2010, 2019 which were considered unfavorable for this crop (Fig. 10, and Table 7).

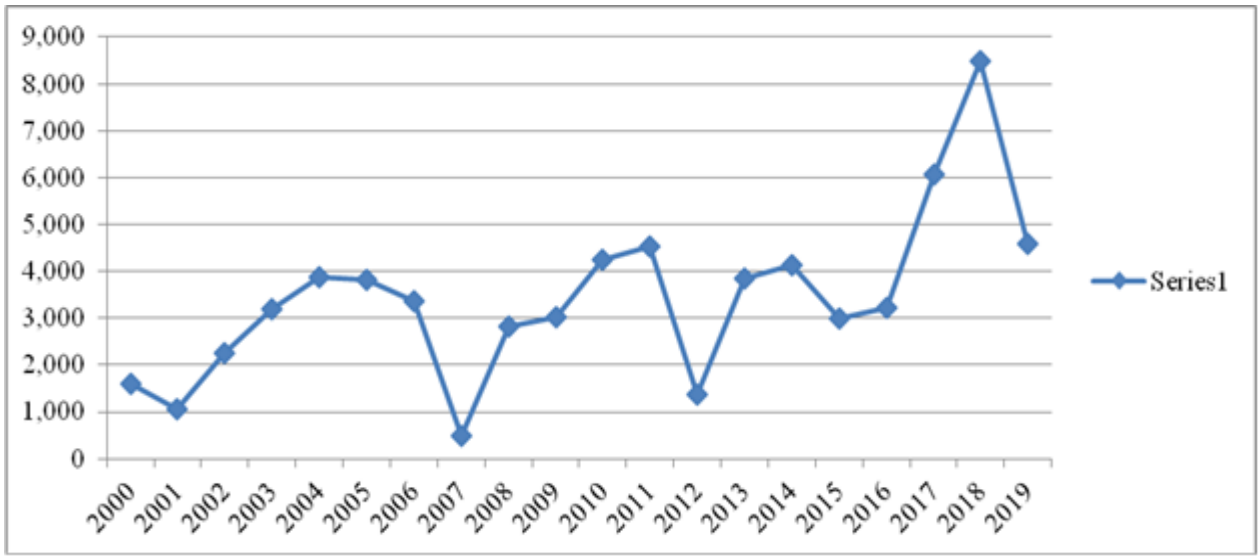


Fig. 10. Dynamics of maize yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

Table 7. The evolution of cereals yields and of the yield losses due to the droughts in Dobrogea region in the decades 2000-2009 and 2010-2019 (kg/ha)

Year	Yield (kg/ha)				Yield deviations from the average yield in the decade 2000-2009 (kg/ha)			
	Wheat	Barley and two-row barley	Oats	Maize	Wheat	Barley and two-row barley	Oats	Maize
2000	**1,914**	**1,784**	**840**	**1,596**	-251.7	-168.4	-370.5	-953
2001	**1,830**	2,064	**1,159**	**1,069**	-335.7	+ 111.6	-51.5	-1,480
2002	**1,977**	1,968	**1,088**	**2,239**	-188.7	+15.6	-122.5	-310
2003	**296**	**984**	**717**	3,204	-1,809.7	-968.4	-493.5	+65
2004	3,145	2,853	2,052	3,881	+979.3	+900.6	+641.5	+1,332
2005	3,024	**1,771**	1,509	3,829	+858.3	-181.4	+298.5	+1,280
2006	3,069	2,216	1,575	3,361	+903.3	+263.6	+364.5	+812
2007	**1,154**	**932**	**474**	**480**	-1,011.7	- 1, 020.4	-736.5	-2,069
2008	3,477	3,030	1,681	2,819	+1,311.3	+1,077.6	+470.5	+270
2009	**1,771**	**1,922**	**1,010**	3,012	-394.7	-30.4	-200.5	+463
Average decade yield	**2,165.7**	**1,952.4**	**1,210.5**	**2,549**	-	-	-	-
	Yield (kg/ha)				Yield deviations from the average yield in the decade 2010-2019 (kg/ha)			
2010	**2,518**	**2,343**	**1,397**	**4,237**	-1,195.4	-937	-553	-246.8
2011	3,860	3,224	2,042	4,541	+146.6	-57	+92	+57.2
2012	**2,133**	**1,651**	**1,354**	**1,374**	-1,580.4	-1,630	-59.6	-3,109.8
2013	**2,946**	**2,659**	**1,699**	**3,852**	-767.4	-622	-251	-631.8
2014	**3,468**	**3,145**	**1,768**	**4,132**	-245.4	-136	-182	-351.8
2015	3,752	3,502	**1,898**	**2,980**	+38.6	+221	-52	-1,503.8
2016	4,036	3,810	2,144	**3,211**	+322.6	+529	+194	-1,272.8
2017	5,060	4,206	2,394	6,065	+1,346.6	+925	+444	+1,561.2
2018	5,132	4,366	2,438	8,472	+1,418.6	+1,085	+488	+3,988.2
2019	4,229	3,904	2,366	4,600	+515.6	+623	+416	+116.2
Average decade yield	**3,713.4**	**3,281**	**1,950**	**4,483.8**				

Source: Own calculation based on the data from [13].

Sunflower seeds yield was 1,068.5 kg/ha in the decade 2000-2009, ranging between 470 kg/ha, the minimum level registered in 2001, and 1,428 kg/ha, the maximum level obtained in 2004. Comparing the yield level in this interval with the mean of the decade, the highest de creases of yield were registered in the years 2001, 2007, 2000, 2009, 2002, 2003. In the second decade, 2010-2019, the sunflower seeds yield accounted for 1,815.6 kg/ha, with variations between 1,315 kg/ha registered in 2010, the minimum level, and 3,583 kg/ha, the maximum level, achieved in the year 2018. Sunflower seeds yield was smaller than the average of this decade in the following years: 2012, 2010, 2013, 2015, 2016, 2014 (Fig.11).

In case of rape crop, the average yield of seeds obtained in the decade 2000-2009 was 1,291.8 kg/ha, ranging between 467 kg/ha in the year 2003, the minimum level, and 2,030 kg/ha, the maximum level recorded in the year 2004. The highest declines of yield compared to the average of this decade were noticed in the years 2003, 2002, 2001, 2000, 2009.

In the decade 2010-2019, rape produced 1,911.2 kg/ha in average, with variations between 1,182 kg/ha, the smallest yield in the year 2011 and the highest level 2,541 kg/ha achieved in 2016. The unfavorable years for rape crop in this second decade, when yield performance was below the average of this interval, were 2011, 2012, 2010, 2013, 2019 (Fig. 12 and Table 8).

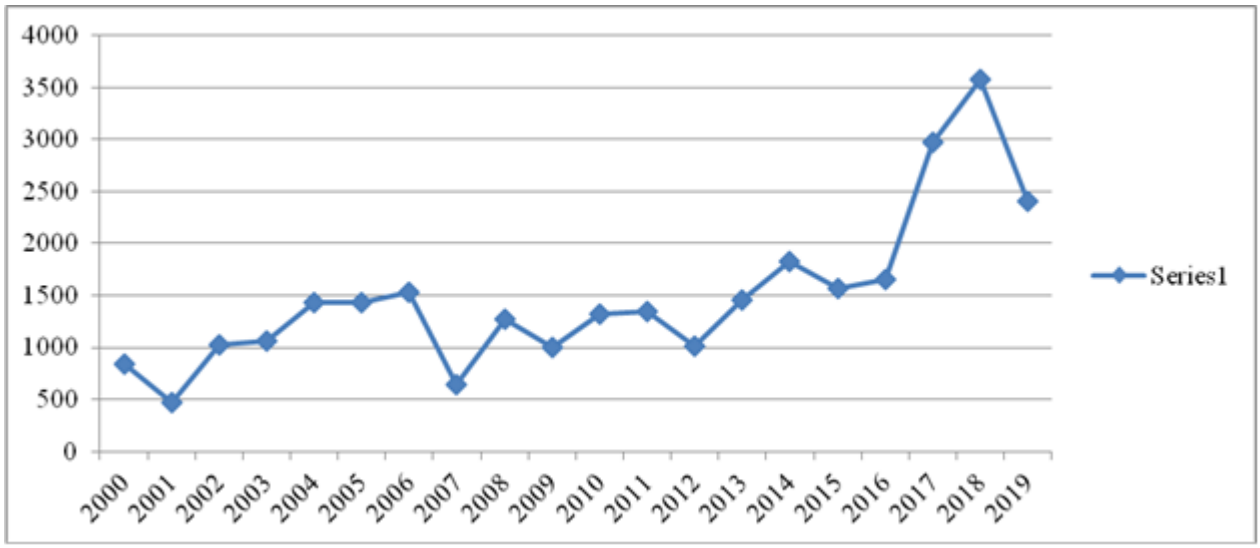


Fig. 11. Dynamics of sunflower yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

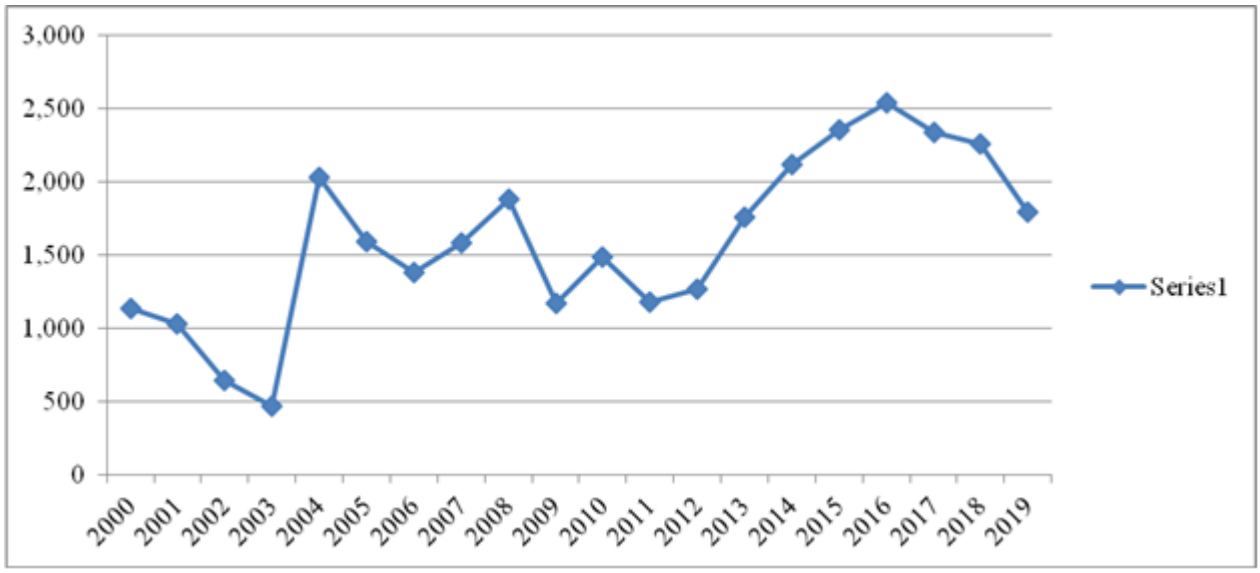


Fig. 12. Dynamics of rape yield in Dobrogea region of Romania, 2000-2019 (kg/ha)
Source: Own design based on the data from [13].

The negative deviation of yield for the main agricultural crops in Dobrogea region compared to the average yield in Romania in the two analyzed decades

Making the difference between the average achievements of yield for the studied agricultural crops in Dobrogea region and the average yield recorded in Romania in the decade 2000-2009, we may easily notice that almost all the crops registered losses of production as follows: - 518.2 kg/ha in case of maize, -389.9 kg/ha in case of barley, -363.5 kg/ha in case of oats, - 107.8 kg/ha in case of wheat and -157.8 kg/ha in case of sunflower. Rape is the only crop whose average in the decade 2000-2009 was by +16.9 kg/ha higher in Dobrogea region than the average production of rape seeds yield in Romania.

In the second decade, 2010-2019, Dobrogea region achieved lower yield levels compared to the average yield at the national level in case of almost agricultural crops, except oats.

The average losses of yield carried out in Dobrogea region accounted for: -316 kg/ha for maize, -168.2 kg/ha for barley, -108.1 kg/ha for wheat, -397.5 kg/ha for rape, -217 kg/ha for sunflower. Oats recorded an average surplus of +23.7 kg/ha in this decade compared to the mean yield at the country level.

All these losses of production are a proof that Dobrogea region was deeply affected by drought in the two analyzed decades, 2000-2009 and 2010-2019 (Table 9).

Table 8. The evolution of oil seeds yields and of the yield losses due to the droughts in Dobrogea region in the decades 2000-2009 and 2010-2019 (kg/ha)

	Yield (kg/ha)		Yield deviations from the average yield in the decade 2000-2009 (kg/ha)	
	Sunflower	Rape	Sunflower	Rape
2000	**834**	**1,136**	-234.5	-155.8
2001	**470**	**1,031**	-598.5	-260.8
2002	**1,030**	**640**	-38.5	-651.8
2003	**1,057**	**467**	-11.5	-824.8
2004	1,428	2,030	+359.5	+738.2
2005	1,430	1,590	+361.5	+298.2
2006	1,529	1,381	+460.5	+89.7
2007	**642**	1,582	-426.5	+290.2
2008	1,267	1,886	+198.5	+584.2
2009	**997**	**1,175**	-71.5	-116.8
Average decade yield	**1,068.5**	**1,291.8**	-	-
	Yield (kg/ha)		Yield deviations from the average yield in the decade 2010-2019 (kg/ha)	
2010	**1.315**	**1,485**	-600.6	-426.2
2011	**1.349**	**1,182**	-566.6	-729.2
2012	**1,010**	**1,268**	-905.6	-643.2
2013	**1,458**	**1,758**	-457.6	-153.2
2014	**1,832**	2,123	-83.6	+211.8
2015	**1,569**	2,362	-346.6	+450.8
2016	**1,656**	2,541	-259.6	+629.8
2017	2,976	2,336	+1,060.4	+424.8
2018	3,583	2,260	+1,667.4	+348.8
2019	2,408	**1,797**	+492.4	-114.2
Average decade yield	**1,915.6**	**1,911.2**		

Source: Own calculation based on the data from [13].

Table 9. Differences between the average yield produced in Dobrogea region versus the national average for the main agricultural crops in the period 2000-2019 (kg/ha)

		Wheat	Barley and two-row barley	Oats	Maize	Sunflower	Rape
		Decade 2000-2009					
1	National average yield	2,273.5	2,342.3	1,574	3,067.2	1,226.3	1,274.9
2	Dobrogea average yield	2,165.7	1,952.4	1,210.5	2,549	1,068.5	1,291.8
3	3 = 2-1	**-107.8**	**-389.9**	**-363.5**	**-518.2**	**-157.8**	+16.9
		Decade 2010-2019					
1	National average yield	3,821.5	3,449.2	1,926.3	4,799.8	2,184,6	2,308.7
2	Dobrogea average yield	3,713.4	3,281	1,950	4,483.8	1,915.6	1,911.2
3	3 = 2-1	**-108.1**	**-168.2**	+23.7	**-316**	**-219**	**-397.5**

Source: Own calculations.

However, in Dobrogea production performance in agriculture during the last decades recorded an ascending trend due to the efforts made by farmers and with the support from the EU and Romanian Government to improve production technologies. In this respect, many farmers from Dobrogea found new alternatives to the classical technologies being more and more oriented to varieties and hybrids not only of high production potential, but also resistant to drought, diseases and pests, to changes

regarding the sowing time and depth, fertilization level, and plant protection measures [7, 8, 9].

CONCLUSIONS

The research results have emphasized the dynamics of yields for the main agricultural crops: wheat, maize, barley and two-row barley, oats, sunflower and rape in the period 2000-2019 in Romania and also in the years when yield level declined due to drought.

Also, the yields for the same crops were analyzed in their evolution during the last two decades pointing out the decline of production in the warmest years when drought had a deep impact in Dobrogea region, which is the most affected part of the country by this climate factor.

Yields were analyzed in Dobrogea region in the studied period 2000-2019, and also in each year compared to the average yield registered in the decade 2000-2009 and 2010-2019.

The substantial yield negative deviations registered by all the cultivated crops: wheat, maize, barley, oats, sunflower and rape compared to the decade averages were due to the severe and strong intensity of drought with which Dobrogea region was facing during the last 20 years and not only.

Also, compared to the average performance of yield at the country level, Dobrogea region carried out smaller yield levels, which is a confirmation that this part of the country si not able to reach its production potential due to drought.

The occurrence of drought characterized by high air temperatures, deficit of precipitations, lack or unsufficient water resource into the soil, high evapo-transpiration had a deep negative impact on agricultural production in Romania, but especially in Dobrogea region. This has affected farmers' harvests, incomes and profit, and put them in a difficult situation not to be able to pay their debts to the banks or leasing companies.

This must be a "red flag" for the authorities who have the responsibility to restore, improve and invest in irrigation systems in Dobrogea region, and also for farmers who have to continue their efforts to adapt the technologies to the change of the climate factors and mainly to drought.

Only using varieties and hybrids of high performance, well adapted and resistant to drought and to the attack of various pathogen agents, identifying the right moment for sowing, choosing the corresponding sowing depth, the corresponding fertilization level and treatments for assuring plant protection, applying agricultural works at the right moment and of high quality, farmers could obtain production which could cover the costs and assure profitableness of their business.

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ROMANIA'S TOURISM TRENDS AND CHARACTERISTICS ON THE SEASIDE RESORTS OF THE BLACK SEA IN THE PERIOD 2010-2019

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Abstract

The purpose of the paper was the analysis of the tourism dynamics in Romania's seaside resorts in the period 2010-2019 in order to identify the main trends and characteristics of tourism in this destination. Based on fixed indices and regression models, the results proved that the seaside resorts are high attraction destinations for spending holidays especially in the summer season and also in extra-season. In 2019, tourist arrivals reached 1,153.7 thousands and the overnight stays accounted for 4,658 thousands, being higher than in 2010 by +64.2%, and, respectively, by +58.75%. The use rate of accommodation units in the seaside resorts increased from 33.8% in 2010 to 51.01% in 2019 being much higher than at the national level. More than 97% tourists on the seashore are Romanians. A number of 816.6 thousands tourists, meaning 10 times more than in 2010, took part to one-day trips organized in the proximity of the seaside by the local travel agencies. Even in the pandemic of covid-19, the Romanian seaside resorts were among the most preferred destinations. The main characteristics of Romania's seaside tourism are: the higher attraction for Romanian tourists than for foreigners, the seasonality and also extra-seasonality of offer and demand, the disruption between the decline of the accommodation capacity (units and places) and the increased number of tourists, the large variety of tourism forms for spending time in an active (heliomarine cure, balneary procedures, nautical sports, fishing, entertainment, gastronomic, wine tasting, cultural-historical etc). The seaside resorts have to continue their efforts to offer a modern and comfortable infrastructure, a large range of opportunities for spending vacations and safe stays in order to increase the number of tourists and incomes.

Key words**:** *tourism, seaside resorts, trends, characteristics, The Black Seashore, Romania*

INTRODUCTION

Tourism is one of the most dynamic branch of the world economy with a deep impact on the economic, social and cultural development of many countries [22, 23].
In 2019, world tourism reached 1.5 billion tourists by 4% more than in 2018, and also the tourism receipts accounted for USD 1.478 trillion in 2019 being by +1.44% higher than in 2018. This means that the average expenditure per international tourist was USD 985.33. And this reflects the close relationship between these two indicators which justify the power of tourism in the global economy [24].
The growth rate in international tourism exceeded the growth rate of the global GDP in the period 2017-2019, which confirms again the high growth rate in tourism industry [42].
Europe is the top destination with 743 million international tourist arrivals in the year 2019 by 4% more than in 2018 and representing 51% of the global market.
In 2019, Europe's receipts from tourism accounted USD 572.9 Billion, representing

38.76% of the global receipts in tourism. In consequence the average expenditure per tourist in Europe was USD 771.06 [42].

The coastal lines are a very attractive destination due to the scenic beauty of the oceans and seas, beaches, large range services of accommodation, entertainment and gastronomy put at the disposal by the stakeholders who develop business in tourism close to the seaside [15].

Also, the development of seaside tourism has a deep impact on "the changes of socio-economic and settlement patterns, on local population' culture, and environment [12].

Coastal tourism is the major sector of tourism in Europe with a contribution of 47% to the number of overnight stays in accommodation units, 60% in employment, and 15% of the land area of the EU belongs to the coastal municipalities [8].

The South Mediterranean area is the most preferred destination coming on the 1st position for 40.8% of the international arrivals from the European countries and for 18.46% of the world arrivals. Numerous tourists are seek of sun, beaches, nautical sports, relaxation and leisure, entertainment on the seaside of Spain, France, Italy, Monaco, Slovenia, Croatia, Greece, Portugal, Turkey.

The South Mediterranean region received USD 234.4 Billion receipts from tourism [21, 43, 38].

Also, the Black Sea region attracts nearly 6% of world tourists every year. Despite that the figure is smaller than tourism flows in other regions of the globe, it has a great potential for developing a sustainable tourism in the coastline countries Turkey, Bulgaria, Romania, Ukraine and Georgia [6]. The share of the Black region in the Europe's tourism accounted for 14% as the tourist arrivals registered a high growth rate during the last two decades. About 115 million international tourists visited the Black Sea the countries which benefited of USD 57 billion receipts [44, 3].

That is "Development of Tourism and Protection of Cultural Heritage" project of cooperation between 13 BSEC member states is destined "to promote sustainable tourism, economic developments, investments, mutual understanding and cultural exchange within the cooperation in the region for the period 2018-2020" [3].

Among the countries with exit to the Black Sea are Romania and Bulgaria situated close to each other and being in a continuous competitiveness in attracting more tourist by offering high quality and diverse tourist services in general, but especially on their seaside. For these countries tourism has a deep economic impact. The larger number of tourists and receipts achieved by Bulgaria compared to Romania is a competitive advantage which has to strengthen the efforts of the both countries to develop sustainable strategies in tourism [2, 5, 10, 27, 28, 32, 39].

During the last decade, Romania's tourism is continuously developing, in 2019 it reached over 13 million visitors and contributed by Euro 5 billion to GDP, much more than in the previous years [25, 30].

In this context, the paper objective was to analyze the dynamics of tourism in the seaside resorts of Romania in the last decade, 2010-2019, for pointing out the main trends and characteristics of this tourist destination.

MATERIALS AND METHODS

The study is based on a large range of information sources regarding the Romanian seaside and the empirical data were collected from the National Institute of Statistics, Tempo Online data base for the period 2010-2019 regarding the main tourism data in the seaside resorts, except Constanta municipality.

The main aspects taken into account to characterize tourism have been the following ones:

(i)Geographical features regarding: position, relief, climate, and natural resources;

(ii)Cultural and historical resources and other attractions for tourists;

(iii)Tourism offer in terms of the number of units for tourists' accommodation and the number of places (beds), the use degree of the accommodation capacity in tourism on the Romanian side;

(iv)Tourism demand in terms of tourists' arrivals and overnight stays;
(v)The relationship existing between tourists' arrivals and overnight stays, between overnight stays and accommodation capacity.
The methods used in this research have been the following one:
(i)Monographic method;
(ii)Statistical analysis based on the time series for the interval 2010-2019 of the main indicators characterizing tourism:
Statistical average:
$\bar{y}=\frac{\sum_{t=1}^{n} yt}{n}$
Fixed basis indexed method for calculating the growth/decline rate: $I_{FB} = (y_n/ y_1) *100$
The use coefficient of the accommodation capacity (CUAC):
CUAC= [Number of overnight stays/(Number of beds $*$ Number of days in operation)]* 100
Regression analysis based on the linear equation: Y= bx + a, where Y is de dependent variable and X is the independent variable for studying the determination relationship between the following pairs of variables:
(a)The regression of overnight stays depending on tourists' arrivals;
(b)The regression of overnight stays depending on the accommodation capacity in operation in terms of beds-days,
(c)The regression of the number of beds depending on tourists' arrivals.
The results were described and displayed in the designed graphics and tables, being accompanied by comments. Finally, the main aspects resulting from this research work have been presented in brief.

RESULTS AND DISCUSSIONS

A brief monographic approach of Romania's seaside at the Black Sea

Romania's Black Sea coastline is an area of high tourist attraction especially in summer season, starting from the month of June and continuing in July and August, but sometimes the extra-seasons in May and September are also suitable and pleasant.
From a geographical point of view, the Romanian seaside is stretching for a length of 245 km (152 miles) between the North border with Ukraine and the frontier with Bulgaria in the South.
For getting there it is very easy, because the distance from Bucharest, the capital of Romania and Constanta, the main city on the Romanian seaside is only 227 km, and various means of connection are available such us: cars, buses, trains allow the tourists to arrive in maximum two hours at the desired destination and also flights to Mihail Kogalniceanu airport situated close to Constanta.
The North area of the seaside is dominate by the Danube Delta and the coastline lakes along a distance of 163 km (101.3 miles) up to Navodari city, and the South zone begins from Navodari and stretches to Vama Veche for a distance of 82 km (50.9 miles).
The beaches are excellent being oriented to East offering an unique image of sunrise from the Black Sea and the pleasant warm of the sunshine almost 14 hours a day in the summer season. The sand is fine of a light golden colour, the width of the beaches being generous varying between 200-300 m in the North area and 100-200 m in the South, where they are surrounded by small bays and high cliffs.
Climate is a temperate continental with marine influence, with summers lacked of heat due to the breeze, warm and pleasant autumns that extend the summer season. The winters are mild, but the wind blows hard from the sea. Sometimes, they could be harsh, the sea freezing up to 200 meters from the shore illustrating a fairytale landscape.
The seaside area has the mildest climate in Romania with an average annual temperature of 11.2-11.3^{0}C, and in summer season temperatures range between 25 and 35°C (77-95°F), and are pleasant and easily supported due to the breeze which starts about 11 o'clock and lasts during the day.
The precipitations are in average below 377 mm/year, but the sun shines about 2,500 hours per year and very rarely it could happen as the clouds to bring short and light summer rains.
The air is fresh, clean, pleasant, loaded with marine aerosols with healing effects.

The sea water has a reduced salinity and a higher temperature than other seas, sometimes it could reach even 28°C, the entrance to the sea is smooth, on a controllable depth especially in the North of the coast, while to the South the water is a little deeper right from the shore.

The chain of seaside charming *resorts* includes from North to South: Navodari, Mamaia, Eforie Nord, Eforie Sud, Techirghiol, Costinesti, Olimp, Neptun, Jupiter, Cap Aurora, Venus, Saturn, Mangalia, 2 Mai and Vama Veche (Map 1).

Map 1. Romania's resorts at the Black Sea
Source: Romania Travel [35].

A large range of tourism forms could be practice in the area of the Romanian seaside among which there are the following ones;

- *Tourism or summer heliomarine cure* which means: beach, swimming in the sea water, inhaling aerosols, walks on the sand and through the sea water etc.

-*Spa (balneary) tourism* due to the presence of the sapropelic mud with a salt content over 50 g/liter in the Techirghiol Lake water and of the peat mud in the area of the beaches from Saturn, Venus and Mangalia.

Also, sulfurous mineral waters with a temperature of 21-28^{0}C in the area of Mangalia is another valuable therapeutic factor.

The spa sanatoriums in Eforie Nord and Techirghiol and Mangalia and the spa polyclinic in Neptun offer therapeutic services of exceptional quality through the internship of a high-class specialists in balneology and a modern infrastructure for performing various recovery and treatment procedures.

-*Nautical sports tourism* has a wide range of possibilities for invigorating the body and raising adrenaline: sea rides with inflatable boats and water bikes, skijet, parasailing, surfing, windsurfing, stand up paddle surfing, kitesurfing, flyboarding, nautical skiing, scuba-diving, snorkeling, yachting.

-*Fishing tourism* for amateurs and professionals could be practiced in the Black Sea or in the fresh waters of the lakes existing near the coast.

-*Entertainment tourism* is well defined on the Romanian coast from the amusement parks in Mamaia and Saturn Holiday Villages, Aqua Park Mamaia to which could be added the nightlife in clubs, discos, outdoor concerts like those in Constanta, Mamaia, Costinesti, Mangalia, the dance rings etc;

-*Gastronomic tourism* displays a range of appetizing and delicious culinary products from the international cuisine but also the traditional Romanian cuisine that can be served at the multitude of terraces, restaurants and fast food units, some luxurious others with rustic and seafood specifics.

-*Wine tasting tourism* can be an unforgettable experience at Murfatlar and Ostrov wineries that present a wide range of white, rosé, red, sparkling wines, etc. medaled at various international competitions that have brought fame to the aromas and bouquet of Romanian wines across the border.

-*Cultural-historical tourism* offers a wide range of objectives of great interest for tourists.

First of all, it is about ***Constanta City***, the gateway city to the Black Sea coat, an old city which was founded around 600 B.C, with a rich history, good economic status, amazing architecture and a multicultural life, because in this city but also in the Dobrogea region there are besides the Romanian population

there are many minorities represented Aromanians, Turks, Tatars, Lipovans, Greeks, Ukrainians and Bulgarians.

The old part of the city of Constanta includes, first of all, *Ovidiu Square* in the canopy of which is *the Statue of the great ancient Roman poet Publius Ovidius Naso*, who wrote the well knows Poems "Tristia" and "Epistulae Ex Ponto", during his exile at Pontus Euxinus. The statue was built in 1887 by Etorre Ferrari, who sculpted Abraham Lincoln's statue in New York. An identical copy of Ovid's statue was built in 1925 in Sulmona, his native place in Italy.

The Museum of National History and Archeology Constanta, founded in 1879 by Remus Opreanu, has an impressive patrimony consisting of 430,000 objects from the paleolitic era till nowadays, reflecting the history of the country and also of Dobrogea region (Greek, Roman, Bysantine and medieval tools, ceramics, architectural items, sculptures, statues, jewels, numismatics, icons, furniture, documents, maps, photos, magazines etc [41].

The Roman Mosaic, belonging to the same museum, is unique in Europe by its dimensions. It was built in the 4th century and extended in the 6th century, during the Roman Empire, and was the place of market and goods storage linking the port and the city. The mosaic pavement has a unique beauty and nowadays only about 860 s.m. are well preserved of its total surface of 2,000 s.m. [17].

Museum of Folk Art in Constanta has a rich collection of about 15,000 exhibits which reflect the folk culture in Romania and Dobrogea region: icons, wood objects, folk suits, barks, fabrics, ornaments, household objects etc [16].

The Casino of Constanta is the symbol of the city. It dates since 1910 being built by the architect Daniel Renard who designed it in the similar style with the well known casinos in Europe. It was a luxury place, with elegant rooms, nicely decorated walls, sophisticated chandeliers, expensive carpets and furniture. It was a place where the mirage of gambling attracted rich people from all over the world. Its terrace was the preferred place for sailors and the elite of the time [4].

Genoese Lighthouse in Constanta is a historical monument situated close to the Casino, behind the Statue of the greatest Romanian poet Mihai Eminescu, sculpted by Oscar Han. The lighthouse was built in 1890 by Artin Aslan, a French engineer of Armenian origin. The origins of the lighthouse dates from 1300 to guide the ships within a 2-miles radius of the sea to the small port of Constanta. Its light can be seen from a distance of almost 10 marine miles [46].

The Orthodox Cathedral of Saints Peter and Paul in Constanta is the seat of the Romanian Orthodox Archbishop of Tomis and also a monastery. It was built in a Greek-Roman style based on the plans of the architects Alexamdru Orascu, Carol Benesch and Ion Mincu and was inaugurated in 1895.

The Roman - Catholic Church Saint Anthony of Padova in Constanta was built in1938 in a neo-Romanic style following the plans of the architect Romano de Simon.

The Greek Orthodox Church Metamorphosis in Constanta was built by the desire of the Greek community between 1865-1868, and by the order of the Sultan Abdul Aziz Bin Mehmet Han based on the plans of the Greek architect Iani Teoharidi [40].

St. Mary Armenian Apostolic Church in Constanta is a historical monument founded in 1880 and is another example of the multiculturalism in Dobrogea region.

The Hunchiar Mosque is the oldest Muslim religious edifice in Constanta, being built in a Moorish architectural style and another example of the multiculturalism in Dobrogea region.

Grand Mosque or Carol Mosque in Constanta is one of most impressive architectural monuments in the city, being built in a Neo-Egyptian and Neo-Byzantine styles with elements of Neo-Romanesque architecture. It was designed by George Constantinescu who was inspired by the Konya Mosque in Anatolia [45].

The Aquarium of Constanta is situated on the shore of the Black Sea and close to the Casino. The Marine Section is the largest and

most representative section of the Aquarium and houses fish and invertebrate species found in the Black Sea, Danube Delta and migrants from the Mediterranean Sea

Constanța Museum of Natural Sciences Complex (Constanta Dolphinarium) includes the Dolphinarium, the Planetarium, Astronomic Observatory and the Mini Zoo Reservation inaugurated in 1972, offers spectacular and invigorating shows to visitors and the protaginists are dolphins, sea lions and penguins [7].

Also, *the double-decker bus rides* on the route Constanta Train Station and Mamaia Nord offer a panorama of the city in its splendor, and *the gondola* in Mamaia resort flies over the resort from the entrance up to Tomis.

Day trips organized by local travel agencies are increasingly requested by tourists. Among the most popular tourist destinations are: Tropeaum Traiani Monument to Adamclisi, Dervent Monastery, St. Andrew Monastery, Casian Monastery, Casian Cave, Histria Fortress, the Danube Delta, Enisala Fortress, the cruises on Siutghiol Lake and the Black Sea, Dobrogea Gorges and Queen Maria of Romania Castle in Balchik, from the former quadrilateral region that belonged to Romania [1, 8,11, 14, 34, 37, 47].

Tourism Offer in the resorts from the Romania's coastline at the Black Sea

The accommodation offer consists of two groups of possibilities:

(a)the classical accommodation in standardized units like: hotels, hostels, motels, bungalows, holiday houses, campgrounds, tourist and agro-tourist guesthouses, and

(b)accommodation in the private sector to locals especially in the rural areas of Costinesti, 2 Mai, Vama Veche, and also in the cities.

In this study, there are used only the official data from the National Institute of Statistics, 2020, therefore, they refer only to accommodation in standardized tourist units.

The number of accommodation units with tourism function on Romania's seaside accounted for 848 in the year 2019, being by 16.38% less numerous that in the year 2010, when there were 1,014 units. Therefore, accommodation capacity in terms of units has recorded in general a descending trend in the last decade,

in comparison with the continuous growth of the number of accommodation units at the level of Romania which in 2019 accounted for 8,402 units, being by 60.89% more numerous than in the year 2010 when the country had 5,222 units with function for tourists' accommodation.

However, the highest decline was registered in the year 2011, but after that the number of accommodation units started recovering increasing year by year (Fig. 1).

As a result, the share of the tourist accommodation units in the resorts of Romania's seashore in the total number of units at the national level declined from 19.41% in the year 2010 to 10.09% in the year 2019.

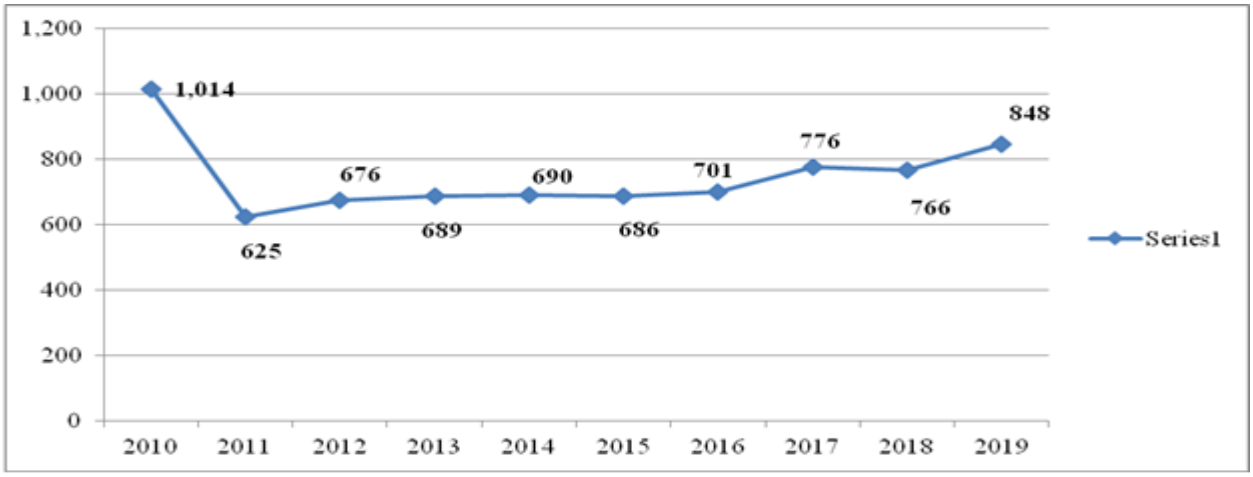

Fig. 1. The dynamics of the number of the accommodation units in Romania's resorts at the Black Sea, 2010-2019
Source: Own design based on the data from [18].

The structure of the accommodation units with tourism function in the year 2019 was the following one: hotels 291 (34.3%), hostels 53 (6.2), motels 1 (0.4%), tourist villas (18.4%), bungalows 284 (33.5%), campgrounds 12 (0.4%, tourist stops 2 (0.4%), small houses 10 (1.3%), school camps 3 (o.4%), tourist guesthouses 15 (1.0%) and agro-tourist guesthouses 15 (1.9%).

The number of places (beds) in the accommodation units with function for tourists' reception on Romania' seashore also declined by 29.69% from 121,003 places in the year 2010 to 85,081 places in 2019 (Fig. 2).

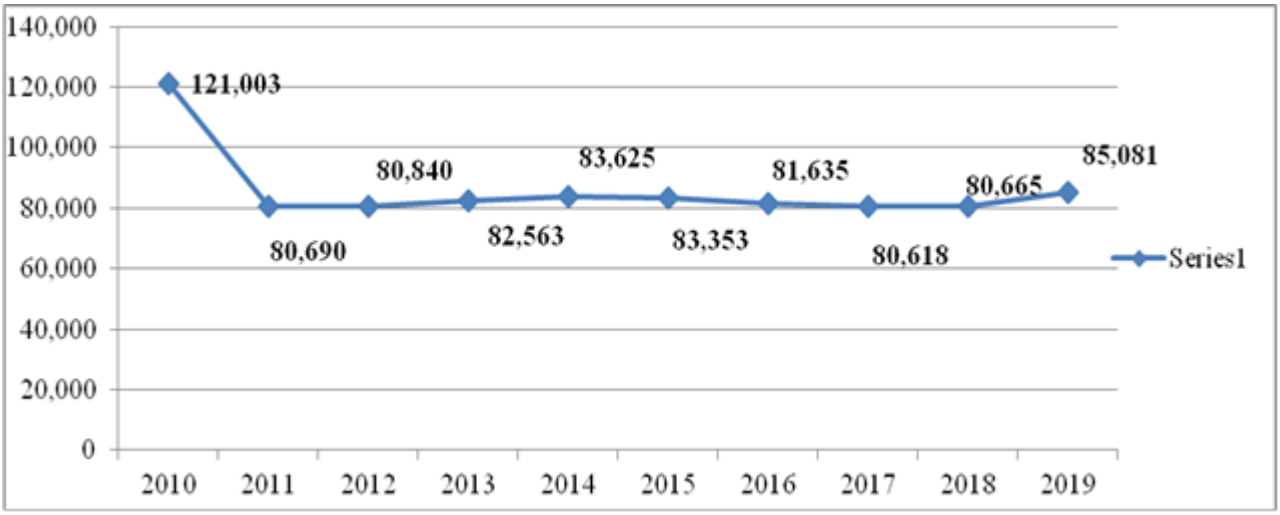

Fig. 2. The dynamics of the number of places in the accommodation units in Romania's resorts at the Black Sea, 2010-2019
Source: Own design based on the data from [18].

This descending trend does not fit to the general increasing tendency of the number of places in Romania's tourism, whose growth was by +14.39% from 311,698 places in 2010 to 356,562 places in the year 2019. However, after the deep decrease registered in the year 2011, in the following year the number of places varied up and down, but with a slight increasing tendency to the year 2019.

In consequence, the share of the number of places in the accommodation units existing on the Romanian coastline at the Black Sea in the total number of places existing in Romania's tourism declined from 38.82% in 2010 to 23.86% in 2019.

Tourism demand in the resorts from the Romania's coastline at the Black Sea

The number of tourists' arrivals in the resorts from the Romanian seaside has continuously increased taking into account both the number of Romanian and foreign tourists, so that in the year 2019, it accounted for 1,153.7 thousands compared to 702.6 thousands in 2010, therefore being by +64.20% higher in the last year of the analyzed decade.

Romanian tourists are dominant and their number increased by 66.8% from 671.1 thousands in 2010 to 1,119.4 thousands in 2019.

The number of foreign tourists arrivals registered a slight increasing tendency from 31.5 thousands in 2010 to 34.3 thousands in 2019, therefore the growth rate on the whole interval was 8.8% (Fig. 3).

In consequence, Romanian tourists have the share of 95.5% in 2010 and 97.02% in 2019, while foreign tourists accounted for 4.5% in 2010 and 2.9% in 2019.

If we compare with the number of Romanian and foreign tourists arrived on the seashore in the total number of tourists who visited Romania, we may find that in 2019 their shares were 8.62% taking into account both Romanians and foreigners, 10.47% for Romanian and, respectively, 1.27% for foreign tourists. Analyzing the evolution of tourists' weights in the interval 2010-2019, we

may easily notice that the shares declined from 11.56% in 2010 to 8.62% in 2019 for Romanians and foreigners, from 14.20% in 2010 to 10.47% in 2019 in case of Romanians and from 2.33% in 2010 to 1.27% in 2019 for foreign tourists.

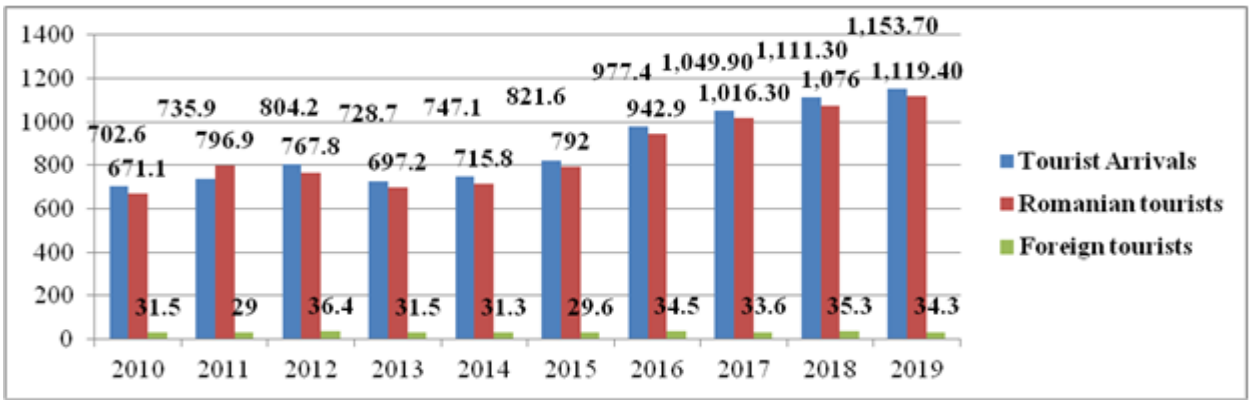

Fig. 3. The dynamics of tourist arrival in the accommodation units in Romania's resorts at the Black Sea, 2010-2019
Source: Own design based on the data from [18].

This reflects that the growth rate of tourists visiting other destinations in Romania has been higher than the increase rate to the resorts of Romania' seashore [31, 29].

However, taking into account the high growth rate of tourist arrivals and the low growth rate of the accommodation units and places, it is obviously that there is an unbalances ratio between demand and tourism offer on the Romanian seaside [33].

And this is an exception from the general increasing trend of offer in terms of accommodation units and places at the country level and also at the macro and micro development regions adapted to high tourist flows [31, 26].

The number of overnight stays has recorded a continuous increase in the seaside resorts of Romania so that in the analyzed interval it accounted for 58.75% from 2,934 thousands in the year 2010 to 4,658 thousands in 2019.

The overnight stays belonging to the Romanian tourist increased much more, by 61.94% from 2,800 thousands in 2010 to 4,534.6 thousands in 2019, while the number of foreign tourists' overnight stays declined by 7.85% from 133.9 thousands in 2010 to 123.4 thousands in 2019 (Fig. 4).

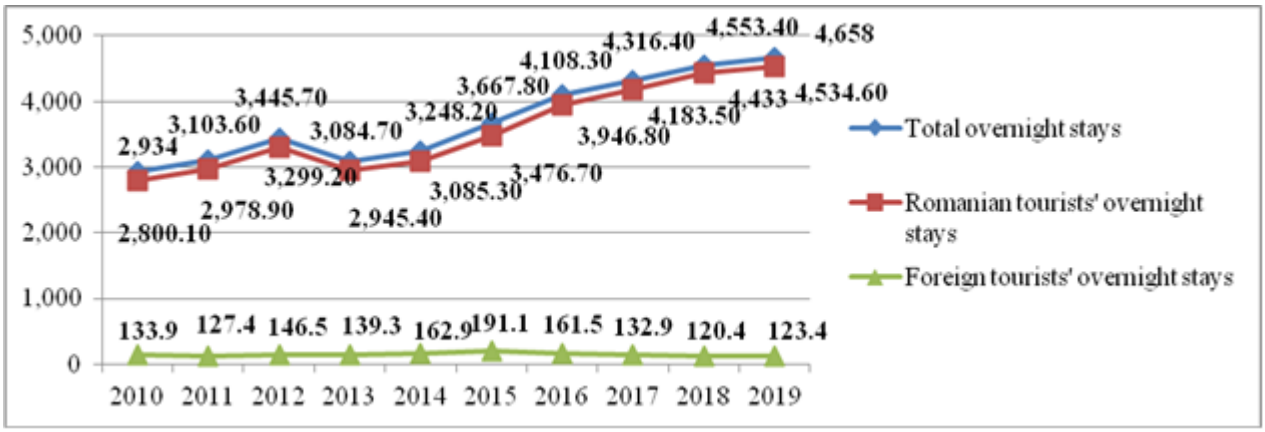

Fig. 4. The dynamics of tourists overnight stays in the accommodation units in Romania's resorts at the Black Sea, 2010-2019
Source: Own design based on the data from [18].

These figures show that Romanian tourists prefer much more to spend their vacations in various seashore resorts, while foreign tourists prefer to visit other destinations, which is a normal situation.

The share of the Romanian tourists in the total number of overnight stays is dominant and increased from 95.43% in 2010 to 97.35% in 2019.

As a result, the share of overnight stays in the seashore resorts in total overnight stays at the national level declined from 18.27% in 2010 to 15.48% in 2019.

If we take into account the overnight stays belonging to Romanian tourists, also their share declined from 21.07% in 2010 to 18.28% in 2019, and in case of the foreign tourists, their weight decreased from 4.83% in 2010 to 2.33% in 2019.

The use rate of the tourist accommodation capacity in the resorts of Romania's seaside

Taking into consideration the increased number of tourists and the decreased number of units and places in the accommodation units from the seashore resorts of Romania, the use rate of the tourist accommodation capacity registered a higher level and dynamics in the seashore resorts compared to the levels recorded in Romania's tourism. Therefore, in case of the seashore resorts, the use rate of the accommodation capacity increased from 32.68% in 2010 to 51.01% in 2019, and this fast growth exceeded the use rate in Romania's tourism, which succeeded to raise from 25.15% to 33.88% in the same interval (Table 1).

Table 1. The use rate of the accommodation capacity in the units from Romania's seashore resorts versus in Romania's tourism, 2010-2019 (%)

	The use rate of the accommodation capacity in the units from Romania's seashore resorts	The use rate of the accommodation capacity in Romania's tourism
2010	32.68	25.15
2011	30.17	26.27
2012	36.34	25.85
2013	34.89	25.13
2014	34.82	26.10
2015	38.97	28.73
2016	46.69	30.53
2017	46.80	30.90
2018	50.40	32.15
2019	51.01	33.88

Source: Own calculation based on the data from [18].

The participation of tourists to the one days travels to various attractions in the proximity of Romanian seashore

The growth of the number of tourists spending their holidays on the Romanian seashore had led to an intensive request and participation to the tours organized by the local tourism agencies to various attractions in the proximity of the coastline or in Dobrogea region.

In 2019, a number of 643,545 tourists, that is 12.9 times more than in 2010, participated to this type of excursions.

Also, 173,090 tourists in 2019, meaning 5.6 times more than in 2010 participated to the one-day trips on itineraries organized by the agencies with the selling activity.

In 2019, the shares of these tourists in the total number of tourists on the Romanian seashore reached 60.47% in case of the participants to the tours organized by the local travel agencies and 74.82% in case of the tourists who applied for travels organized by agencies with selling activity (Table 2).

Table 2. The number of tourists accommodated in seaside resorts who applied for organized travels to various tourist attractions in the proximity of the Romania's seashore in 2019 versus 2010

One-day trip organizer	2010	2019	2019/2010 %
Tour operator agency	49,865	643,545	1,290.57
Agency with sales activity	30,895	173,090	560.25

Source: Own calculation based in the data from NIS, 2020.

One of the tourism agencies which organizes seaside tours, trips to the Danube Delta, Murfatlar wine tasting and offers other sorts of tourist services is "Vacante minunate"[19, 20].

The unbalanced ratio between the tourist demand and tourist offer

The regression of overnight stays depending on tourists' arrivals is presented in Fig.5. The regression equation, Y= 0.2644x - 98.047 shows that for an increase of 1,000 tourists arrivals the accommodation demand in terms of overnight stays will go up by 2,644. Taking into account the t value and the significance

threshold P-value, this coefficient is statistically significant.

The value of the determination coefficient, R^2 = 0.984, is a positive and strong one, reflecting a high relationship between these two indicators (Fig. 5).

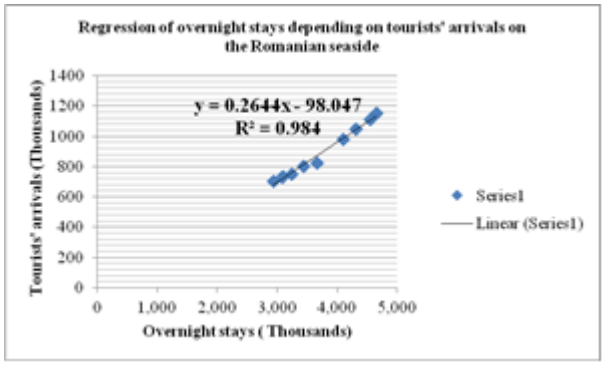

Fig. 5. Regression of overnight stays depending on tourists' arrivals on the Romanian seaside, 2010-2019
Source: Own design based on the date from [18].

The regression of overnight stays depending on the accommodation capacity in operation in terms of beds-days is presented in Fig. 6. In this case, the regression equation, Y = -0.2001x + 9,993.2 reflects that for increase of the accommodation offer by 1,000 beds-days, the overnight stays with determine a reduction of overnight stays by 2,001. The same situation is confirmed by the coefficient of determination whose value is R^2 = 0.0909, reflecting that only 9.09 % of the variation of overnight stays will be determined by the variation of the beds-days (Fig. 6).

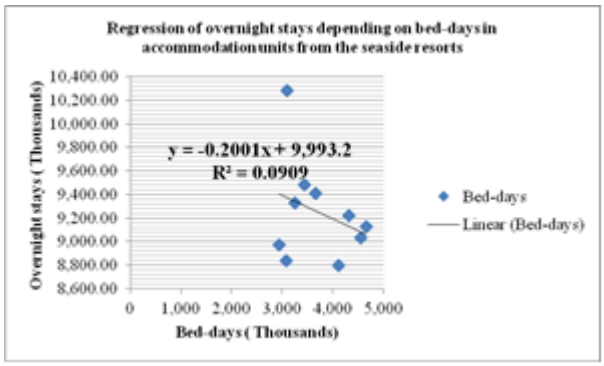

Fig. 6. Regression of overnight stays depending on the number of bed-days on the Romanian seaside, 2010-2019
Source: Own design based on the date from [18].

The regression of the number of beds depending on tourists' arrivals is presented in Fig. 7. The regression equation, Y= -25.645x + 108,658 shows that for increase of the number of tourists arrivals by 1,000, the accommodation capacity declines by 25.645 places (beds) which confirms that between accommodation capacity in terms of beds and the tourist arrivals is not a balanced ration.

The coefficient of determination, R^2 = 0.1278 reflects that just 12.78 % of the variation of the accommodation capacity in terms of beds is a result of the variation in the number of tourists' arrivals (Fig. 7).

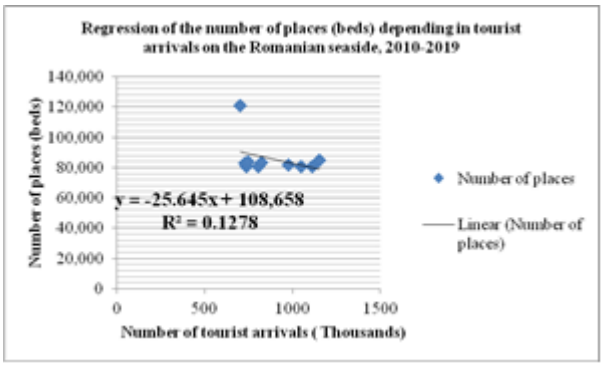

Fig. 7. Regression of number of places (beds) depending on the number of tourists' arrivals in the accommodation units on the Romanian seaside, 2010-2019
Source: Own design based on the date from [18].

Romanian seashore facing with Covid-19 pandemic

The pandemic of covid-19 caused important problems almost to all economic sectors, but especially to tourism.

The population had to respect the measures imposed by authorities not to spread the virus in Spring season and the relaxation measures applied since May 15 have allowed to think of vacations and where to spend them in safe environment.

At the beginning of May, tourism managers of "Liroralul romanesc" Travel Agency, the greatest tour operator on the Romanian seaside launched an online survey on a sample of 1,181 individuals based on a questionnaire for testing tourists' intention to spend their vacation on the seashore and which are their wishes related to the measures of security to offer them a safe stay in accommodation units, in restaurants and beaches.

The processed answers of the questioned persons proved that "most of tourists prefer to

spend their vacations in Romania (48%), and that they intend to choose the resorts from the Black Sea because they feel safer here (17%), the Romanian seaside is closer to their homes (10.3%) and could be easily reached by car (17%) and that it is safer to spend your holiday in our country than abroad (7.5%)". Also, "almost questioned persons affirmed their wish as the tourism units to assure them a safe vacation" taking the corresponding measures of hygiene as imposed by authorities [36].

The managers of tourism units on the Romanian seaside have taken important decisions to offer a safe vacation for their tourists. In this respect we mention: checking the temperature of employees and tourists at the entrance in hotels and other sort of accommodation units, assuring the disinfectant dispensers at the entrance in the accommodation units and restaurants, the obligation of the personnel working in tourism units and restaurants to wear masks, rooms to be disinfected after each tourist, the playgrounds for children to be disinfected, the beaches belonging to hotels to to ensure a greater distance between umbrellas and sunbeds, the restaurants were prepared to assure a greater distance between the tables.

In 2019, the summer season on the Romania seashore started later than usual due to the corona virus pandemic and the measures which had to be respected for not spreading it.

"About, 160,000 Romanians have applied for spending their summer in the seashore resorts, but their number was by 20% smaller than in 2019.

The most numerous tourists came from Bucharest (38.11%), and from the following counties: Timis (5.24%), Iasi (5.11%), Prahova (4.52%), Cluj (4.42%), Brasov (4.32%), Arges (2.9%), Bacau (2.18%), Galati (2.06%) and Dambovita (1.88%) as mentioned by the greatest tour operator Litoralul Romanesc".

Another feature was the fact that many tourists made reservations in the last minute, because probably they did not know how the pandemic will evolve and at the moment when the restriction measures have been relaxed they decide that the best destination for their holidays is the Romanian seashore.

Also, many tourists practiced spending the week-ends on the seashore, which made a pressure on tourism accommodation units and restaurants, and beaches have been full of people who in many cases did not respected the rules of protection.

The most desired seashore resorts in 2019 were Mamaia, Eforie Nord, Jupiter, Neptun, Saturn, Venus, Costinesti and Eforie Sud.

The average stay length was 5.3 days a little bit longer compared to 5.1 days in 2019 [13].

The average cost of a vacation this year was similar with the year 2019, that is Euro 471/person.

This reflect that the tourism in the seaside resorts of Romania has continued to be a preferred destination by Romanians even under the conditions of the pandemic, but the smaller number of tourists compared to 2019 caused substantial losses in tourism sector.

CONCLUSIONS

The research results emphasized the increased importance of Romania's tourism on the Black Sea seaside during the holiday period and week-ends pointing out that a higher and higher number of tourists applied for accommodation in the units exiting in the seashore resorts.

The tourist flow in terms of tourists arrivals and also of overnight stays raised during the last decade in this tourist destination of Romania

Tourism offer in terms of the number of accommodations units and number of places (beds) registered a deep decline in the year 2011, but it started a slight recover which growth rate is behind the increase rate of the number of tourists.

This led to high and fast dynamics of the use rate of the accommodation capacity in the seashore resorts compared to the use rate of the accommodation capacity in Romania's tourism.

To synthesize the main characteristics of Romania's tourism on the seashore we could mention the following:

- the Romanian seaside has become a destination more and more attractive for Romanian tourists and in a smaller proportion for foreign tourists;
- the seashore tourism has a high seasonality as it runs usually in summer season, meaning June, July, August and sometimes in extra season being encouraged by the discount applied by accommodation units and travel agencies in May and September;
- over 95 % of tourists who prefer to enjoy their vacations on the seashore are Romanians;
- during the analyzed decade, 2010-2019, it was noticed an unbalance between the high demand and the lower tourist offer; while the number of tourists arrivals increased, the number of accommodation units and places decreased and raise with a small growth rate;
- on Romanian seaside tourists have at their disposal a large range of tourism forms to spend their time in an active way, to recover their forces and strengthen their body and health;
-more and more tourists accommodated in the seaside resorts are keen to participate in one-day excursions for visiting different objectives in the proximity of the seashore.

In conclusion, the resorts of Romanian seaside have an important contribution to the development of tourism which is confirmed by the brief summary of the statistics regarding the key indicators in the year 2019, reflecting the share of the seaside resorts in Romania's tourism: 10.09% for the accommodation units, 23.86% for the number of places (beds), 8.62% for tourist arrivals (Romanians and foreigners), 10.47% for Romanian tourists' arrivals, 1.27% for foreign tourists' arrivals, 15.48% for overnight stays (Romanians and foreigners), 18.28% for Romanians' overnight stays, 2.33% for foreign tourists' overnight stays, 10.28% for the places-days, 51.01% for the use rate of accommodation units.

The beautiful landscapes of the Black Sea, the joy of spending vacations laying in the sun, swimming or making nautical sports, benefiting of entertainment opportunities during the night life, tasting the local culinary offer based main of fish and seafood, the flavored wines, and the comfortable infrastructure are a guarantee that the seaside resorts will continue to be a very attractive destination for many tourists in the next years. Seaside tourism is a real opportunity for the development of business and strengthen the local economy and also the national tourism, therefore it has a socio-economical and environment impact.

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INFLUENCE OF PRE-KILLING LIVING WEIGHT ON THE QUALITY OF CARCASES OF HYBRID PIGS IN THE CONDITIONS OF INDUSTRIAL PORK PRODUCTION IN UKRAINE

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Abstract

The optimal pre-slaughter live weight of pigs for fattening in the conditions of an industrial pig complex in Ukraine was determined and its influence on the quality of pig carcasses was investigated. For the study, 80 heads of young pigs were selected, of which 32 were pigs and 48 were boars. Boars were surgically castrated at the age of 2 days. During fattening, all animals had free access to food and water. Pigs were fattened in group pens for 20-25 heads on a completely slotted floor. Feeding was carried out with complete feed of own production in the wet type. When the animals reached the age of 170 days, depending on live weight, they were divided into 3 groups: Group I - 85-95 kg; Group II - 100-110 kg, Group III - 115-120 kg and slaughtered at the meat plant. The results of slaughter were used to determine the main slaughter characteristics of pigs in accordance with generally accepted methods. After measurement, the carcasses were cut into pieces and evaluated for the yield of lean pork by deboning. As a result of the study, it was found that with the increase of ante-mortem live weight, the carcass yield of carcasses also increased. In all weight groups, pigs outnumbered boars in slaughter yield. At the same time, pig carcasses lost more weight during cooling compared to castrates (0.2-0.4%). The carcasses of castrated animals had a thicker fat, measured at different points on the carcass (0.1 to 3.6 mm above the first thoracic vertebra and 0.8 to 3.3 mm above 6-7 thoracic vertebrae). Further analysis of the carcasses showed that the ratio of valuable parts of carcasses does not change significantly with increasing pre-slaughter live weight of animals. The mass fraction of tenderloin, neck, shoulder, loin and ham was higher in pig carcasses, while in castrates only the proportion of brisket was higher. In general, the weight of meat from the four main cuts in pigs was significantly higher than in castrates (group I - 58.4 against 52.2%; group II - 56.6 against 55.5%; group III - 58.3 against 56.6%). Analysis of the morphological composition of the carcasses showed an increase in meat content with increasing pre-slaughter live weight. In particular, in animals with a live weight of 115-120 kg, the proportion of meat in the carcass was 68.6 ± 0.34 in castrates and 71.0 ± 0.59% in pigs.

Key words**:** *pigs, castrates, pre-slaughter live weight, weight of valuable parts of carcass, meat yield*

INTRODUCTION

Pig farming has become widespread in the vast majority of countries around the world. Despite the process of unification of technological elements, which has been observed over the past 20-30 years, there are still some differences between countries in the technology of pork production. This is mainly due to traditional food preferences, however,

it is based on economic feasibility. This aspect concerns such elements as the organization of feeding and ration formation, the choice of breeds and breed combinations for fattening, as well as others. Among these factors, the intensity of fattening and, especially, the live weight of animals before slaughter are important.

It should be noted that in world practice there is no unambiguous answer to the question of the optimal live weight of animals before slaughter. European practice shows an approximate weight of live animals before slaughter 110-115 kg. However, in some countries, such as Ireland, pigs are slaughtered with a live weight of about 95 kg (MLC, 2003) [16], due to the traditional desire of the population to eat lean bacon. However, there is currently a change in consumer preferences and the associated increase in demand among processing companies for heavier carcasses (DARD, 2002) [6].

In other countries, such as Italy, the slaughter weight of pigs exceeds 150 kg. This is mainly due to the production of traditional dried meat, which is in demand in this country.

The weight of pigs slaughtered in Asian markets, in particular in South Korea and China, is about 90-110 kg (Kim at al., 2005) [14]. We point out that consumers in Asian countries prefer brisket and shoulder with a high fat content, but the breeds traditionally used in these countries are precocious and early salted. At the same time, with the development of industrial pig breeding in Asian countries and the breeding of the world's most common breeds, we can expect an increase in the pre-slaughter weight of pigs in these regions in the near future.

Pork producers in North America sell pigs of about the same weight as producers in Europe. However, there is a tendency to increase the live weight of animals before slaughter. Thus, in the United States since 1995, the average weight of pigs at slaughter has increased by 12-15%. If this trend continues, the average carcass weight in 2030 will be 104 kg, in 2040 - 111 kg, and in 2050 - 118 kg (Harsh at al., 2017) [11]. This constant growth is due to some factors, including genetic improvement of the original genotypes, improvement of feeding levels, the use of new feed additives and others. It is these factors that increase the efficiency of production in the fattening of heavy pigs.

In general, the growth rate of muscle tissue decreases after reaching a live weight of 90 kg, while the growth rate of adipose tissue increases linearly to a live weight of 150 kg (Gu at al., 1992) [10]. This pattern of muscle formation explains the decrease in the content of muscle tissue relative to fat in the carcasses with an increase in live weight from 95 to 130 kg. Therefore, prolonging the fattening period and increasing the fat content may lead to less efficient feed consumption. These features of heavier carcasses limit their use, which in turn forces producers to be careful in choosing the genotypes of pigs for fattening.

It should be noted that the different pre-slaughter weight of pigs causes differences in the composition of their carcasses. It is known that with increasing ante-mortem live weight of both castrates and pigs, the content of lean meat in the carcass decreases while the content of intermuscular fat does not change (Beattie at al., 1999) [2]. High slaughter weights mean lower unit costs in processing, but also improved meat quality, since the meat is more mature and the intramuscular fat content increases with increasing slaughter age (Hempler at al., 2009) [12].

In general, the main argument in favor of low carcass weight is the reduction of feed costs and lean meat, while the arguments of opponents are the desire to obtain products with high fat content. However, both want to engage in cost-effective production.

All the above applies to Ukraine, which currently uses different technologies of pork production in households and in industrial farms of different sizes.

krainian pork production in the absence of significant exports is in fact focused exclusively on the domestic market and the demand that is observed in it. The main factors that form the competitive advantage of each producer are the quality of pig carcasses, which is largely related to their weight. In

industrial production in Ukraine, pigs with a live weight of 100-110 kg are traditionally slaughtered, but given the global trend (Friedhelm, 2006) [8], local producers are studying the feasibility of increasing the pre-slaughter live weight of animals to 120 kg.

However, the increase in pre-slaughter weight of animals is associated with certain organizational issues and additional logistical workload, so it may not be appropriate in every case.

It is also known that the relationship between live weight before slaughter and the economic efficiency of fattening depends on the genotype, gender, specifics of feeding, animal health, the intensity of production processes and other factors. In order to determine the optimal pre-slaughter live weight of pigs for fattening in the industrial complex in Ukraine, these studies were conducted.

MATERIALS AND METHODS

The research was carried out in the conditions of the industrial complex of Globinsky Pig Complex LLC, Dnipropetrovsk region, Ukraine. At the birth of 20 F1 sows, a combination of Irish Yorkshire and Irish Landrace and boars of the Maxgro synthetic line, 80 heads of young pigs were selected, of which 32 were pigs and 48 were boars. Boars were surgically castrated at the age of 2 days. All animals were kept mixed and received a standard diet, according to the recommendations of the firm Hermitage (Hermitage). During fattening, all animals had free access to food and water.

Fattening of pigs was carried out in machines of 20-25 heads on a completely slotted floor with an area of 0.7 m^2 per 1 head. Feeding was carried out with complete feed of own production on wet type of feeding, according to the technology accepted on a complex.

When the animals reached the age of 170 days, depending on live weight, they were divided into 3 groups: Group I - 85-95 kg; Group II - 100-110 kg, Group III - 115-120 kg. The pigs were transported to the meat processing plant and slaughtered in accordance with the technology adopted at the enterprise (stunning in the gas chamber SCHALLER "BUTINA" - DK 4300), the carcasses were cooled first in a shock tunnel at -14 ^oC for 105 minutes and then for temperature 4 ^oC for 24 hours.

The results of slaughter were used to determine the main slaughter characteristics of pigs in accordance with generally accepted methods. The carcasses were weighed immediately after slaughter (steam carcass weight) and after 24 hours of aging and cooling (chilled carcass weight).

To determine the quality characteristics of the carcasses, the thickness of the fat and the thickness of the longest back muscle were measured. All measurements were performed on the left half carcass with a ruler (GOST 427-75) and an ultrasonic device Fat-o-Meat'er S71.

The thickness of the lard with a ruler was measured at 3 points, mm:

X1 – on the withers;

X2 – over 6-7 thoracic vertebrae;

X3 – on the buttocks, mm.

The measurement was performed at the level of 3-4 last ribs 6 cm away from the mid-back line, mm:

X4 – fat thickness;

M1 – the thickness of the longest muscle of the back (MLD).

After measurement, the carcasses were cut into pieces and evaluated for the yield of lean pork by deboning. The research results were processed using the application program Statistica v.10.

RESULTS AND DISCUSSIONS

As a result of the research, 80 pigs were slaughtered, including 48 castrates and 32 pigs. The distribution of castrates and pigs by groups was uneven: the first group 40% of castrates and 60% of pigs; the second group - 80% of castrates and 20% of pigs; the third group - 60% of castrates and 40% of pigs (Table 1).

Heavier pigs had more steam and chilled carcass and slaughter yield. This coincides with the results of other researchers, who note a linear increase in carcass weight and slaughter yield (Cisneros at al., 1996) [3], as

well as steam carcass weight and chilled carcass weight (Hugo at al., 2015) [12] with increasing pre-slaughter live weight.

Table 1. Slaughter characteristics of animals of different groups

Indicators	Group I (85-95 kg)		Group II (100-110 kg)		Group III (115-120 kg)	
	castrates, n=12	pigs, n=18	castrates, n=24	pigs, n=6	castrates, n=12	pigs, n=8
Live weight, kg	88.2±1.4	86.4±0.8	102.4±0.8	104.5±1.5	114.5±0.9	116.9±0.8
Weight of steam carcass, kg	64.9±1.2	64.3±0.7	75.8±0.8	78.4±1.2	86.1±0.7	89.1±0.9[1]
Slaughter yield,%	73.6±0.4	74.4±0.4	74.0±0.3	75.0±0.4[1]	75.2±0.5	76.2±0.6
Weight of chilled carcass, kg	63.5±1.3	62.6±0.8	74.3±0.8	76.6±1.2	84.1±0.7	86.9±0.9[1]
Losses after cooling,%	2.2±0.1	2.6±0.4	1.9±0.1	2.3±0.3	2.3±0.1	2.5±0.2

Note: [1] - $P < 0.05$; Source: Own calculations.

In each weight category, except for the first group, pig carcasses were heavier. The best slaughter yield was obtained when slaughtering pigs in all weight categories, but a significant difference ($P \leq 0.05$) was obtained only in the second group. Similar data were obtained by other researchers (Čobanović at al., 2016, Gispert at al., 2010, Czyżak-Runowska at al., 2015) [4, 9, 5]. However, some research results deny the existence of a link between the sex of the animal and individual indicators of carcass quality (Oliveira at al., 2015) [18].

It should be noted that during cooling more carcasses of pigs lost weight compared to castrates. For the first and second groups, the difference was 0.4%, for the third - 0.2%. In similar studies by other authors, it was found that castrates during cooling in the first 24 hours also lost less weight than pigs (2.09 and 3.17%, respectively) (Cisneros at al., 1996) [3].

The thickness of the fat at the measurement points increased with increasing ante-mortem live weight (Table 2).

Table 2. Thickness of the fat and the longest muscle of the back

Indicators	Group I (85-95 kg)		Group II (100-110 kg)		Group III (115-120 kg)	
	castrates, n=12	pigs, n=18	castrates, n=24	pigs, n=6	castrates, n=12	pigs, n=8
X_1, mm	37.7±1.5	36.4±0.9	42.3±0.8	42.2±3.5	49.0±2.3	45.4±2.5
X_2, mm	21.1±1.2	20.1±1.1	25.6±0.5	24.8±1.8	30.4±1.6	27.1±1.4
X_3, mm	17.3±1.6	14.6±1.2	18.4±0.8	16.3±1.6	20.6±0.8	17.8±1.8
X_4, mm	16.5±1.0	15.7±0.8	18.8±0.6	22.0±1.2[1]	20.8±1.2	22.9±2.5
M_1, mm	47.0±1.4	46.6±1.5	46.9±1.2	47.8±2.2	53.0±1.3	51.6±2.2

Note: [1] - $P < 0.05$; Source: Own calculations.

The results obtained are confirmed by studies by (Oliveira at al. 2015) [18], which also showed an increase in the thickness of the fat with increasing carcass weight.

Castrated animals had a greater thickness of lard at three measuring points. They predominated pig carcasses from 0.1 to 3.6 mm in fat thickness over the first thoracic vertebra; from 0.8 to 3.3 mm - over 6/7 thoracic vertebrae; from 2.1 to 2.8 - above the buttocks. This trend has been observed by other researchers (Bahelka at al., 2007, Tischendorf at al., 2002) [1, 20]. At the same time, (Mohrmann at al., 2006) [17] found no significant differences between the genders.

However, the measurements made by the Fat-o-Meat'er S71 give slightly different information. Thus, pigs had a smaller fat thickness only in the first group, in the other two they were worse than castrates by 3.2 mm (group II) and 2.1 mm (group III). In terms of MLD thickness, castrates predominated in the first and third groups, by 0.4 and 1.4 mm, respectively.

It is obvious that despite the increase in the absolute mass of valuable parts of the carcass with increasing pre-slaughter live weight, their ratio (%) does not change significantly (Table 3).

Table 3. Weight and proportion of valuable parts of the carcass

Indicators	Group I (85-95 kg)		Group II (100-110 kg)		Group III (115-120 kg)	
	castrates, n=12	pigs, n=18	castrates, n=24	pigs, n=6	castrates, n=12	pigs, n=8
Cutting, kg	0.9±0.02	0.9±0.02[2]	1.1±0.03	1.1±0.04	1.3±0.03	1.3±0.03[1]
%	1.5±0.03	1.6±0.03	1.4±0.03	1.5±0.05	1.5±0.03	1.5±0.04
Neck, kg	3.6±0.10	3.6±0.07	3.9±0.09	4.2±0.29	4.4±0.10	4.7±0.13
%	5.9±0.17	5.7±0.10	5.2±0.10	5.3±0.12	5.2±0.09	5.4±0.17
Shoulder, kg	7.4±0.19	7.3±0.17	8.7±0.13	9.4±0.22	10.4±0.20	11.2±0.36
%	11.9±0.15	11.7±0.19	11.5±0.11	12.1±0.11	12.3±0.22	12.7±0.30
Loin, kg	4.3±0.14	4.5±0.10	5.0±0.13	5.4±0.15	5.6±0.16	6.5±0.19
%	6.9±0.19	7.1±0.14	6.6±0.13	6.9±0.20	6.6±0.16	7.4±0.18
Belly, kg	5.1±0.12	4.9±0.11	5.9±0.10	5.8±0.18	7.0±0.14	7.0±0.16
%	8.2±0.13	7.9±0.19	7.9±0.12	7.4±0.13	8.3±0.16	7.9±0.14
Ham meat, kg	14.7±0.40	15.3±0.22	17.3±0.29	18.2±0.24	19.2±0.25	20.6±0.32
%	23.7±0.38	24.4±0.31	22.9±0.21	23.4±0.24	22.7±0.26	23.4±0.34

[1] – p<0,05; [2] – p<0,01; Source: Own calculations.

In particular, although the mass of the shoulder in castrates of group I was significantly less than the mass of the shoulder in castrates of group III (7.4±0.19 kg and 10.4±0.20 kg, respectively), its mass fraction did not actually change 11.9% and 12.3%). Such results are confirmed by other researchers (Martin at al., 1980) [15], who claim that the yield of valuable parts of the carcass is influenced more by breed and gender than the weight of animals before slaughter (Fortin, 1980) [7].

The weight of tenderloin, neck, shoulder, loin and ham was higher in pig carcasses. In the carcasses of castrates was only a large proportion of belly. These results are confirmed by other studies. In particular, it was found that pigs significantly outnumber castrates by muscle mass of the four main cuts (shoulder blades, loins, belly and ham) - 57.68 against 52.77%, respectively (Bahelka et al., 2007) [1]. The analysis of the morphological composition of the carcass showed a gradual increase in meat content with increasing pre-slaughter live weight (Table 4). The highest rates were obtained at the slaughter of pigs of group III (castrates 68.6%, pigs 71.0%). At the same time, in some studies (Hugo at al., 2015) [13], opposite results were obtained, which show that lighter pigs had a significantly higher content of lean meat compared to heavier ones.

Table 4. Total weight and proportion of meat, fat and bones

Indicators	Group I (85-95 kg)		Group II (100-110 kg)		Group III (115-120 kg)	
	castrates, n=12	pigs, n=18	castrates, n=24	pigs, n=6	castrates, n=12	pigs, n=8
Meat, kg	41.4±0.88	43.7±0.75	51.6±0.77	54.6±0.88[1]	58.2±0.57	62.5±0.97[3]
%	67.0±0.58	69.6±0.53[2]	68.5±0.35	70.1±0.26[3]	68.6±0.34	71.0±0.59[2]
Fat, kg	13.7±0.47	12.6±0.32	16.4±0.27	15.9±0.60	18.9±0.39	17.2±0.65[1]
%	22.2±0.59	20.1±0.44[1]	21.8±0.34	20.5±0.50[1]	22.3±0.40	19.6±0.67[2]
Bones, kg	6.7±0.10	6.4±0.09	7.3±0.09	7.3±0.14	7.8±0.14	8.3±0.13[1]
%	10.8±0.18	10.3±0.19[2]	9.7±0.11	9.4±0.28	9.2±0.19	9.4±0.16

[1] – p<0,05; [2] – p<0,01; [3] – p<0,001; Source: Own calculations.

A comparison of the carcasses of castrates and pigs shows a higher content of meat in the carcasses obtained from pigs at slaughter in all weight categories. Thus, the difference in group I was 2.6% (P <0.01), in group II - 1.6% (P <0.001), in group III - 2.4% (P <0.01). In the carcasses of all weight groups obtained from pigs, a lower fat content was found, which coincides with the results of other researchers (Povod at al., 2018) [19].

CONCLUSIONS

In terms of industrial production in Ukraine, it is advisable to slaughter animals of high weight (over 115 kg), which will increase the slaughter yield by 1.8% and 1.6% in pigs and neutered, respectively. It is important to consider the sex of the animals, as the carcasses of pigs had a higher yield of meat compared to the carcasses of castrates in all weight groups by 1.6-2.6%. As the ante-mortem mass of animals increases, the mass of valuable parts of the carcass increases, although their relative share in the carcass does not actually change.

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PROBLEM OF FORMING BALANCED AGROINNOVATION SYSTEMS: EMPIRICAL EVIDENCE FROM RUSSIAN REGIONS

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Abstract

The paper studied the issues of the balanced spatial development of agro innovation systems of Russian regions using the main indicators of agricultural innovation for 2015-2019: innovative products in crop and livestock production, agricultural machinery, as well as graduates of agricultural universities and employed in the agricultural sector. The degree of concentration of these indicators was determined using the Herfindahl-Hirschman index for the regions of Russia. The results reveal a high of concentration of costs of technological innovations in the agro production, when from 50% to 90% of the costs of the technological innovation in the crop and livestock sectors are concentrated in only 2-3 Russian regions, as well as the absence of dependence on the production of innovative agricultural products on the degree of concentration of indicators and a balanced ratio in the labor market of agricultural specialists in the regions of Russia. To ensure progressive structural changes and enhance innovative activity in regional AIS and increase the efficiency of agriculture, measures are proposed to enhance the balance of AIS components and spillover effects of innovations, resulting in an increase in the efficiency of agro innovation systems functioning.

Key words**:** *Russian regions, innovative activity, agro innovation system, regional development, Herfindahl — Hirschman index*

INTRODUCTION

The relevance of this study is explained by the increasing role of innovation and knowledge flow in the economic development of systems, regions and countries in recent decades and the need to develop approaches to improve the efficiency of innovation in various fields. Today, innovative development is becoming a vector followed by more and more territories and industries. The development of priority sectors of the economy, such as agriculture and food security, is also based on the effective organization of the diffusion and implementation of innovations. To ensure sustainable economic growth in the agricultural sector, a transition to knowledge-intensive agricultural activities is necessary.

For the effective organization of innovation management in agriculture, it is important to develop directions for its balanced development, taking into account spatial and strategic approaches both at the level of the country as a whole and at the regional level. This is possible using the concept of national and regional agro-innovation systems (AIS).

This article continues the search for a methodology for the development of regional AIS and is devoted to the analysis of the factors affecting the improvement of the AIS efficiency. The purpose of the paper is to analyze the balance of AIS in agriculture in regional and sectoral aspects based on data of Russian regions. For this purpose, an analysis of the territorial structure of production and spatial concentration in the regions of Russia for the main sectors of agriculture in terms of the production of innovative agricultural products, the availability of agricultural machinery in the regions and the provision of highly qualified specialists in agriculture was carried out, and the balance of regional AIS for these parameters was assessed.

The main research issue of the article is to analyze the factors influencing the management of innovations in AIS and to determine the degree of consistency of its elements for its effective and balanced development.

The issues of increasing the efficiency of agriculture are typical in all countries. The growing role of knowledge and innovation in the efficient development of agriculture has led to the application of the concepts of AIS and AKIS in the study of agricultural economics. The need to manage innovations in agriculture and the formation of AIS is associated with the limitations of extensive development and the transition to intensive development based on innovations, which becomes possible not only due to the introduction of technological innovations in agriculture, but also the establishment of interaction at all stages between all participants involved in the process of agricultural production. If the regional innovation system produces innovations in the economic system, then innovations in agriculture are an AIS product. The approach from the standpoint of the innovation system in this case allows us to consider the actors of production, infrastructure and institutions, as well as the relationship between them as a whole.

Theoretical analysis shows that AIS is a network of organizations, enterprises, and individuals who are "bringing new products, new processes and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance" [9].

An innovation system must be understood not only as elements, but also the connections between them (Lundvall B. A., 1992) [14]. As in any system, the efficiency of AIS is achieved due to the property of emergence: a combination of components allows it to be more effective than these components separately. Researches noticed that "an AIS is a collaborative arrangement bringing together several organizations working toward technological, managerial, organizational, and institutional change in agriculture" (Anandajayasekeram R., 2000) [1, p. 7].

The composition of AIS can differ significantly and different institutions can act as the main generator of innovation, and their interaction with manufacturers can take different forms. AIS can draw on the international, country and regional agricultural research institutions, private agribusiness firms and entrepreneurs, farmers and consumer organizations.

Scientifically, the AIS concept is in a state of renewal and development, as is the case with other territorial innovation systems. Therefore, in the literature there are discrepancies in the interpretation of the term, approaches to the analysis of the phenomenon (Pant, LP, Hambly-Odame, H., 2009) [16], (Spielman, D., Ekboir, J., Davis, K., 2009) [22], Hall, A., Clark, N., 2010) [10].

The literature discusses the differences between AIS and AKIS. AIS is an agricultural innovation system, AKIS is agricultural knowledge and information system. The difference between them in that AKISs focuses on the "generation and diffusion of knowledge, and AISs on the generation, diffusion, and application of knowledge" (Roseboom, J., 2002) [20].

Anandajayasekeram P. notices, that "AKISs, and AISs are soft systems. A soft system is a social construct that does not physically exist but is nevertheless more relevant when studying social phenomena, such as research, knowledge, or innovation" (Anandajayasekeram P., 2011) [1, p.5].

Discussing the difference between these concepts, Rivera WM notes that "AIS did not evolve as a further development of the AKIS framework, but rather as a parallel development which did not build upon the insights of the AKIS literature and the practical experience in applying this framework" (Rivera, W.M., Sulaiman, R.V., 2009) [18, p. 587].

According to Hall et al., the main difference between AIS and AKIS lies in the "greater and more explicit focus of AIS on the influence of institutions (seen as organizations like companies, public research institutes and learning and innovation" [9].

The formation of regional AIS is a complex process that is possible only with an equal contribution of a number of constituent factors, including technological, economic, geographic, social, and institutional.

In this regard, the legislative system, export restrictions, infrastructure, and the development of market relations play an important role in the formation of effective AIS and relations between AIS actors. All these relations undergo a process of reorganization in the process of AIS formation, reaching a certain necessary balance (Leeuwis C., 2004) [13], (Röling N., 2009) [19], (Klerkx, L. at all, 2010) [12]. As a result of this process, a number of actors can be squeezed out of the system of emerging relations (Vanloqueren, G., Baret, P., 2009) [25], (Thompson, J., Scoones, I., 2009) [23], (Brooks, S., Loevinsohn, M., 2011) [3].

At the same time, AIS is at the same time a process of interaction of various actors that create and rely on changes in technology, socio-economic sphere. Such actors have different ideas about how to improve the process of agricultural production.

The issues of AIS formation are widely studied in the literature of all countries. The literature notes that the existing knowledge of how to improve processes in the agricultural sector is often limited in its application due to a weak economic-financial and material base: the high cost of credit, general deterioration of equipment, etc. [2].

The need for the formation of AIS arises earlier in countries with limited land, soil and agro-climatic resources. For example, in Russia in the 90s, after a sharp reduction in support for agriculture, huge areas of cultivated land were abandoned. The problems of AIS formation are especially actualized only at the present stage, when it is required to increase the efficiency and intensification of the economy and bring agricultural production capacities closer to the cities as the main consumers of agricultural products [4, 5].

The formation of the effective AIS presupposes the organization of cluster interaction between participants as a possible condition. Clustering at the local level contributes to the strengthening of regional innovation systems, and the technologies, know-how and innovations created within their framework become the main instrument for the conquest and retention of high competitive positions by the cluster and the region.

An important aspect of the study is the interaction of AIS elements forming in the regions. Some experience has been accumulated about the influence of the agricultural policy of one country on another. In particular, Ulimwengu, J. and Sanyal, P., analyzing the growth rate of agriculture (understood as the result of the agricultural policy), provide evidence that, on average, no country has faced negative side effects due to the agricultural policies of neighbouring countries. On the contrary, on average, each country achieved a 2.5 % growth rate as a result of an overflow from its neighbours [24].

It is also necessary to especially touch upon the issues of the diffusion of innovations and the course of spillover effects in AIS. The diffusion of innovations occurs through technology transfer. Due to its systemic properties, the process of innovative improvement in individual farms can have a spillover effect on other farms in the region, which will contribute to its overall development. The growth in the use of innovations generates significant spillover effects and leads to various direct and indirect effects through the spillover and knowledge transfer [7, 15, 26]. An innovative spillover as an overflow is a consequence of the diffusion and transfer of technologies and innovations in the form of processes of transferring intellectual property, supporting innovative enterprises, and the mutual flow of personnel between industry and the R&D sector.

Geographically, such changes are localized near large agricultural farms around large cities, in which the need to improve the efficiency of the economy is more acute than in peripheral farms. An additional incentive is the financial resources concentrated in large cities, which will make it possible to modernize the production capacities of the agricultural sector. Factors that contribute to the efficiency of AIS are skilled labour, modern agricultural practices, improved seed technology, etc. AIS are formed in regions with different values and ratios of the

following potentials: production potential, investment potential, scientific and educational potential, innovation structure and demand for innovation. Accordingly, an increase in some potential can have a positive effect on the system as a whole. Therefore, we can talk about the spillover effect that occurs in AIS due to the enhancement of its various components, which ultimately leads to an increase in the efficiency of the AIS.

MATERIALS AND METHODS

In this paper, empirical data of agriculture by regions of Russia for 2015-2019 were used as materials for the study. The information of Rosstat was analyzed on the main indicators of agriculture: on the production of innovative products in crop and livestock production, data on the number of agricultural machinery for a number of years, data on the number of graduates in agricultural training areas for each Russian region and information on the structure of employed in the economy by regions of Russia. Thus, the work analyzed the spatial structure of costs for the production of innovative agricultural products in Russia.

Using the Herfindahl-Hirschman Index (HHI), the degree of spatial concentration of agriculture in the regions of Russia was determined. The HHU was calculated according to the formula [11, 17]:

$$HHI=\sum Yi^2, \quad (1)$$

where: Yi is the share of the cost of the i-th type of product in the region from the value for the country as a whole. The Interpretation of the HHI is the following one. The closer HHI is to 0, the more evenly the studied attribute is distributed over the territory, the closer it is to 1, the more significant its concentration in one of the regions.

Also, the share of agricultural graduates trained by universities was compared with the share of workers employed in agriculture in the region. All data were subjected to structural and territorial analysis. This made it possible to analyze the balance of regional AIS in terms of the main parameters: innovative products, technology and equipment, and staffing.

RESULTS AND DISCUSSIONS

As a result of calculating the HHI for the main sectors for Russian agriculture for 2018, the following values were obtained: crop production: HHI = 0.042; livestock production: HHI = 0.029. Thus, the concentration of agricultural production in both sectors is low. The opposite situation is observed in the production of innovative agricultural products (Table 1). The highest concentration of innovation is found in pig and poultry breeding.

Table 1. HHI in innovative agricultural production, 2017

Branches of agriculture	HHI
Growing annual crops	0.294
Growing vegetables, melons, root and tuber crops, mushrooms and truffles	0.377
Breeding of dairy cattle and raw milk	0.185
Pig breeding	0.683
Poultry breeding	0.655

Source: Own calculation on the basis of data from Rosstat [6].

We note that the costs of technological innovation in the cultivation of various crops and the production of livestock products are concentrated in only 5 regions, which is extremely small. There are 85 regions in total in Russia. For example, more than half of the cost of technological innovation in the cultivation of cereals (excluding rice), pulses and oilseeds are in two regions: Tumen Region (32%) and Krasnodar Region (24%). (Fig. 1.)

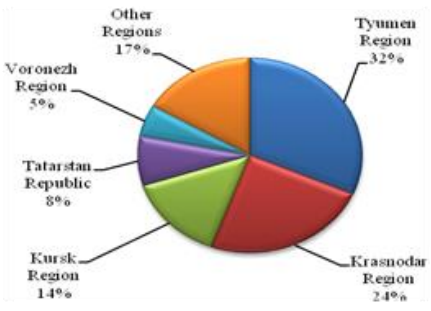

Fig. 1. Share of Russian regions in costs of technological innovations in the producing of cereals (except rice), legumes and oilseeds, 2017 (%).
Source: Own calculation on the basis of data from Rosstat [6].

A similar situation is observed in the cultivation of vegetables, melons, root and tuber crops and mushrooms: three regions account for more than 95% of all Russian costs. These are Belgorod Region (11%), Lipetsk Region (22%) and Volgograd Region (52%). A such situation is with the technological costs of innovations in animal husbandry. So, in the breeding of dairy cattle, the production of raw milk, more than half falls on 2 regions: the Vologda Region (42%) and the Ryazan Region (15%). Attention is drawn to the significant cost indicators in the Siberian regions. For example, from 4 to 7% of all Russian costs are observed in 4 regions: Tomsk, Omsk, Kemerovo and Krasnoyarsk Regions. The Tambov (66%) and Tyumen (28%) regions stand out in terms of costs for pig breeding. Mordovia (68%) and Leningrad (23%) Regions are leading in poultry breeding.
The availability of agricultural machinery in the regions and its use to increase the efficiency of agricultural production is of great importance. In Russia as a whole, there was a decrease in the number of tractors and seeders in the period 2015-2019. Only in some regions there was a positive trend towards an increase in the number of equipment, they are presented in Table 2.

Table 2. Regions with positive dynamics in the number of agricultural machinery, 2015-2019 (%)

Agricultural machinery	Regions
Seeders (more than 5% increase, over 100 seeders)	Republic of Crimea, Republic of North Ossetia-Alania, Altai Republic, Astrakhan Republic, Karachay-Cherkess Republic, Primorsky Region, Tambov Region, Kabardino-Balkarian Republic, Lipetsk Republic, Smolensk Republic, Republic of Sakha (Yakutia)
Tractors (more than 5% increase)	Jewish Autonomous Region, Republic of North Ossetia-Alania, Altai Republic, Karachay-Cherkess Republic, Khanty-Mansi Region, Sakhalin Region, Kabardino-Balkarian Republic, Irkutsk Region, Republic of Adygea, Belgorod Region

Source: Own calculation on the basis from Rosstat [24].

It is noteworthy that the most significant growth in equipment fell not on the regions producing the largest volume of crop production, but on small subjects of the North Caucasus, as well as Asian regions with difficult agro-climatic conditions for growing agricultural products.
Similarly, in the main sectors of agriculture, the production of innovative products is concentrated almost entirely in only two of the 85 regions of Russia (Table 3). This is caused to some extent by the natural conditions for farming, but it also indicates the imbalance in the development of agriculture in the country as a whole.

Table 3. Share of Russian regions in innovative products by sector of agriculture, 2017, %

Sector of agriculture	Regions
Cultivation of cereals	Krasnodar Region (78%), Lipetsk Region (11%)
Growing vegetables	Lipetsk Region (56%), Belgorod Region (20%)
Pig breeding	Tambov Region (82%), Belgorod Region (9%)
Poultry breeding	Mordovia Region (78%), Leningrad Region (20%)

Source: Own calculation on the basis from Rosstat [6].

The level of development of the economies of specific regions directly depends on the level of development of human capital and the provision of the needs of the region with highly qualified personnel, who are the generators and implementers of innovative transformations in the agricultural sector.
In order to implement such innovations, specialized agricultural education is important, since any AIS is formed and functions in specific agro-climatic conditions [3]. Therefore, an analysis of AIS staffing in Russian regions was also carried out.
In any territorial innovation system, special attention in the development strategy should be paid to the qualifications of personnel. Maintaining the correspondence of the number of trained specialists to the needs of the regional economy in them is an urgent task of regional policy. Tables 3 and 4 present an analysis of the number of specialists with higher agricultural education over those employed in agriculture in the regions of Russia, demonstrating the excess and lack of agricultural specialists. The regions were divided into 2 groups: in which there is an

excess of personnel (Table 3), and a shortage of personnel (Table 4).

Table 4. Excess of personnel with higher education in the agriculture over employed by Russian regions, 2016

Region	Excess, times	Region	Excess, times
Saint Petersburg	11.12	Kamchatka Region	1.73
Moscow	8.44	Saratov region	1.65
Sakha (Yakutia)	4.59	Chuvash Republic	1.65
Chechnya	4.22	Vologda Region	1.62
Kostroma Region	3.81	Ryazan Region	1.61
Republic of Buryatia	3.81	Nizhny Novgorod	1.59
Ingush Republic	3.48	Adygeya Republic	1.58
North Ossetia-Alania	3.26	Khakassia	1.57
Moscow Region	3.14	Kurgan Region	1.55
Ivanovo Region	2.57	Rostov Region	1.51
Amur Region	2.45	Volgograd Region	1.43
Kaliningrad Region	2.45	Udmurt Republic	1.39
Ulyanovsk Region	2.41	Kalmykia	1.34
Sverdlovsk Region	2.31	Kaluga Region	1.30
Republic of Tuva	2.29	Pskov Region	1.26
Krasnoyarsk Region	2.20	Yaroslavl Region	1.24
Chelyabinsk Region	2.12	Republic of Komi	1.24
Kabardino-Balkariya	2.04	Smolensk Region	1.23
Republic of Mari El	1.94	Kemerovo Region	1.18
Astrakhan Region	1.90	Omsk Region	1.14
Bryansk Region	1.88	Perm Region	1.13
Republic of Karelia	1.83	Tver Region	1.10
Tatarstan	1.77	Arkhangelsk Region	1.08
Primorsky Republic	1.76	Irkutsk Region	1.03
Altai Republic	1.74	Tyumen Region	1.00

Source: Own calculation on the basis from Rosstat [6].

Regions form Table 4, in which agriculture occupies a large share in the economy, have a shortage of personnel. Many of them make a significant contribution to the production of agricultural products in the country, and are major producers and exporters of crop products. Among them, we would like to highlight the Krasnodar, Stavropol, Belgorod and Voronezh Regions, and the Republic of Dagestan (they are marked with *). We can also notice that all regions from Table 2, which make a significant contribution to the volume of agricultural production in Russia, are regions with disproportions of agricultural personnel from Table 4. Most of the regions with positive dynamics of agricultural machinery also belong to this group. Analysis of the personnel component of AIS in the showed that they are not balanced.

Table 5. Regions, experiencing a shortage of personnel with higher education comparing with employed, 2016

Region	Shortage, times	Region	Shortage, times
Karachay-Cherkesia	0.97	Dagestan	0.63
Voronezh Region*	0.97	Altai Region	0.63
Kirov Region	0.95	Krasnodar Region*	0.62
Novosibirsk Region	0.94	Tomsk Region	0.56
Tambov Region	0.87	Penza Region	0.44
Oryol Region	0.87	Leningrad Region	0.43
Zabaikalsky Region	0.84	Stavropol Region*	0.41
Novgorod Region	0.79	Samara Region	0.41
Kursk Region	0.74	Sakhalin Region	0.40
Orenburg Region	0.73	Tula Region	0.32
Belgorod Region*	0.72	Khabarovsk Region	0.30
Mordovia	0.65	Lipetsk Region	0.24
Bashkortostan	0.64	Vladimir Region	0.15

Source: Own calculation on the basis from Rosstat [6].

For the regions from Table 4, which are significant producers of agricultural products throughout the country, an influx of trained specialists from the regions of the first group from Table 3 with a surplus of specialists for agriculture will be significant. The migration of young specialists to these regions after graduation is a prerequisite for the formation of balanced and effective AIS in these regions. For the development of innovations, constant professional development of specialists, exchange of experience, and tacit knowledge are of great importance. The competencies they bring will cause a spillover of knowledge in the emerging AIS region.

CONCLUSIONS

The analysis showed that there is no dependence on the output of innovative agricultural products on the degree of concentration of agricultural production and agricultural machinery and a balanced ratio in the labour market of agricultural specialists in the regions of Russia. In many regions with

favourable conditions for agriculture, there is no increase in agricultural machinery, costs for agricultural innovations, and there is a shortage of agricultural specialists by universities. On the contrary, it is the regions unbalanced in these parameters that are ahead of others in the production of innovative products. Regions with a shortage of agricultural specialists produce a high proportion of innovative products. This testifies to the imbalance and lack of formation of effective AIS in most regions of Russia. The cost of innovation in the Russian agricultural sector is highly concentrated across regions. From 50% to 90% of the costs of technological innovations in the crop and livestock sectors are concentrated in 2-3 Russian regions, and a significant increase in the cost of agricultural machinery is observed in regions that do not produce the largest volume of products. This testifies to the formation of such a configuration of AIS in the Russian regions, when large agricultural holdings prevail among organizational forms, mainly they introduce innovative technologies due to economies of scale and the advantages of concentration of financial and other resources. However, the share of agriculture in Russia today in GDP is only 3.5%, with favourable climatic and territorial advantages of Russia and the presence of a huge scientific, technological and human potential for its development. In modern conditions of various economic risks and the COVID epidemic, in order to reduce food security risks, there is a real need and opportunity to increase the contribution of agriculture to the GDP. To ensure progressive structural shifts and strengthen the innovative component of agricultural products and improve the efficiency of agriculture, it is necessary to develop direct and indirect measures to stimulate investment and introduce innovations in the agricultural sector, as well as programs to develop migration and adjust training programs for universities and state support for the balance of demand and labour market offers. General management and regulation of the effectiveness of the national innovation system in all sectors are in the area of innovation and state policy and the institutional environment of innovation, which are components of the innovation ecosystem. Modern approaches to innovation shift the focus of innovation policy towards interactions between actors of national innovation systems and consider interactive processes in the creation, dissemination and use of knowledge as a basis for the development of institutional interaction in the dissemination of innovations in regional AIS [8].

The following recommendations for adjusting the agrarian innovation policy are possible:

- to continue “growing” of national food giants and increase the export of agricultural products, but at the same time involve small agricultural enterprises in the vertical chains of these companies through cooperative and contractual forms of interaction;
- to change the model of interaction between agricultural producers, reduce the number of intermediaries between the farmer and the retail network, improve the service for packaging and delivery of products, the coherence and integration of retail chains in the regions of Russia;
-to more actively support the innovative costs of small producers in improving technologies, strengthen the integration of small businesses into food chains;
- to stimulate investments in innovations of small farms, indirect support measures in overcoming internal and external barriers to market entry;
- to introduce measures for the development of rural areas in all regions of Russia, and not individual points of innovation, since modern technologies and innovations by transfer mechanisms will be transferred from large agricultural holdings to numerous small agricultural organizations and farms, giving positive spillover effects [21].

We would like to note, that these provisions of our research of the specifics of AIS in Russian regions are relevant for many agrarian countries with a large extent of territory and the remoteness of the periphery from the centers of economic development. Further analysis of these main components of

innovative development and the phenomena of innovation diffusion is needed from the standpoint of the balance of both regional AIS and at the country level as a whole. The imbalance does not allow the formation of a fully-fledged effective AIS and inhibits the knowledge spillover and the innovations diffusion. In modern conditions, improving the balance of AIS will lead to intensive development of the agricultural complex and will contribute to increasing their efficiency.

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ADULT LEARNING IN THE FIELD OF AGRICULTURE

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Abstract

In Romania, the used agricultural area is operated by approximately 3.4 million farmers whose main feature is the fact that they have the lowest level of professional training among all European Union countries. Many of these farmers lack basic skills that are considered essential for a modern agricultural economy. The main objectives of this paper are to analyze the current conditions and the main trends in the field of adult education in the agricultural sector and to identify its strengths and weaknesses. The analysis is centered to the current European context of lifelong learning and includes: statistical benchmarks, legal and institutional framework, adult training programs, funding sources and education and training providers. The working methodology targeted three stages: identification of documentary sources and collection of data and materials for analysis; statistical processing and analysis of data and information; information synthesis. The main conclusions of this study show that Romania has a well-established legal and institutional framework for adult learning with a diverse range of funding sources for the vocational training courses. In agriculture, the main vocational training providers are the county agricultural directorates/public advisory and extension service, private firms, agricultural faculties and non-governmental organizations. However the assessment of adult vocational training quality is facing the lack of a regulatory and implementation framework has led to the discrediting, to a large extent, of this type of training.

Key words**:** *adult learning, agriculture, vocational training programmes*

INTRODUCTION

With an agricultural area of 14.63 million hectares, out of which 64% arable land, Romania is an important agricultural country (ranking 6th in EU 28). Significant human resources are involved in the farming activity (23% of total employed population), this share placing Romania on a top position in the EU member states (yet on a downward trend). The population working in agriculture is old aged (about 40% over 50 years old) and has a low level of school education (more than 55% with primary and secondary education) (NIS, 2020) [15].

The utilised agricultural area is operated by 3.422 million farms, representing about one third of the total number of farms in the EU 28: 99.24% of these are individual farms without legal status, with an average area of 2.04 ha, operating 55.40% of UAA. Although Romania has the greatest number of farmers in the EU member states, these farmers have the lowest vocational training: 96.40% have only practical experience, 3.13% basic agricultural training and only 0.47% have full agricultural training (Eurostat, 2020) [7].

The Romanian farmers have the lowest training level in the EU, thus having the highest level of exposure to labour market volatility and to low incomes. Many farmers are lacking basic skills, which are considered essential for a modern agricultural economy. It is true that in a world increasingly characterised by important/radical technological changes, it becomes less and less likely for the Romanian farmers to rely only on the skills and knowledge they have acquired from their predecessors or from school. In addition, the development of agriculture involves complex issues that require not only knowledge in this field, but also in related fields, such as technology of information and communications, environmental protection, food safety, etc. These are the areas mostly exposed to innovation. It is obvious that formal agricultural education, regardless of level and

involved institution, is not sufficient to support a competitive agricultural sector. As a reaction to these challenges, the concept of lifelong learning has been promoted (Muenchhausen & Haering, 2012; EPRS, 2017; Barrantes & Yagüe, 2015) [13, 6, 2]. A key component of lifelong learning is adult learning. In the agricultural sector, adult learning is particularly important, as a higher number of workers who lack specific agricultural training are involved in the farming activity. Thus, adult learning targets three distinct sets of priorities in socio-economic development: needs and objectives of individuals, needs and objectives of institution and needs and objectives of society.

The farmers can follow a variety of paths in the field of education and vocational training beyond the formal system. For some people, the decision to return to education and vocational training is a difficult one: it is therefore necessary to use different approaches that offer participants the most flexible ways to participate. These may include formal, non-formal and informal learning, so that farmers can become involved in training or retraining programmes to improve their work and life opportunities, in general (MNE, 2015) [12].

MATERIALS AND METHODS

The main objective of this paper is to present the current conditions and trends in adult learning in the field of agriculture. The analysis is circumscribed to the current European context of lifelong learning and it includes: statistical benchmarks, legal and institutional framework, adult training programmes and funding sources, education and training providers, possible data on the efficiency of the existing system. We identified a series of expected educational needs/fields/themes. The working methodology targeted the following stages: i) identification of documentary sources and collection of data and materials for analysis; ii) statistical processing and analysis of data and information; iii) information synthesis.

RESULTS AND DISCUSSIONS

Adult learning: statistical benchmarks

The agricultural production conditions are changing fast due to urbanization, growing inequalities, human migration, globalization, change of food preferences, climate changes, environmental degradation, etc. Farmers must adapt their production and management systems to maintain and/or increase the competitiveness of their farms. Innovations are expressed in structural changes (farm size, cooperation, land ownership, labour force, own and/or loan capital, infrastructure, market structure) and in agricultural practices (intensity, productivity and specialization / diversification of existing systems, new products and technologies, innovations in management) (EC, 2017) [5]. The agricultural knowledge and information and the learning ability are prerequisites for successfully coping with these changes. Adult learning, as we have already specified, brings considerable benefits to people, to companies and to the entire society. Despite these benefits, the European Union is far from reaching the 15% target it has set for the year 2020.

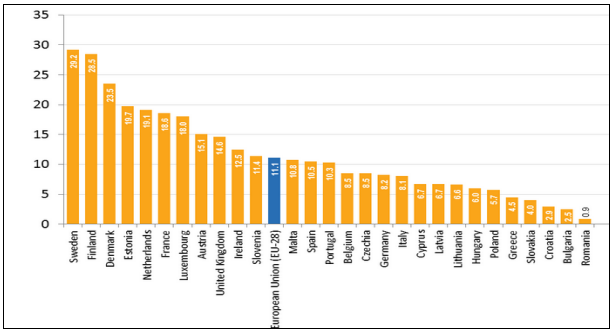

Fig. 1. Adult participation in learning, 2018
Source: Eurostat, 2018 [8].

The progress is even lower in Romania's case: participation of only 1%. Reaching the European benchmark for adult learning has been limited due to weaknesses in current policies implemented, both in the member states and at EU level (NIS, 2008) [14]. Effective policy actions are needed to correct and improve this situation: diversification of learning opportunities, fully or partially funded by governments; initiation of actions

to increase the availability of learning (both formal and non-formal, both at and outside the workplace); promoting actions that provide adequate learning opportunities for adults with specific needs (for instance, to be able to exercise a certain profession or to qualify); actions to increase employers' motivation to train and develop their employees, as well as the motivation of adults themselves to take up available learning opportunities, etc. (Grujika, 2016) [9].

An analysis of training hours, by field of study, reveal that Romania is above the European average in the case of four areas, including "agriculture, forestry, fisheries and veterinary medicine", in which case 11.2% of adults aged 25 – 64 years benefited from formal and non-formal education and training as against 1.8% at EU level.

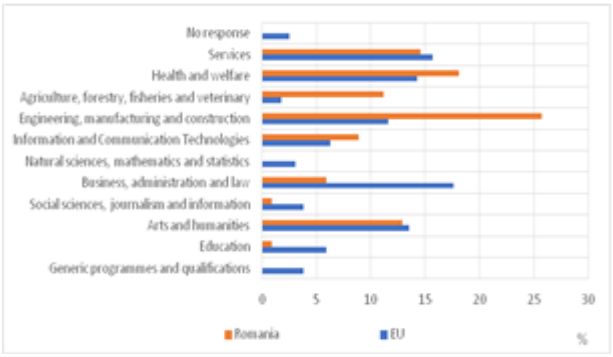

Fig. 2. Distribution of adult education and training by field of education in Romania and European Union, 2016 (% share of total hours spent by adults aged 25–64 on formal and non-formal education and training)
Source: Eurostat (trng_aes_174)

To foster competitive and sustainable farming at EU level, the Agricultural European Innovation Partnership (EIP-AGRI) was established, with the motto 'achieves more and better from less'. Its intervention fields target the following: i) promoting innovation and knowledge base in rural areas; ii) strengthening the links between research and innovation in agriculture and forestry; iii) promoting lifelong learning and vocational training in agriculture and forestry (EC, 2015) [4].

Legal and institutional framework

Romania has a well-defined legal and institutional framework, this regulatory framework targeting education, apprenticeship, internships, volunteering, as well as adult vocational training. This represents an asset for the development of the adult training system. Romania has also operated a series of changes in the legislative and institutional system over time, following the changes produced in the EU strategy in the field of education, in general, and vocational training, in particular.

As it can be seen in Table 1, several institutions in Romania are involved in adult vocational training.

Table 1. The main institutions involved in adult vocational training in Romania

Ministry of National Education (MEN) and Ministry of Labour and Social Justice (MMJS) have overall responsibility for policy, legislation and strategies in education and vocational training based on national and European requirements. *National Employment Agency (ANOFM)* is a public institution of national interest, with legal status, under the authority of MMJS. One of the main objectives of this institution is to boost employment and increase labour employment. The National Employment Agency applies the policies and strategies on labour employment and vocational training of persons looking for a job. It subordinates 42 county agencies in the structure of which there are 23 vocational training centres and 8 regional adult vocational training centres; *National Qualifications Authority (ANC)* designs and implements the methodological framework necessary for the development of the national qualifications system. The sectoral committees are social dialogue structures, coordinated by ANC, and have representatives in the National Qualifications Council, an advisory body at ANC level. Since 2013, sixteen sectoral committees have been established that are fully operational, having representatives of employers, trade unions, professional associations, vocational training providers, ministries and NGOs as members. The main roles of these committees are to validate the qualifications and associated standards, as well as to develop the training, evaluation and certification framework. *National Agency for Community Programmes in the Field of Education and Vocational Training* – in charge of the management of *Erasmus* +, a new EU programme for education, vocational training, youth and sports for the period 2014-2020 replacing several EU programmes and covering all the sectors of education. Different ministries or central / sectoral authorities are responsible for the organization / approval of different adult vocational training programmes (Ministry of Agriculture and Rural Development in the case of agricultural training).

Source: MNE, 2015 [12].

However, efforts are not well coordinated and the process is not sustained or comprehensive enough. The responsibilities are divided between different ministries and institutions.

Targeted groups/beneficiaries

According to the Romanian legislation into effect, adults are defined as persons aged at least 16 years (15 years with the consent of their parents). These can establish an employment relationship and participate in vocational training programmes. The access of adults – employees or unemployed – to vocational training is a right guaranteed by the Labour Code. In fact, the unemployed are obliged to participate in vocational training programmes, at the recommendation of local employment agencies where they are registered, otherwise unemployment benefits are withdrawn.

Romania has made significant efforts for adult training, but in practice adults' participation in education and training is quite limited and somewhat unbalanced.

Vocational training programmes

Adult vocational training is achieved through: a) authorised vocational training programmes, organised by authorised vocational training providers (for levels 1-5 according to CNC); b) evaluation of competencies acquired in ways other than formally, through assessment centres of competencies obtained in other ways than formally (for levels 1-3, according to CNC).

Vocational training through accredited training programmes

The accredited adult vocational training programmes can be organised for: *a) occupations* – according to the Classification of Occupations in Romania (COR) (approved by MMJS and NIS); *b) qualifications* – according to the List of Qualifications (approved by MMSJ and MEN); *c) key competencies* – common for several occupations (from the list approved by ANC, based on the 8 European key competencies).

The occupations and qualifications are described in terms of competency by occupational standards or training standards. These standards are designed by experts in each sector of activity and are validated by the sectoral committees and approved by ANC.

Adult vocational training is achieved through the following organization forms: a) *initiation* – acquiring of one or several competencies specific to a qualification according to the vocational training standard; b) *qualification, requalification* respectively, represents vocational training that leads to the acquisition of a set of professional competencies that enable a person to carry out activities specific to one or several occupations; c)*refresher training or specialisation* aims at developing or supplementing the knowledge or skills of a person who already has a qualification.

Participation in authorised vocational training programmes is completed by passing a graduation exam. Training completion requires the acquisition of graduation or qualification diplomas with national recognition and/or certificates of professional competence.

Evaluation and certification of professional competencies acquired in ways other than formally

The evaluation and certification of professional competencies obtained in ways other than formal ones (either on the job or in the family or in the spare time) is based on the occupational standards and should provide the guarantee that the certified person has the necessary knowledge and skills to carry out the activities described in the standard.

This type of evaluation is made in professional competencies assessment and certification centres authorised by ANC.

The challenges related to the assessment and certification of professional competencies acquired in non-formal and informal contexts are related to the administrative capacity of these centres. The evaluation and certification services are provided by ANC accredited experts. The professional competencies certificate obtained following this type of evaluation respects the regime of study documents in Romania and it is recognised both in Romania and in the EU member states. The professional competencies

certificate is the equivalent of qualification certificate.

Apprenticeship at the workplace

Apprenticeship is vocational training at work. It is organised for the qualification levels 2, 3 and 4 established by the legislation into effect and for the occupations included in the classification of occupations in Romania, for which vocational training and occupational standards respectively exist. Apprenticeship promotes the active involvement of social partners in the design and implementation of on-the-job learning. The number of apprenticeship contracts has not been encouraging in previous years, and out of this reason, it is considered that increasing the amounts offered to employers could stimulate them to hire inexperienced people who want to participate in vocational training programmes.

Funding sources

The most important funding sources for the participation in adult vocational training are the following:

Public funds – on the basis of the Labour Code, public institutions must draw up annual vocational training plans for employees and implement these plans. The financial support of these plans is made according to allocations from the state budget.

Table 2. Vocational training of employees in APIA- Agency of Payments and Interventions for Agriculture

APIA, in the Human Resource Strategy for the period 2015-2020, has set as main objective the development of the human capital of the institution. This objective will be reached in two stages. In a first stage, the focus is laid on providing vocational training programmes that will meet the immediate labour training needs for the tasks assigned to each employee. The second stage aims to meet the vocational training needs of staff and strengthen the acquired skills, on the long term.

Source: APIA, 2014 [1].

In the case of the unemployed, an important source for funding the vocational training measures is the unemployment insurance budget. In this case, the courses are organised by ANOFM through its county units. In the field of agriculture, the participants obtain certificates of qualification, such as: agricultural worker, zootechnical worker, agricultural mechanic, field crop equipment operator, etc.

European funds: Romania has benefited from pre-accession and post-accession European funds, for vocational training measures inclusively. For instance, before the accession to the EU, a series of Phare projects were carried out, through which both rural teachers and trainers for agricultural workers were trained. Prior to 2007, the year of Romania's accession to the EU, a series of bilateral vocational training projects were carried out with the Netherlands, Germany, United Kingdom, etc., targeting the ANC staff, members and experts of sectoral committees, human resources involved in accrediting vocational training providers, etc. Since 2007, the vocational training measures have become eligible through the European Agricultural Fund for Rural Development and the European Social Fund (in conformity with the Sectoral Operational Plan Human Resources Development).

Private funds: Private employers, according to the Labour Code, have the obligation to support financially the training of their employees. Yet, in practice, most enterprises do not allocate funds to support this activity.

In the agricultural sector, there are also farmers who are willing to pay for acquiring new competencies and practical skills, for the development of their career or for their personal development. Usually, the persons willing to pay for their vocational training prefer to participate in training programmes offered by accredited training providers who issue national recognition certificates.

Vocational training providers

The vocational training providers for adults can be natural or legal entities, of public or private law, based in Romania, in the EU member states or in the EEA countries, regardless of their legal organization form.

Depending on the type of vocational training programme, the authorised training provider can issue the following types of certificates: a) certificate of professional qualification – for qualification or requalification courses and apprenticeship at work; b) graduation certificate – for initiation courses and

internships, as well as for refresher or specialisation courses and internships. These documents are issued by the authorised institutions and have the status of study documents, being accompanied by an annex that stipulates the professional competencies acquired.

Providers of vocational training in agriculture. In agriculture, the main providers of vocational training courses are the County Agricultural Directorates, the private firms, the faculties with agricultural profile, the non-governmental organizations, etc.

The county agricultural directorates /public agricultural advisory service – are relatively new institutions on the vocational training market for farmers: since 2017, they have provided training courses for farmers. The courses are organised at the headquarters of institutions or in the territory.

Table 3. Types of courses provided by the public agricultural advisory service

Qualification courses – dedicated to persons with no vocational training or with a low level of knowledge. They target the following fields: agriculture, horticulture, livestock farming, agriculture mechanization, pisciculture, food industry, agro-tourism and other fields required. The main objective is to provide to participants knowledge and skills necessary in the implementation of modern technologies. The qualification courses are of standard type – with duration of 3 months and a total number of 360 hours, out of which 120 theoretical hours and 240 hours practical work. For the theoretical training, experts from agricultural chambers and research institutes and stations are involved. The practical training takes place on units with agricultural profile (private farms, didactic farms, didactic production workshops, processing units, etc.), which have the necessary endowments.
Initiation courses – organised for acquiring minimum knowledge and skills necessary to carry out activities in agriculture and related fields. They address mainly to farmers who wish to access European funds under NRDP measures, as well as to those who have already started an agricultural business with their own efforts and do not have the necessary training. The duration of these courses is minimum 150 hours (50 theoretical hours and 100 practical hours). The thematic targets: CAP 2014-2020; implementation of cross-compliance rules in support schemes and measures for farmers: agriculture adaptation to climate changes; attenuating the climate change effects on agriculture and countryside; utilisation of renewable energy sources; crop, livestock farming and primary processing technologies.
Training courses – intended, in general, for farmers wishing to obtain new information on technologies, legislation, financing programmes, scientific research results, etc. The thematic of this type of courses is established according to farmers' requests and the priority objectives of the Ministry of Agriculture and Rural Development (MARD).
Refresher courses – organised for improving the vocational training of advisors (addressed to the county and local experts). These benefit from periodical training courses on the new regulations in agriculture.

Source: MADR, 2014 and 2015 [10, 11].

The County Agricultural Directorates have taken over the vocational training activity from the County Agricultural Chambers which, according to the legislation into effect, began to be abolished starting with the year 2017 (Law 157/2016 and Government's Decision 860/2016).

During their operation period, the county agricultural chambers were authorised as vocational training providers in agriculture by ANC for the following types of courses: initiation, qualification, training, training of trainers and refresher courses.

The agricultural universities and faculties - provide in their strategies the development and diversification of adult training forms, post-graduation courses, continuous training, professional re-training, specialisation and in-depth training. Most agricultural faculties, alone or in partnership with private firms, farmers' associations, public institutions, etc., can be involved in farmers' vocational training.

The private firms – can provide vocational training service if they have included this activity in their constitutive act. Private vocational training providers can be the following: providers accredited at national level – issue national recognition certificates; accredited / authorised providers at sector level – deliver recognized certificates at sector level.

The agricultural input suppliers can also provide vocational training to farmers, while promoting the sale of their products. The vocational training activities are accompanied by technical assistance, documentation materials, practical demonstrations, etc.

Non-governmental organizations: Romania has a dynamic NGO sector. A report on this sector, published by the Civil Society Development Foundation in late 2015, showed that 48,586 non-governmental organizations were operating in Romania, out of which 10% in the agricultural sector. The agricultural NGOs mainly operated in the following sectors: livestock farming, agro-processing industry, food industry, arable crops, forests, soil and water protection and conservation (FDCS, 2017) [3].

There is not much information on the collaboration and cooperation in the field of vocational training provided by these organizations, as this is a relatively recent activity (it was initiated mainly with the emergence of the opportunity to access European funds).

CONCLUSIONS

Romania has set itself the goal to increase the participation rate of adults (25-64 years) in lifelong learning to 12% by the year 2020. However, according to statistics, our country has one of the lowest participation rates (1%), below the level established at EU level (15%). This limited participation is due to the existence of the following constraints: i) insufficient and asymmetric information between the institutions involved; ii) low incentives to participate in vocational training activities; and iii) inadequate institutional capacity (WB, 2017) [16].

Romania has a well-established legal and institutional framework for adult learning. According to the legislation into effect, vocational training is organised both through authorised vocational training programmes, organised by authorised vocational training providers (for levels 1-5 according to CNC), and through the assessment of competencies obtained in ways other than formal (for levels 1-3, according to CNC). The authorization process is bureaucratic and time consuming.

There is a diverse range of funding sources for the vocational training courses: a) governmental funds: unemployment insurance budget – courses are organised by ANOFM through its county units; b) European funds – Romania has benefited from pre-accession and post-accession funds; c) private funds – funds provided by employers and private funds of farmers.

Any public or private institution with vocational training role, specified in its legal status, can provide vocational training programmes, but only the authorised institutions can issue national recognition certificates. In agriculture, the main vocational training providers are the county agricultural directorates/public advisory and extension service, private firms, agricultural faculties and non-governmental organizations.

The assessment of adult vocational training quality is facing the lack of a regulatory and implementation framework, which has led, over time, to the discrediting, to a large extent, of this type of training. Although mechanisms have been developed to certify the learning results in adult vocational training, their implementation has been deficient and does not ensure the system-level confidence in the quality of qualification certificates.

As regards the recognition and validation of the learning results acquired in formal and informal context, although a recognition and validation procedure has been developed, the institutional capacity for its implementation is still limited.

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STOCHASTIC FRONTIER PRODUCTION FUNCTION: AN APPLICATION TO ANKARA MOHAIR GOAT FARMING SYSTEM

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Abstract

The main purpose of this paper is to ascertain changes in the performance of the Mohair (Ankara) goats farming system during the 2017-2018 production periods. In this study, we examined both production and technical efficiency of goat's farms in Ankara. The study adopted the stochastic frontier production function to estimate technical efficiency of the mohair goat establishments in the study area. The model utilized data from 45 Turkish mohair goat farmers. At the same time, technical inefficiency effect model also was calculated by the same method. The Cobb-Douglas production function was ascertained as a best fitted model. In addition, the technical inefficiency effects contained random element. The empirical results revealed statistically insignificant individual effects of some of the variables. However, all of the joint effects of these four explanatory variables on the levels of technical inefficiencies were statistically significant in the mohair goat farming system of Ankara in Turkey.

Key words**:** *stochastic frontier production function, mohair (ankara) goats*

INTRODUCTION

Angora goat was only bred in Anatolia until 1838 when the breeding spread to several other countries, mainly to South Africa. Angora goat is not generally grown in Ankara only, but also in some other provinces such as Konya, Karaman, Kırşehir, Niğde, Yozgat, Eskişehir, Kütahya, Bolu, Afyonkarahisar, Çankırı, Çorum, Kastamonu, Siirt, Mardin, Bitlis and Van. Angora goats are uniquely characterized by a cover of soft body, small, curly and bright mohair. A very important production strategic purpose is for their mohair. The mohair comes in variety of featured colours such as white, cream, yellow, black, gray, brown and black. Some determinant criteria for mohair yield is as follows: gender, age and feeding type of Angora goats. Mohair yield from male goats differs from that of female goats; Yield range from an average of 3 kg in males and 1.5 - 3 kg in females. Mohair is used in different sectors for products such as clothing, blankets, carpets, shawls, hats, scarves, boots, slippers, wigs etc. [9].

Objectives of this study: Firstly, the study seeks to explore the technical efficiency effects are searched. Second, if present, whether or not they contain a significant random element. Third, as a matter of importance to question whether technical inefficiency effects are influenced by farm specific factors. Fourth, the other crucial question is to assess the return to scale in mohair farming in Ankara.

This paper contains three sections as follows: section two describes the stochastic frontier model used in this study. Section three presents empirical results and discussion. And, the final section consists of the major conclusions of our research.

MATERIALS AND METHODS

Stochastic frontiers and efficiency measurement

Analysis of this data was implemented by the production function frontier approach. The determination of maximum possible output per unit produced given input X [5]. [1], [5] were the first author to emphasize about the stochastic frontier production function.

The subject of production efficiency measurement has been a crucial research area in economics and other scientific subjects. In this study, Stochastic frontier production function has been used. [3] implemented the stochastic frontier production function onto many agricultural studies. [8] emphasied that there are some advantages of stochastic frontier models. These advantages are as follows: Firstly, it presents a disturbance term which stands in for statistical noise, measurement error and exogenous shocks exceeding the control of production units which in other respects, would be attributed to technical inefficiency. Secondly, it renders the underlying foundation for carrying out statistical tests of hypthosis relating to the production structure and the extent of inefficiency. Thirdly, the evaluation of frontier function and efficiency can be accomplished either in one or two stages.

In this paper, [2] approximations were used. One of this approximation is stochastic and the other is effects of technical inefficiency in the frontier function. Estimation of all the parameters ~~is~~ were made by the Maximum Likelihood Method that forms a single step estimation analysis in this study. [6] emphasized an approach to efficiency measurement and conducted an empirical analysis from different sampled farmers in Pakistan. [4] estimated the production of the technical efficiencies and implemented their approaches during their study.

Model and variables

The study used primary data which were collected from 45 mohair goat farmers/establishments located in the Ankara province [7]. For estimating the parameters, Cobb-Douglas production function, being an adequate model and given the properties of the corresponding frontier model, was used. In this paper, stochastic frontier model is defined as follows:

$$\ln(Y_i) = \beta_0 + \beta_1 \ln(X_{1i}) + \beta_2 \ln(X_{2i}) + \beta_3 \ln(X_{3i}) + \beta_4 \ln(X_{4i}) + \beta_5 \ln(X_{5i}) + V_i + U_i \quad \text{.....(1)}$$

where:

Ln: represents the natural logarithm that is base: e,

The subscript, i denotes the i^{th} farmer in this research sample i=1,2,…,45.

Mohair production, (Y_i): the total mohair production for the farmer,

Employee wage (X_{1i}): the total employee;

Forage (X_{2i}); the quantity of forage;

Veterinary (X_{3i}): the total cost of veterinary applied to all of he goat;

Vaccine-medicine (X_{4i}): the total cost of vaccine-medicine

Other costs (X_{5i}): the other remains total costs.

The $\beta_k's$: k=0, 1, 2, 3, 4, 5 are undisclosed parameters for the production function.

The $V_i's$: represents random errors associated with errors of measurement in the production of mohair as reported, or the combined effects of input variables which are not included in the production function, where $V_i's$ are assumed to be independently and identically distributed $N(0, \sigma_v^2)$ random variables.

The $U_i's$ represent non-negative random variables that are associated with technical inefficiency of production by the farmers which are assumed to be indepently distributed in such a way that the technical inefficiency effect for the i-th farmer.

U_i is obtained by truncation at zero of the normal distribution with mean U_i and variance σ^2 such that,

$$U_t = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} \quad \text{.....(2)}$$

where:

Z_{1i} : the state support,

Z_{2i} : marketing,

Z_{3i} : stud animals,

Z_{4i} : animals disease,

δ_s : unknown parameters to be estimated.

Frontier 4.1 software program was written by [3].

It was used to estimate for the stochastic frontier model. Estimated variance parameters from the frontier model are $\sigma_s^2 = \sigma_v^2 + \sigma^2$ and $\gamma = \frac{\sigma^2}{\sigma_s^2}$ and here the γ parameter has values ranging between zero and one.

RESULTS AND DISCUSSIONS

The parameters of the stochastic frontier production function are estimated using the maximum likelihood estimation. According to the equation 1 and 2 are calculated and these results are given in here standard errors and t-values in Table 1.

Table 1. Parameters of Stochastic Frontier Production Function and Inefficiency model for Mohair Goat Farmers in Ankara, Turkey

Variable	Coefficient	Standard-error	t-value
β_0	0.298	0.967	0.309
Ln of Employee wage	-0.222	0.633	-0.351
Ln of Forage	0.106	0.111	0.955
Ln of Veterinary	-0.418	0.896	-0.467
Ln of Vaccine-medicine	0.567	0.948	0.598
Ln of Other costs	0.613	0.199	0.309
Inefficiency model			
δ_0	-0.245	0.161	-0.152
The state support	0.325	0.107	0.306
Marketing	-0.220	0.159	-0.138
Stud animals	-0.273	0.944	-0.289
Animals disease	-0.111	0.358	-0.311
Variance parameters			
σ_s^2	0.733	0.192	0.382
γ	0.999	0.169	0.593
Log-likelifood Function	-54.79		

Source: Authors' results.

Stochastic Frontier:

$$\ln Y = 0.298 - 0.222\ln(\text{Employee wage}) + 0.106\ln(\text{Forage}) - 0.418\ln(\text{Veterinary}) + 0.567\ln(\text{Vaccine} - \text{medicine}) + 0.613\ln(\text{Other costs})$$

Inefficiency model:

$$U_t = -0.245 + 0.325\text{The state support} - 0.220\text{Marketing} - 0.273\text{Stud animals} - 0.111\text{Animals disease}$$

Variance Parameters:

σ_s^2=0.733,

γ=0.999

Log(likelihood)= -54.79

Table 2. Tests of hypothesis for parameters of the inefficiency frontier model for Mohair Goat Farmers in Ankara, Turkey

Null Hypothesis	Log (Likelihood)	$\chi^2_{0.95-value}$	Test Statistic*	Decision
$H_0: \gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$	-38.79	11.07	66.13*	H_0 Rejected
$H_0: \gamma = 0$	-49.86	9.49	39.91*	H_0 Rejected
$H_0: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$	-36.11	9.49	71.49*	H_0 Rejected

Source: Authors' results.

The best fit function for data was found to be The Cobb-Douglas production function taking into account the specification of the corresponding Translog production function model. Log-Likelihood function value for The Cobb-Douglas model was 54.79. Due to the fact that Cobb-Douglas production function is used in model, β estimates shows the elasticities of production. The estimate of the variance $\gamma = \frac{\sigma^2}{\sigma_s^2}$ linked with the inefficacy effect is nearly 99.9% of the two variances that it has high value.

The first null hypothesis is tested under the equation as follows:

$$H_0: \gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$$

This equation shows the omit of u_i from the exact model that it implies the restrictions on the full model. When the implementation of restriction on the full model (As shown in equation 1 and 2), log likelihood statistics reduces -38.79. Test statistics value has 66.13 and it is bigger than the critical value 11.07. We can give a decision as a reject for the first restriction. The first null hypothesis is rejected.

The results of hypothesis test of the stochastic frontier parameters and inefficiency effects models for mohair goat farmers in Ankara district are given in Table 2. In this Table 2, the first column belongs to the restriction imposed, that is the null hypothesis. And, the second column shows log likelihood statistics and we can define this column as imposed on the original model. Test statistics are shown in the third column. Critical values for the test statistic are presented in the fourth column. The last column represents the decision column indicating that null hypothesis tested is rejected or not. That is; whether restrictions are valid or not.

The second null hypothesis is given in Table 2 as follows: $H_0: \gamma = 0$ which shows that technical inefficiency effects aren't stochastic. Given γ is zero, the variance of the technical inefficiency effect is zero. We can conclude from this extraction that the model reduces the traditional mean response function where the state support, marketing, stud animals and animals disease variables are included in the production function. Moreover, the second null hypothesis ~~is~~ equals to zero and then δ_0 parameter is not identified. Namely, we can say that, the production function has an intercept value. If we implement the restriction on the model ($H_0: \gamma = 0$), log likelihood statistics ~~is~~ becomes -49.86. A generalized likelihood ratio test statistic of 39.91, this value is larger than the critical value of 9.49. In conclusion, the second null hypothesis is rejected and the technical inefficiency effects aren't random.

The four agricultural spesific factors which were included in the inefficiency model have a crucial influence on the degree of technical inefficiency linked with the mohair goat farmers. Null hypothesis is given below:

$$H_0: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$$

When this restriction was imposed on the full model, the log likelihood statistics reduces to -36.11. Test statistics belonging to likelihood ratio ~~is~~ was 71.49. This value is greater than the critical value of 9.49. That is to say, the four agricultural specific factors do not have any effects on the technical inefficiency. For this reason, we can reject the null hypothesis.

CONCLUSIONS

Different restrictions were implemented on the model by equation 1 and 2. Likelihood ratio tests were very crucial in deciding to control whether the restrictions are valid or invalid.

While the individual effects of some of the variables aren't statistically significant, the joint effect of these four explanatory variables on the levels of technical inefficiencies were statistically significant.

In a stochastic frontier production function, technical inefficiency effects were estimated. An application of this model was implemented by using data from 45 Turkish mohair goat farmers in Ankara Province of Turkey. The model for the technical inefficiency effects indicated a significant signs in the stochastic frontier production function. After estimating this model, we can say that inefficiency effects are both stochastic and have a known distribution.

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MODEL TO DESCRIBE THE INFLUENCE OF N AND PK FERTILIZERS IN THE VARIATION OF RAPESEED PRODUCTION

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Abstract

The production variation in relation to fertilizers with N and PK was analyzed. The study was conducted on rapeseed. Four levels of fertilization with PK (0, 80, 100 and 120 kg a.s. ha^{-1}) and three levels of fertilization with N were performed (0, 70, 140 kg a.s. ha^{-1}). The combination of doses resulted in 12 experimental variants, which ensured the differentiated nutrition of the plants. Production ranged from 986.88 kg ha^{-1} (V1), and 3,167.33 kg ha^{-1} (V9). The variation of production was described by a function of type Y = f (N, PK), in conditions of statistical certainty (R^2=0.976, p<0.001). From the analysis of the values of the production increase given by N and PK, it was found that, with the increase of N doses, in the studied interval, the contribution of PK to the production increase was more and higher. Regarding PCA, PC1 explained 99.244% of variance, and PC2 explained 0.65613% of variance. The PCA diagram highlighted the distribution of the considered variants, in relation to the attributes of the experiment, N, PK and Y. The cluster analysis facilitated the grouping of variants based on Euclidean distances, in conditions of statistical safety, Coph. corr. = 0.762. Based on similarity and distance indices (SDI) the highest degree of similarity was identified between variants V2 and V12 (SDI = 11.49), followed by variants V8 and V11 (SDI = 31.71), and variants V6 and V7, respectively (SDI = 100.6).

Key words: *experimental attributes, model, NPK, PCA, similarity distance indices, yield*

INTRODUCTION

The production of crop plants is dependent on inputs and factors, and their sizing requires a permanent adaptation and adjustment in order to optimization [23], [49].
Fertilizers represent important inputs in plant production, and dose sizing is a particularly important technical aspect, in relation to the agricultural system, soil and climatic conditions, production and its quality [32], [43], [48].
Macronutrients (NPK) represent the highest consumption of mineral elements for crops. Harmonization of the doses of these elements is important for crop plants. Nitrogen is a nutrient that quantitatively defines plant growth, biomass production and agricultural production, in general [18], [44], [51]. Phosphorus and potassium are macro elements with major influence in fruiting, production quality, and plant tolerance to certain vegetation conditions [54], [11], [6].
Various studies have addressed the influence of nutrients (macro- and microelements) in order to analyze and model the variation of production and quality at crop plants, in relation to them [17], [4], [16], [25], [5].
Optimization problems are permanent, in relation to agricultural systems [12], [26], [37], in relation to crop plants and the production potential of cultivated genotypes [24], [3], [7], with the spatial and temporal variability of soil fertility [29], [50], [22], with the variation of market requirements for agricultural products [38], [39], with climatic conditions variations [14], [47], with crops technologies [2], [42], or facilities offered by related fields, remote sensing, GIS, smart agriculture [13], [19], [20], [8], [10], [30].
The present study analyzed the variation of rapeseed production in relation to different doses of nitrogen (N) and phosphorus and potassium (PK) considered together, in order to estimate by models the response of rapeseed plant crop, and the production increase.

MATERIALS AND METHODS

The study looked at the influence and contribution of nitrogen (N), phosphorus and potassium (PK) on rapeseed production.
The study was carried out in the Zadareni - Arad area, in chernozem type soil conditions.
The biological material was represented by rapeseed (*Brassica napus* L.).
Differentiated nutrition was provided to the plants by fertilization with nitrogen (N) and phosphorus and potassium (PK).
Four levels of PK fertilization (0, 80, 100 and 120 kg a.s. ha^{-1}) were performed. On each level of PK fertilization, three levels of nitrogen fertilization were performed (0, 70, 140 kg a.s. ha^{-1}). From the combination of the two types of fertilizers (N and PK), 12 experimental variants resulted.
The influence of fertilization on rapeseed production was analyzed, in terms of the two types of fertilizers used.
The analysis of the experimental data was done with EXCEL and PAST software [15]. The graphical distribution of the production values according to N and PK fertilizer was made with Wolfram alpha software [46]. Variance analysis, correlation analysis, regression analysis, PCA and cluster analysis were used.
As a statistical safety parameters the regression coefficient (R^2), the correlation coefficient (r), the Cophenetic coefficient (Coph. corr.), similarity and distance indices (SDI), the p parameter and the F test, respectively, were used.

RESULTS AND DISCUSSIONS

The study analyzed the influence of N and PK on rapeseed production and hypothesized the finding of models to describe the variation and distribution, based on similarity, of the experimental variants.
Under differentiated nitrogen (N) and PK fertilization conditions, rapeseed production ranged from 986.88 kg ha^{-1} (V1) to 3,167.33 kg ha^{-1} (V9) (Table 1).
Nitrogen fertilization, on the four levels of fertilization with PK led to the variation of production between 986.88 kg ha^{-1} (V1) and 1,796.52 kg ha^{-1} (V3), in PK0 conditions; 1,537.99 kg ha^{-1} (V4) and 2,734.53 kg ha^{-1} (V5) in PK80 conditions; 2,156.50 kg ha^{-1} (V7) and 3,167.33 kg ha^{-1} (V9) in PK100 conditions; 2,378.00 kg ha^{-1} (V10) and 2,964.98 kg ha^{-1} (V11) in PK120 conditions, respectively. Graphic representation is presented in Figure 1.

Table 1. Rapeseed production, under the influence of N and PK fertilization

Fertilizer doses (kg active substance ha^{-1})		Experimental variant	Yield
N	PK	Trial	Kg ha^{-1}
0	0	V1	986.88^{ooo}
70	0	V2	1,345.87^{ooo}
140	0	V3	1,796.52^{ooo}
0	80	V4	1537.99^{ooo}
70	80	V5	2,734.53
140	80	V6	2,055.90***
0	100	V7	2,156.50^{ooo}
70	100	V8	2,933.27*
140	100	V9	3,167.33***
0	120	V10	2,378.00^{ooo}
70	120	V11	2,964.98**
140	120	V12	2,746.02
Limits of Significance of Differences (LSD) Interpretation was made compared to V5			LSD5% = 162.690 LSD1%=221.636 LSD0.1%=297.873

Source: Own data from the experiment.

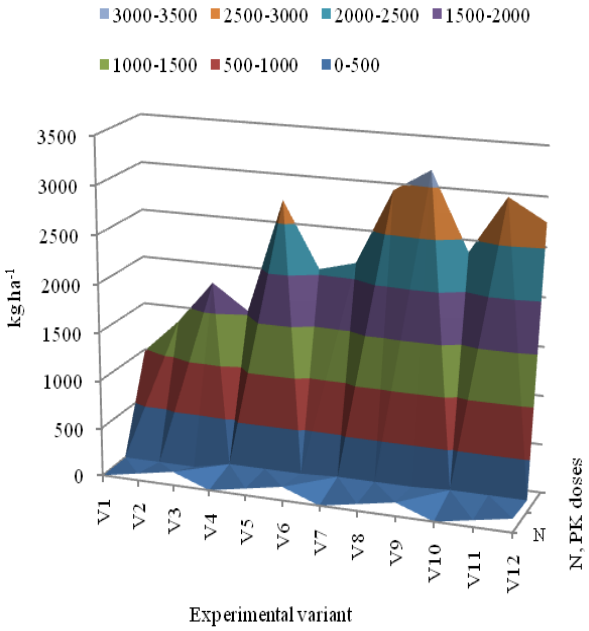

Fig. 1. Graphic distribution of production in relation to experimental variants
Source: Original graph, based on experimental data.

The variation of rapeseed production (Y), depending on the doses of N and PK was described by equation (1), in statistical safety conditions, according to R^2=0.976, p<0.001, F=59.0258. For high accuracy, the values of the coefficients of equation (1) were used to 16 digits.

The 3D distribution of production, depending on N and PK, is shown in Figure 2, and the distribution in the form of isoquants is shown in Figure 3.

$$Y = ax^2 + by^2 + cx + dy + exy + f \quad (1)$$

where: Y – rapeseed production;
x – N fertilizer (kg a.s. ha^{-1});
y – PK fertilizers (kg a.s. ha^{-1});
a, b, c, d, e, f - the equation (1) coefficients;
a= -0.1049769;
b= -0.0137494;
c= 27.0952100;
d= 21.6663994;
e= -0.0774712;
f= 0.

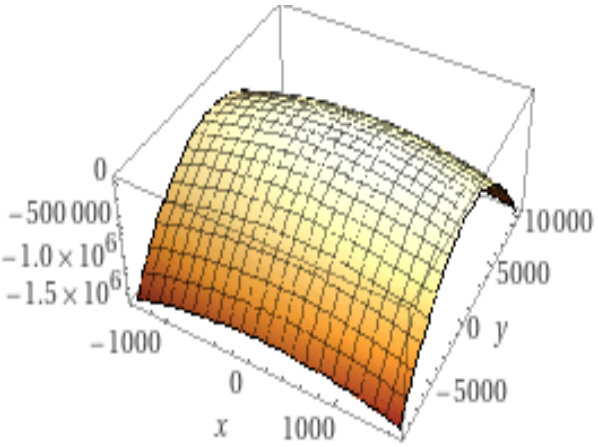

Fig. 2. 3D graphical distribution of Y values in relation to N (x-axis) and PK (y-axis)
Source: original graph based on experimental data, generated with Wolfram Alpha [46].

The 3D graphical distribution shows a much wider variation of rapeseed production in relation to PK, compared to the variation depending on N.

The production increase generated by N and PK for rapeseed is shown graphically in Figure 4.

From the analysis of the values of the production increase given by N and PK, it was found that the PK contribution to the production increase was higher compared to the N contribution, under the study conditions.

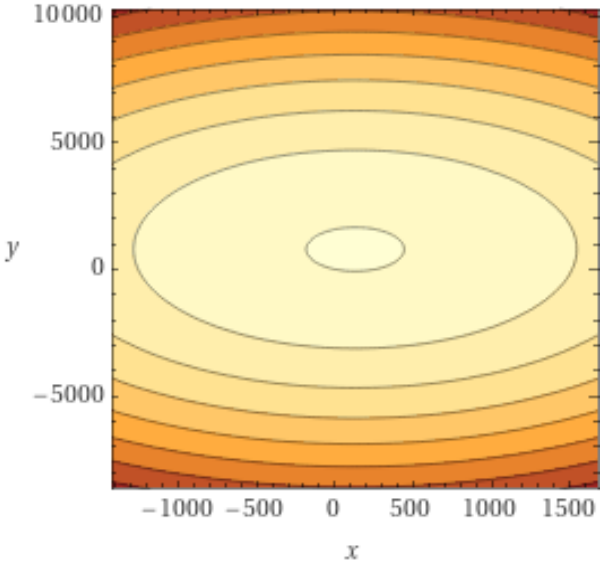

Fig. 3. Graphic distribution in the form of isoquants of Y values in relation to N (x-axis) and PK (y-axis)
Source: original graph based on experimental data, generated with Wolfram Alpha [46].

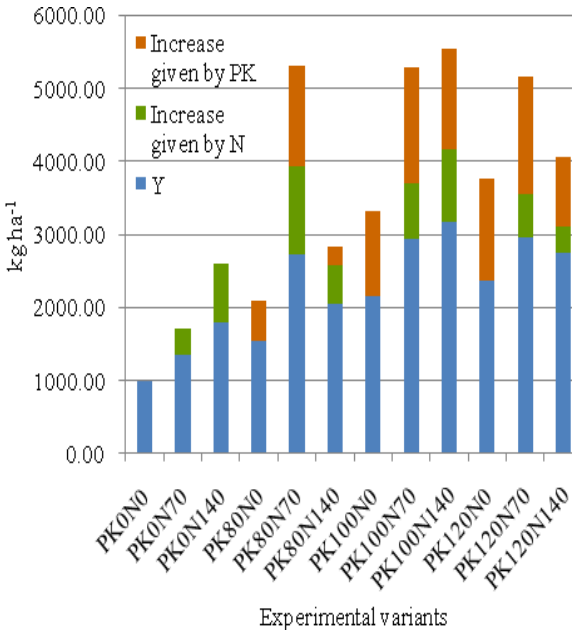

Fig. 4. Graphical representation of the production increase generated by N and PK fertilization in rapeseed
Source: original graphic generated based on experimental data.

The results are consistent with other research on the relationship between N and PK for plant nutrition. With the increase of N doses

through fertilization, there is an increase in the need for P, respectively K of plants, and nutrition and production relationships have been studied to different crops, such as wheat, corn, sunflower, rapeseed etc. [21], [36], [27], [1], [31].

Principal Component Analysis led to the diagram in Figure 5. PC1 explained 99.244% of variance, and PC2 explained 0.65613% of variance.

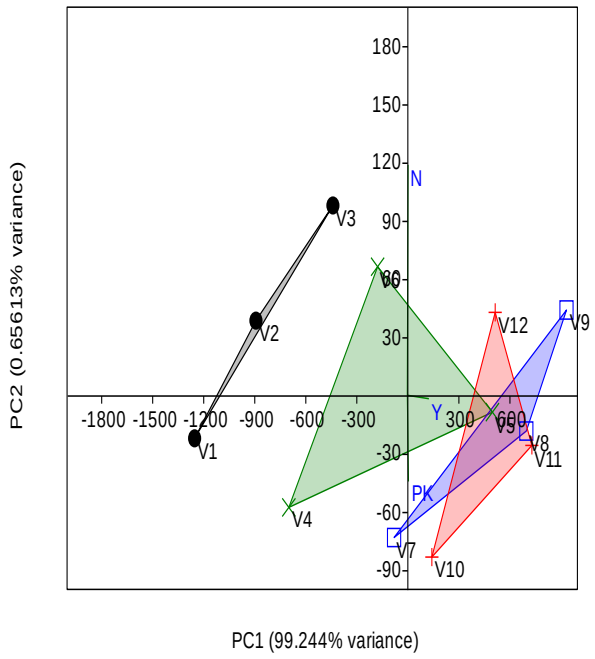

Fig. 5. PCA variant distribution diagram
Source: original figure, generated based on experimental data

From the analysis of the PCA diagram, it was found the independent placement of the first three variants (single fertilization with N). Associated PK biplot were placed variants V4, V7 and V10 (fertilization with PK 80, 100 and 120 kg ha^{-1}, and N0).

In relation to the attributes of the experiment (Y, N, PK), associated with the Y biplot, the variants V5, V8, V9, V11 and V12 were registered, which ensured high production levels.

Cluster analysis facilitated the grouping of variants based on Euclidean distances, figure 6, in statistical safety conditions, Coph corr. = 0.762.

Two distinct clusters were obtained. A cluster C1 comprises variants V1 - V4, with V1 on a separate position, V2 and V4 with values of the similarity index SDI = 192.12, to which variant V3 is associated.

Cluster C2 comprises two sub clusters (C2-1 and C2-2), each grouping several variants. Cluster C2-1 comprises three variants (V6, V7) for which SDI = 100.6, and V10 which is affiliated to this group. Cluster C2-2 comprises five variants. The V9 variant was positioned on a distinct position, which generated the best production results. Variants V5 and V12 were associated and had the best value on the similarity index (SDI = 11.49). V8 and V11 variants were also associated, for which SDI = 31.71 (Table 2).

Within the C1 cluster, the framed variants generated products between 986.88 kg ha^{-1} (V1) and 1,796.52 kg ha^{-1} (V3). The variants from cluster C2-1 generated productions between 2,055.90 kg ha^{-1} (V6) and 2,378.00 kg ha^{-1} (V10). The variants within the C2-2 cluster generated productions between 2734.53 kg ha^{-1} (V5) and 3167.33 kg ha^{-1} (V7).

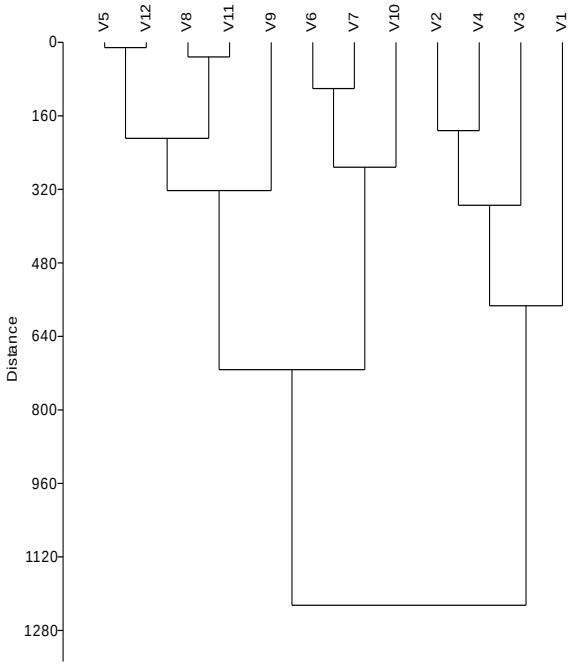

Fig. 6. Cluster diagram of grouping variants based on Euclidean distances
Source: original diagram based on experimental data.

Within each cluster, different fertilization options have led to similar results, which provide important information for agricultural practice. It is possible to opt for certain fertilization, in relation to the production

interval in which it is desired to obtain the results, and different fertilizations have different costs. Thus, the production and costs of fertilization can be taken into account to choose an appropriate fertilization option.

Table 2. Values for similarity and distance indices (SDI), depending on the rapeseed production influenced by N, PK fertilization

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
V1		358.99	809.64	551.11	1,747.7	1,069	1,169.6	1,946.4	2,180.4	1,391.1	1,978.1	1,759.1
V2	358.99		450.65	192.12	1,388.7	710.03	810.63	1,587.4	1,821.5	1,032.1	1,619.1	1,400.2
V3	809.64	450.65		258.53	938.01	259.38	359.98	1,136.8	1,370.8	581.48	1,168.5	949.5
V4	551.11	192.12	258.53		1,196.5	517.91	618.51	1,395.3	1,629.3	840.01	1,427	1,208
V5	1,747.7	1,388.7	938.01	1,196.5		678.63	578.03	198.74	432.8	356.53	230.45	11.49
V6	1,069	710.03	259.38	517.91	678.63		100.6	877.37	1,111.4	322.1	909.08	690.12
V7	1,169.6	810.63	359.98	618.51	578.03	100.6		776.77	1,010.8	221.5	808.48	589.52
V8	1,946.4	1,587.4	1,136.8	1,395.3	198.74	877.37	776.77		234.06	555.27	31.71	187.25
V9	2,180.4	1,821.5	1,370.8	1,629.3	432.8	1,111.4	1,010.8	234.06		789.33	202.35	421.31
V10	1,391.1	1,032.1	581.48	840.01	356.53	322.1	221.5	555.27	789.33		586.98	368.02
V11	1,978.1	1,619.1	1,168.5	1,427	230.45	909.08	808.48	31.71	202.35	586.98		218.96
V12	1,759.1	1,400.2	949.5	1,208	11.49	690.12	589.52	187.25	421.31	368.02	218.96	

Source: Original data, resulting from the analysis of experimental values.

It is obvious that for a high level of production, a balanced fertilization is necessary, a consistent contribution of PK to production being registered also by the present study.

The analysis of the obtained results shows the differentiated contribution of the two categories of mineral elements (N and PK) on the production, in the case of the present study of rapeseed production.

Under the conditions of the singular application of N, the harvest had an increasing trend, in the range of the studied fertilizer doses.

A relatively balanced share of the two categories, N and PK in production generation, was recorded in the case of variant V5 (N80, PK70).

As the dose of PK increases, the level of production increases, associated with N, and the share of the two types of fertilizers, N and PK, in the production increase was changed, in the context of experimental conditions.

A higher value of the production increase was associated with PK fertilizers, compared to N.

PCA method explained the source of the variance in the experimental data set, and the cluster analysis facilitated the grouping of the variants in relation to the experimental attributes. Within each of the three clusters, different fertilization variants, in the range of studied doses, led to similar productions, under the experimental conditions.

This model of grouping and presentation of variants offers the possibility to choose a certain experimental variant depending on the expected level of production afferent to a certain level of input, in the form of fertilizer allocation

PCA is a very objective method in the analysis, evaluation and differentiation of variants in relation to different performance or benchmarks [33], [34].

Cluster analysis is also a very useful method in analysis and sorting - classification of results, especially in the case of a large number of variants, for the analysis and understanding of variability and degree of similarity, as an effect under different influencing factors [40], [28], [53], [35].

The results obtained are consistent with other studies, which reported similar results on the analysis and classification of the effect of some mineral elements on different plants of

interest [41], [52], [45], [9].

CONCLUSIONS

N and PK fertilizers have differentiated the influence of rapeseed production. With the increase of the doses of PK fertilizers, a higher production increase was registered and associated with a better capitalization of N.
The mathematical model described in statistical safety conditions the variation of the production in relation to the two categories of fertilizers, N and PK.
PCA and cluster analysis facilitated the identification and evaluation of variance and the grouping of fertilization variants in relation to the degree of affinity and similarity to the main attributes.

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INCREASING THE EFFICIENCY OF THE LABOUR RESOURCES USAGE OF AGROSECTOR ENTERPRISES IN THE SYSTEM OF SUSTAINABLE DEVELOPMENT OF THE RURAL TERRITORIES: A CASE STUDY OF UKRAINE

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Abstract

In the article it was found that during 2016-2019 in Ukraine the total productivity of agricultural workers increased, due to increased investment and technological renewal of agricultural production by large agricultural holdings. The main reason for this growth is the opening of access to Ukrainian agricultural enterprises to the markets of the European Union. Accordingly, the enterprises of the agricultural sector of Ukraine focus on the development of crop production, which is more attractive in terms of increasing profitability due to significant export opportunities. According to the obtained results, the amount of labour costs of employees in agricultural enterprises for the analysed period has generally more than doubled. In the article we have identified regional features of labour productivity of enterprises in the agricultural sector of Ukraine, in terms of studying the level of efficiency of staff use. We have substantiated the proposals for the introduction of a special algorithm in the activities of agricultural enterprises to ensure the efficiency of the management of their labour resources. We in the article proved that the improvement of the system of formation and use of labour resources of agricultural enterprises of Ukraine should also consider the identified regional disparities in the levels of labour productivity, in order to stimulate the productivity of enterprises in the regions with the lowest rates.

Key words**:** *rural territories, labor resources, agricultural enterprises, sustainable development, labor efficiency*

INTRODUCTION

Peculiarities of the functioning of agricultural enterprises involve the involvement in the labour process of a significant number of employees, effective management of which is designed to ensure the appropriate level of profitability. Thus, the need to study the efficiency of human resources in the enterprise is of particular importance in modern conditions.

In Ukraine, for a long time, the efficiency of labour used in agriculture was low due to the low level of income of agricultural enterprises and the lack of structural investment in agriculture. However, the situation has changed dramatically since the signing of the Association Agreement between Ukraine and the EU in 2014. It resulted in the wide opening of the European Union markets to Ukrainian agricultural producers. In the market, there were tendencies to a rapid increase in the level of profitability of agricultural enterprises, a significant increase in investment in fixed assets, and subsequently - in the human capital of agricultural enterprises. Currently, the market is experiencing a systematic transformation of agricultural producers into large agricultural holdings, which invest heavily in upgrading equipment and machinery. At the same time, the urgent need of such enterprises is the formation of an effective system for ensuring the high efficiency of labour resources, because as practice shows, with extensive development of the agricultural sector in the

recent past, quantitative estimates of reserves and resources were basic. with the transition to an intensive path of development. In addition, since improving the efficiency of staff in practice is one of the key reserves for improving the market position of the enterprise, the need to improve the management system of the efficiency of labour resources of agricultural enterprises becomes especially relevant.

Many scientists and practitioners have studied the issue of efficient use of labour resources of agricultural enterprises at different times. In particular, it is worth noting the works of D. Bohynia [2], A. Cherep [4], O. Grishnova [7], Ye. Kachan [8], V. Nykyforenko [11], M. Vynohradskyi [27], O. Shubalyi [22, 23] and others. In addition, a significant contribution to the study of specific aspects related to the efficient use of labour resources of enterprises is based on studies of scientists such as O. Agres [1], A. Boiar [3], M. Dziamulych [5; 6; 20; 21], A. Kibanov [9], A. Popescu [13; 14; 15; 16; 17; 18; 19], S. Strumilin [25], I. Tsymbaliuk [26], V. Yakubiv [31], Ya. Yanyshyn [28-30], I. Zhurakovska [33]. However, rapid technological changes and transformations, the intensive spread of innovations in agriculture necessitate a significant deepening of existing research on the efficiency of labour resources of agricultural enterprises.

MATERIALS AND METHODS

The classic criteria that characterize the use of labour resources of enterprises in agriculture include labour productivity as the main indicator; the level of use of the working time fund; the state of labour discipline and the level of staff turnover; the number and proportion of workers engaged in manual labour; high-quality compliance of personnel with production requirements and positions held; the relative and an absolute number of workers laid off. In this case, productivity reflects the ability of the personnel management system to provide a certain result in changing conditions and capabilities of the enterprise. However, in the process of intensification of investments in agricultural enterprises and technological renewal of their production base, the methodology of measuring efficiency is changing, which is based not only on economic indicators of calculating the ratio of personnel costs and results (determining the profitability of staff use) but reflects achieving the set goals in the field of personnel management [10].

However, the analysis of labour efficiency is not limited to labour productivity and its derivative results but is a broader system of indicators based on comprehensive coverage of labour results and features of the organization of the production process in agricultural enterprises. As a result, not only the cost but also some absolute and natural indicators of labour use are considered.

In particular, the analysis of the number and movement of labour resources is important for the analysis of the efficiency of the use of labour resources of agricultural enterprises in terms of labour turnover. For this purpose, the following coefficients are calculated:

– turnover ratio on acceptance;
– turnover ratio from dismissal;
– total staff turnover ratio.

The calculation of these indicators and coefficients is performed according to the following method.

Staff turnover ratio for acceptance:

$$R_{ac} = \frac{N_e}{N_{av}}$$

where N_e – the number of employees hired in the organization for a certain period;

N_{ac} – the average number of employees is the corresponding period.

Staff turnover ratio for the release:

$$R_r = \frac{N_d}{N_{av}}$$

where: N_d – the number of dismissed employees of the organization for a certain period.

Total staff turnover ratio:

$$R_t = \frac{N_e + N_a}{N_{av}} = R_{ac} + R_r$$

In addition, given the seasonality of many types of work in agricultural enterprises, the calculation is recommended staff turnover ratio, which characterizes the movement of labour under the influence of negative causes.
Staff turnover ratio:

$$R_{st} = \frac{N_d - N_{id}}{N_{av}}$$

where: N_{id} – the number of inevitably laid-off workers.
The second stage of the analysis covers the completeness of the use of labour resources, which can be estimated by the number of working days of the employee during the reporting period, as well as the intensity of working time. However, the main indicator that characterizes the efficiency of labour resources of agricultural enterprises is currently labour productivity, which is measured by the ratio of output to labour costs. Depending on the direct or inverse relationship, there are two indicators: output and labour intensity.
Production - is the amount of output per unit time or the number of products per average employee or worker per year, quarter, month. It is measured by the ratio of the volume of output to the amount of working time spent on its production:

$$Y = \frac{Q}{T}$$

where: Y – yield;
Q – volume of output;
T – working time.
Labour intensity is an indicator that characterizes the cost of time per unit of output (ie the inverse of production):

$$L_i = \frac{T}{Q}$$

where: L_i – labour intensity per unit of output.
The greater the output per unit time or the lower the cost of time per unit of output, the higher the level of productivity [32].

Production and labour intensity are interrelated and inversely related, but the percentage increase in output is not equivalent to the percentage decrease in labour intensity. The relationship between them is expressed as follows:

$$P_{Li} = \frac{P_Y}{(100 + P_Y)} \times 100$$

or

$$P_Y = \frac{P_{Li}}{(100 + P_{Li})} \times 100$$

where: P_{Li} – the proportion of labour intensity reducing, %;
P_Y – the share of production increase, %.
The most common and universal indicator is the output, the indicators of which, depending on the unit of measurement of working time can be measured:
– in man-hours worked;
– in the worked man-days;
– in man-months, man-years (these units of time are equivalent to the average number of employees for the corresponding period).
If labour costs are measured in man-hours worked, then get an indicator of average hourly output:

$$Y_h = \frac{Q}{T_h}$$

Hourly output characterizes labour productivity for the actual time worked, daily also depends on the length of the working day and the use of working time within the shift. Its level is affected by intermittent downtime and loss of time. The relationship between these indicators of productivity is characterized by the relationship:

$$Y_{day} = Y_h \times L$$

where: L – is the average actual length of the working day [29].
Thus, assessing the efficiency of labour resources of agricultural enterprises provides an opportunity to identify and eliminate the causes of their inefficient use, as well as – to identify existing reserves to improve such

efficiency through the rational placement of agricultural personnel and its use in accordance with production plans and employment opportunities.

RESULTS AND DISCUSSIONS

As you know, one of the most important factors in increasing the profitability and competitiveness of agricultural enterprises is the effective management of its labour resources. It should be noted that the labour resources themselves will play the role of a key component of overall competitiveness, along with other factors to ensure its high level. In this aspect, economic methods of human resource management are a set of ways to influence by creating economic conditions that encourage employees to act in the right direction and seek solutions to their problems.
Since the basic and most informative criterion for assessing the efficiency of labour resources of agricultural enterprises is labour productivity, it is necessary to assess its dynamics considering the difference in indicators in terms of agricultural industries – crop and livestock (Fig. 1).

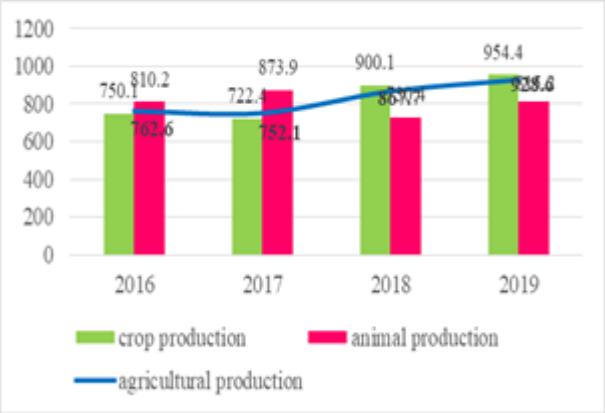

Fig. 1. Labour productivity in agricultural enterprises in Ukraine (per 1 employee on agricultural production, in 2016 prices; thousands UAH)
Source: [24].

It was found that during 2016-2019 in Ukraine the total productivity of agricultural workers increased, which was due to increased investment and technological renewal of agricultural production by large agricultural holdings. As already mentioned, the main reason for this growth is the opening of access to Ukrainian agricultural enterprises to the markets of the European Union. Thus, in comparative prices labour productivity increased from 762.6 to 928.6 thousand UAH. per one employee employed in agriculture, i.e. by almost 22% (almost 5.5% annually). This value is significantly higher than the industry average even in comparison with the developed countries of Central and Eastern Europe.
However, if we consider the dynamics of labour productivity by industry, it is clear that during the analysed period the main growth occurred in crop production, where productivity increased from 750.1 thousand UAH. in 2016 to UAH 954.4 thousand. per employee in 2019. At the same time, in the livestock sector in 2018 there was a significant decline in labour productivity and as of the end of 2019, its overall indicator in the industry by only 0.6% exceeded the value for 2016. Such disparities are due to the fact that the main element in the structure of exports of agricultural products of Ukrainian enterprises is crop production. That is why the main investments are aimed at updating the technological base and stimulating employees employed in this field. At the same time, livestock products are more focused on the domestic market, which is not characterized by significant fluctuations in consumption in the short term. Accordingly, the enterprises of the agricultural sector of Ukraine focus on the development of crop production, which is more attractive in terms of increasing profitability due to significant export opportunities. For this reason, the dynamics of labour productivity in the livestock sector during the analysed period remained almost unchanged.
Since the main criterion influencing the assessment of the efficiency of labour resources in terms of labour productivity is the cost of labour, we analysed the dynamics of this indicator in the agricultural sector of Ukraine in 2016-2019 (Fig. 2).
According to the results of the study, it was found that the amount of labour costs of employees in agricultural enterprises for the

analysed period has generally more than doubled.

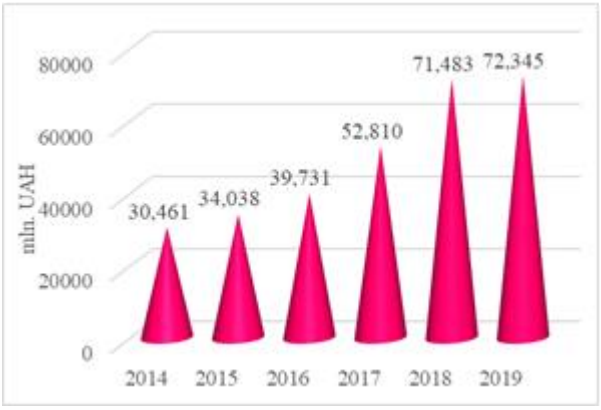

Fig. 2. Dynamics of labour costs of employees of agricultural enterprises of Ukraine for 2014-2019
Source: [24].

At the same time, during the first half of the analysed period, there was not a significant increase in labour costs, which was mainly due to an increase in prices due to inflation in Ukraine's economy. The second period - instead, starting in 2017 with the opening of the EU market for enterprises in the agricultural sector of Ukraine, the level of labour costs of agricultural workers increased by UAH 13.079 million. or by 32.9% year on year, in particular, the growth in 2018 compared to 2017 was 35.4%. Thus, it can be concluded that the expansion of the share of the European Union market available to Ukrainian agricultural enterprises gave them the opportunity to increase labour costs, which resulted in increased productivity.

We have identified regional features of labour productivity of enterprises in the agricultural sector of Ukraine, in terms of studying the level of efficiency of staff use (Fig. 3).

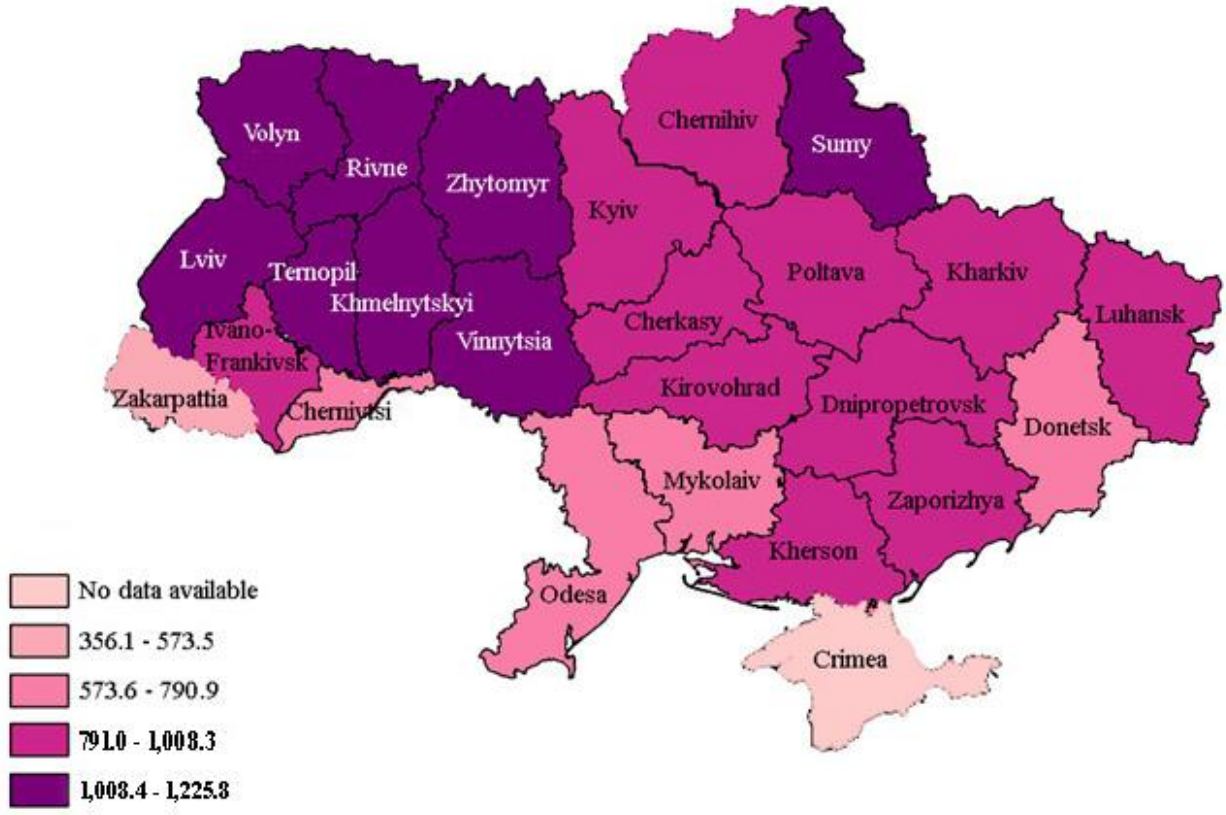

Fig. 3. Labour productivity in agricultural enterprises in regions of Ukraine in 2019 (per 1 employee on agricultural production, in 2016 prices; thousands UAH)
Source: [24].

As we can see from the analysis, the highest level of labour productivity in Ukraine is characteristic of the Western regions, which in terms of resources are among the least favourable for agricultural production. At the same time, in the regions of Central and

Eastern Ukraine, where the most fertile soils are located, the productivity of agricultural enterprises is lower, and in some southern regions (Odesa, Mykolaiv region) the efficiency of staff use is relatively low. The explanation for this fact is the resource provision of enterprises – in those areas that have limited opportunities for agricultural production, enterprises are forced to make more intensive use of the available potential of hired labour to ensure their competitiveness and increase profits. At the same time, in regions where natural conditions are conducive to agricultural production, the requirements for high efficiency in the use of workers are lower, as profitability is ensured through better use of the climatic factor.

As practice shows, each producer determines the directions and reserves of labour productivity by specific agricultural and technical and organizational-economic situation: the achieved level of culture of agriculture and animal husbandry, mechanization and electrification of production, specialization of agriculture, availability of labour resources, their age, gender, professional composition, etc. At the same time, the level of lab or productivity is also influenced by natural and economic conditions: soil quality, rainfall, temperature, length of the growing season, the use of technical means, etc. However, the increase in labour productivity is economically progressive only when it occurs on the basis of increasing the production of gross agricultural output.

Thus, labour productivity is effective and important, but not the only factor that improves the efficiency of labour resources of agricultural enterprises. In addition, since the most effective incentive to increase productivity is financial surcharges, it should be noted that many companies are quite limited in this regard to widely apply it without compromising their investment plans. Accordingly, there is a question of availability of alternative methods of increase of efficiency of the use of labour resources of the agricultural enterprises in the system of the necessity of formation of social capital of rural territories.

As the practice of economic activity shows, to ensure effective personnel management at the enterprise level, it is necessary to comprehensively use the tools of all available methods of influencing the functioning of labour resources. Accordingly, in addition to the basic methods of human resource management, in practice, a more complex system of methods is used, which considers the specifics of the processes of implementation of the tasks of human resource management.

The formation of a system for managing the efficiency of labour resources of agricultural enterprises should be based on a system of stimulating the labour potential of workers, so such a system should include the following elements:

– formation of principles of effective management of labour resources in modern conditions;
– ensuring managerial influence on labour resources in the process of implementing the strategy of enterprise development;
– ensuring the introduction of innovative approaches to vocational training, retraining, and advanced training of enterprise personnel;
– introduction of the system of social partnership at the enterprise for stimulation of increase of efficiency of use of labour resources.

Thus, the assessment of the effectiveness of human resource management can be implemented by determining its economic, social, and organizational efficiency. The essence of the approach is to use indicators for these types of efficiency in correlation analysis and expert evaluation, by developing criteria for achieving certain end results with the appropriate level of resources and product quality, as well as in determining weights using rank correlation to calculate a comprehensive efficiency indicator. The value of the criteria is calculated by comparing the actual values of the partial exponent to the base value using the mathematical adjustment function of the four types of dependence. Maintaining the weighting factor is due to the need to coordinate interests between employees, staff, and enterprise [12].

It should also be noted that in addition to purely technical factors associated with the

production activities, the efficiency of labour resources will certainly be directly or indirectly affected by subjective factors, which can generally be reduced to a group of socio-economic factors. At the same time, there is a problem of forming unified approaches to ensuring the institutional and organizational-economic structure, which would allow forming topical approaches to ensuring the overall economic efficiency of the use of labour resources in agricultural enterprises.

This need, in turn, requires ensuring the availability of relevant and adequate tools to identify reserves to improve the efficiency of labour resources and opportunities for the formation of current long-term plans for enterprises to implement measures aimed at improving staff efficiency.

The availability of conceptual approaches to finding reserves and planning current measures to effectively improve the efficiency of their own employees will allow agricultural enterprises not only to improve their management system but also to provide opportunities to improve strategic planning and increase opportunities for profitability.

Therefore, one of the main and extremely important elements of the formation of a system of socio-economic factors to improve the efficiency of labour resources in the agricultural sector is their practical complementarity. Thus, we have substantiated the proposals for the introduction of a special algorithm in the activities of agricultural enterprises to ensure the efficiency of the management of their labour resources (Fig. 4).

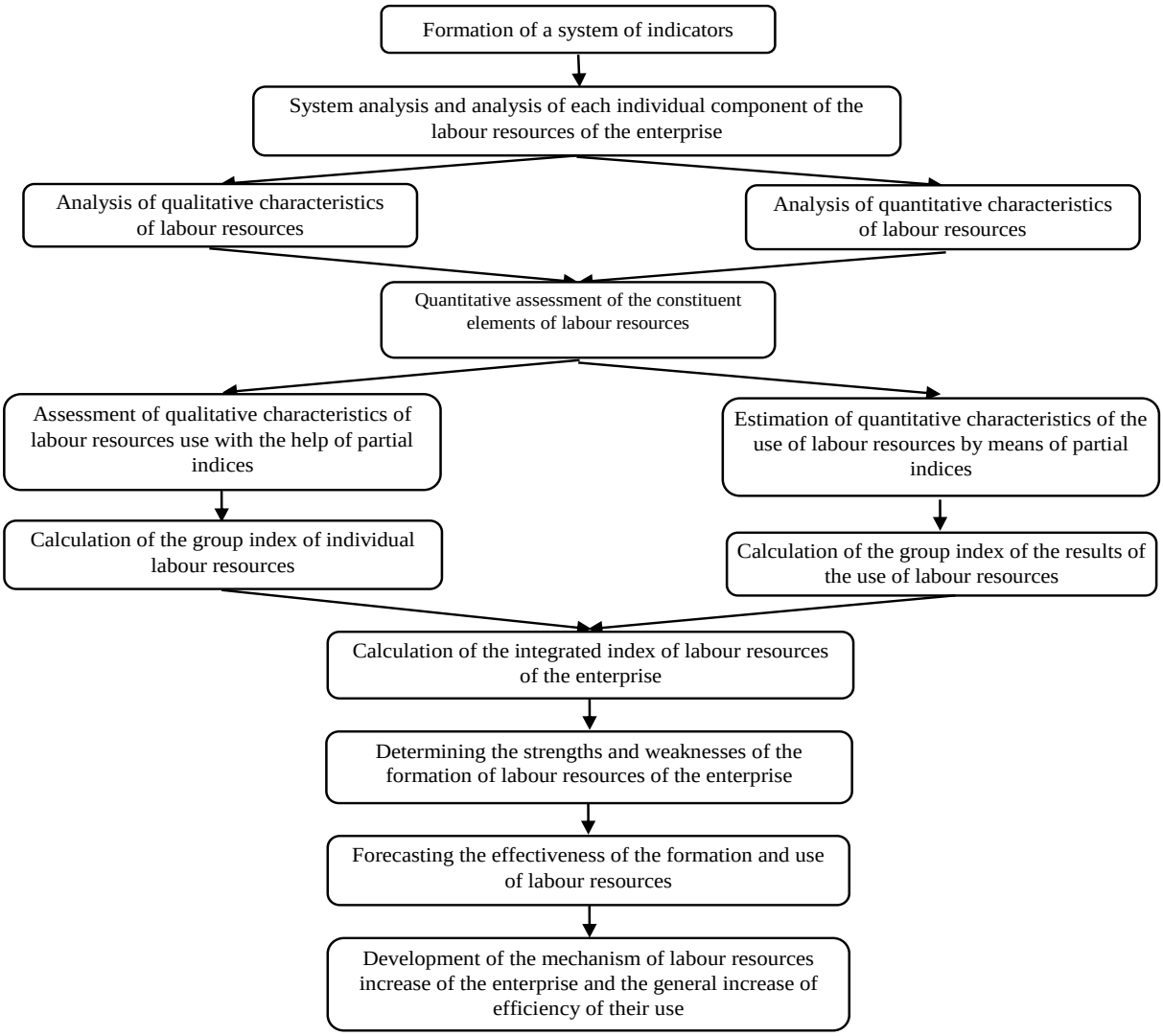

Fig. 4. Algorithm of formation and use of labour resources of agricultural enterprises
Source: author's own development.

The practical application of the proposed mechanism to improve the efficiency of labor resources is a combination of quantitative and qualitative characteristics of the formation of efficiency according to the specified parameters. Based on this, it is possible to determine the integrated index of labor efficiency, which is the basis for planning, forecasting and implementation of effective measures aimed at improving the productivity of agricultural enterprises in Ukraine. Thus, the incentive for employees to increase efficiency will be based not only on productivity indicators, but also through the integrated index will include the results of assessing the quality characteristics of the staff of agricultural enterprises.

CONCLUSIONS

According to the results of the study, we propose to form a system of criteria for assessing the efficiency of labour resources of agricultural enterprises, which would be based on considering both the economic and social effects of the effectiveness of their impact. In our opinion, the general criteria for assessing the effectiveness of use should be grouped into two main areas:

(1) Evaluation of the effectiveness of the use of labour resources on the basis of the evaluation of the performance of an individual employee, which includes the following performance criteria:

– production efficiency;
– professional skills;
– compliance with deadlines;
– the amount of hourly output;
– efficiency of working time use;
– attentiveness in performing tasks;
– observance of technological discipline in production;
– observance of rhythmic work;
– speed of recognition and correction of mistakes.

(2) Evaluation of the effectiveness of the use of labour resources based on the evaluation of the performance of an individual employee in a particular workplace, which should include the following criteria:

– the structure of time spent on tasks assigned to the employee;
– observance of labour discipline by a specific executor;
– manifestation of personal initiative in solving problems and ensuring the continuity of the production process;
– the level of ability to consciously make independent decisions to improve the efficiency of the tasks;
– readiness to constantly learn new skills and improve their skills;
– the level of workload;
– transfer of professional knowledge and skills to other employees in the process of performing production tasks;
– the level of readiness, if necessary, to help other employees in the process of performing the tasks.

We believe that the improvement of the system of formation and use of labour resources of agricultural enterprises should also consider the identified regional disparities in the levels of labour productivity, in order to stimulate the productivity of enterprises in the regions with the lowest rates.

Thus, in the introduction of a system to improve the efficiency of labour resources of agricultural enterprises in the system of rural development and the formation of human capital in rural areas, the most important place is a set of measures to increase productivity. This is due to the fact that in the general structure of personnel efficiency indicators labour productivity occupies a leading place, both in the process of long-term planning and in the process of forming specific current production plans and finding reserves to increase the profitability of agricultural enterprises in Ukraine as a whole.

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THE EVOLUTION OF TOURISM IN ALBA COUNTY IN THE PERIOD 2015-2018

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Abstract

The present work includes some aspects related to the evolution of tourism in Alba County in the period 2015-2018. In order to underline as good as posible a number of aspects specific to tourism in this county, several indicators were analyzed, such as: structures of tourist reception with functions of tourist accommodation; the capacity of a tourist accommodation according to types of tourist reception structures; tourist arrivals in tourist reception structures; overnight stays in tourist reception structures; the net use index of accommodation places. In the future, if investments are made, on the one hand in the infrastructure, and on the other hand in the modernization of accommodation capacities, Alba County can become a pole with a high degree of tourist attractiveness for both Romanian and foreign citizens. The statistical data used in the paper were taken from the National Institute of Statistics and were interpreted, thus highlighting the true state of tourism in Alba County.

Key words**:** *Alba County, accommodation capacity, tourist arrivals, overnight stays*

INTRODUCTION

Since ancient times, since antiquity, people have traveled, closer or farther from where they lived, in an organized or less organized form. Later, as society developed, the simple journey turned into a tourist activity. Thus, the nineteenth century is considered the period when the phenomenon of mass tourism appears, when "tourism has become a large economic activity and a well-defined and influential aspect of social life" [10].

Currently, " tourism is an important activity for any country which could generate a competitive advantage by valorizing its natural and anthropic resources in proper landmarks and products" [13].

„Romanian`s tourism is continuously developing year by year as the country attracts more and more visitors" [12].

Due to "an extremely generous natural potential and a valuable cultural heritage, the Transylvania region" [11] is seen as a magnet that attracts not only Romanian tourists but also foreigners from European countries and from other continents too.

One of the well-known Transylvanian counties in terms of the hospitality industry and which has a lot to provide from this point of view is Alba County.

Fig. 1. Map of Alba County
Source:https://pe-harta.ro/judete/Alba.jpg) [8].

Located in the central-eastern part of the country, Alba County has an area of 6,242 km², representing 2.6% of the territory of the country and "is neighboring with Cluj County

to the north, Bihor and Arad Counties to the west, Hunedoara County to the south-west, with Vâlcea County to the south and Sibiu and Mureș Counties to the east" [7], (Fig. 1).

Fig. 2. Alba County of Romania's map
Source: https://ro.wikipedia.org [1]

Considering the archaeological discoveries, it is estimated that the settlements in Alba County date back from the Neolithic period. During the Daco-Roman period, settlements like Apulum (Alba Iulia), Ampelum (Zlatna) and colonies like Alburnus Maior (Roșia Montană) and Brucla (Aiud) were established. After the Romans' withdrawal, "the area was marked by an intense population, as certified by the important archaeological evidence specific to the 4th-6th centuries" [6].

Alba County (Fig. 2) is located in the "historical region of Transylvania, with its residence in the municipality of Alba Iulia. It is part of the Centru development region and consists of 4 municipalities (Alba Iulia, Aiud, Blaj, Sebeș), 7 cities (Abrud, Baia de Arieș, Câmpeni, Cugir, Ocna Mureș, Teiuș, Zlatna), 67 municipalities and 656 villages" [5].

From the point of view of the ethno-folkloric areas, in Alba County there are four major regions: the Moți Land, the Mocani Land, the Székely Land and the Transylvanian Saxons Land, each of them having a particular specificity of the popular clothes and customs.

Alba County is dominated by mountain regions that occupy about 52% of the surface, hills and plateaus represent 26%, and the plain area and the river meadows total only 22%.

Alba County enjoys the possibility of carrying out several forms of tourism, being endowed with potential for natural and anthropic tourism that is in great demand.

"The natural environment plays a dual role at the same time, namely that of material support of all activities in the tourism field, as well as that of their essential motivation when its beauty determines the establishment of tourist flows" [4].

The Apuseni Mountains are an important area of tourist attraction that includes a significant area of the Apuseni Natural Park and is characterized by the existence of keys, gorges, karst springs, (eg. Tăuz karst spring), avenas, caves, (eg. Scărişoara), waterfalls (ex. Pişoaia), the lonely rocks that give a note of dynamism and beauty combined with the mountain fauna and flora.

In the Trascău Mountains there is the Piatra Secuiului "paradise for climbers and paragliders" [16] and Ighiel tarn, the largest karst tarn in Romania, formed "by accumulating water in a perfect limestone channel, created by slope collapse" [16].

Deep in the Metaliferi Mountains there are gold ores that have been exploited since Roman times in Roşia Montană, at present being considered "the largest gold deposit in Europe." [16] Here is the Mining Museum, where tourists, without having special equipment, descend 157 steps in Roman galleries, 1.80 m high and 1 m wide, "being the only ones in the world that can be visited in situ (ie in their natural environment)", [16] because 150 m are arranged for tourists.

The tourist trip through Alba County should also include the municipality of Alba Iulia, county residence, where there is "the best preserved and largest medieval fortress in Transylvania, Alba Carolina, built in Vauban style. Here took place the first unification of the Romanian Countries in 1600, by Mihai Viteazu and the Great Union in 1918. In the Catholic Cathedral there is Iancu de Hunedoara's tomb, and in the Reintegration Cathedral, in 1922, King Ferdinand and Queen Mary were crowned king and queen of Greater Romania" [14].

Mountain tourism, cultural tourism, leisure tourism, rural tourism and agrotourism, urban tourism, business tourism, youth tourism, event tourism, rail tourism are the forms of tourism encountered in Alba County.

Considering the SWOT analysis of Alba County, we can highlight the strengths of this area as well as the opportunities that would add value to the county and lead to the development of different forms of tourism.

Among the strengths which Alba County is proud of we mention: the existence of various natural resources spread throughout the territory of Alba County; anthropic tourist landmarks, of local and national interest, existing both in cities and in villages; high ethnographic and cultural potential; tourist reception units with classified accommodation functions, in number of 204, with an increasing accommodation capacity, reaching 5,278 places in 2018; the possibility of practising several forms of tourism throughout the year; increasing tourist flow.

Economic valorization of the natural and anthropic potential of Alba County; the conclusion of new partnerships with localities in the EU area; accessing European programs that lead to the development of tourism and implicitly of the local community, Alba County; rehabilitation of tourist resorts and villages with tourist potential; organizing as many cultural, artistic events as possible, to bring to light the ancient traditions and customs and to publicize them nationally and internationally, are just a few of the opportunities that would be well taken into account and that could give new value to the county and secondary would lead to the development of the hospitality industry and of many other things.

MATERIALS AND METHODS

In this research, a series of indicators were analyzed to better reflect the evolution of the tourism sector in the economy of Alba County. The indicators that were subjected to analysis in this research are the following: the main structures of reception with accommodation functions; capacity of operating tourist accommodation, taking into account the most important types of tourist reception structures; tourist arrivals in tourist reception units with accommodation functions; the number of overnight stays in the tourist reception structures and the net use index of the operating tourist accommodation capacity.

The average and the annual growth rate were used as statistical indicators.

The average achieved for the analyzed period:

$$(x) = \Sigma(x)/n$$

where:

x is the analyzed technical, economic or social phenomenon and *n* the number of years.

Annual growth rate (r%) calculated with the formula:

$$(r\%) = ((\text{sqrt}(\prod p1/po)^{1/n})-1)*100$$

where:

$\prod p1/po$ = chained growth indicators; the number of years of the period [2].

In this study, the analysis was focused on the period 2015-2018.

In order to carry out a research that reflects in a realistic way the situation of tourism in Alba County, a series of specialized material was consulted on the one hand, and on the other hand the statistical data related to this county that have been provided by the National Institute of Statistics.

RESULTS AND DISCUSSIONS

The National Institute of Statistics defines the structure of tourist reception with tourist accommodation functions as "any construction or place arranged or elaborated according to the design and execution, for the accommodation of tourists."

Alba County offers tourists various accommodation structures, both hotels, motels, guesthouses, as well as tourist villas, campsites, hostels, tourist cottages, located in urban or rural areas. The total number of these accommodation spaces has increased in the

last four years, by 28%, from 159 accommodation units in 2015 and 2016, to 191 in 2017, reaching 204 in 2018. The evolution of the main tourist reception structures with accommodation functions from Alba County in the period 2015-2018 is presented in Table 1 where you can see the average number of accommodation units, as well as the annual growth rate. The highest growth rate is found in the case of tourist stops with more than 44%, followed by tourist villas with 26% and agrotourism pensions with a growth rate of 13.7%.

Table 1. Tourist reception structures from Alba County in the period 2015-2018

Types of tourist reception structures	2015	2016	2017	2018	Average	2018 vs 2015		Growth rate
	No	no	no	no	no	no	%	%
Total	*159*	*159*	*191*	*204*	*178.3*	*45*	128.3	8.7
Hotels	19	19	19	19	*19.0*	*0*	100.0	0.0
Hostels	3	3	4	3	*3.3*	*0*	100.0	0.0
Motels	7	6	5	6	*6.0*	*-1*	85.7	-5.0
Tourist villas	6	5	10	12	*8.3*	*6*	200.0	26.0
Tourist cottages	8	9	11	6	*8.5*	*-2*	75.0	-9.1
Campsites	1	1	1	1	*1.0*	*0*	100.0	0.0
Tourist stops	1	1	2	3	*1.8*	*2*	300.0	44.2
Students and preschoolers camps	3	3	3	3	*3.0*	*0*	100.0	0.0
Tourist guesthouses	30	28	28	29	*28.8*	*-1*	96.7	-1.1
Agrotourist guesthouses	81	84	108	119	*98.0*	*38*	146.9	13.7

Source: INSSE, [15] accessed on 16.05.2019 and processed data.

As we can see by analyzing Table 1, the dynamics of the tourist reception structures in Alba County is different, increasing in terms of agrotourist guesthouses, by 47% in 2018 compared to 2015, of tourist villas, where there is a doubling of the number of units, from 6 to 12 villas in 2018 and tourist stops where there are 3 structures in 2018 compared to 1 classified unit in 2015 and 2016.

The decrease in the number of tourist accommodation units is observed with respect to motels by 15% in 2018 compared to 2015, in the case of tourist cottages by 25%, as well as the number of tourist guesthouses by 4% in 2018 compared to the reference year 2015.

Regarding the accommodation structures hotels, hostels, campsites, students and preschoolers camps, there is a stagnation of the number of classified units in the reference period 2015 - 2018.

Another indicator that has been analyzed regarding the tourism in Alba County is the existing tourist accommodation capacity which "represents the number of places of tourist accommodation registered in the last act of reception, approval, classification of the tourist reception structure with tourist accommodation functions, exclusive of the extra beds that can be installed in case of necessity. The number of places is determined for the tourist reception structures with tourist accommodation functions existing on December 31 and in working condition" [9].

Table 2 presents both the number of places existing in the most important tourist reception structures in Alba County, as well as the dynamics of the accommodation capacity existing between 2018 and the reference year 2015.

It is found that taking into account the total number of tourist reception structures, the number of existing places is increasing, by 15% in 2018 compared to 2015. Significant increases in the existing accommodation capacity are registered in the case of tourist stops by 188%, of tourist villas by 90 %, hostels by 47% and agrotourist guesthouses by 32%. Decreases in the number of places in

tourist structures with reception functions are observed in the case of tourist cottages by 33%, due to the decrease of the number of such units from 8 cottages in 2015 to 6 classified structures in 2018, as well as in the case of students and preschoolers camps with a decrease of 20%, although the number of reception units remains the same over the 4 years, 2015-2018.

Also table no. 2 presents the average of the existing tourist accommodation capacity in the analyzed period, 2015-2018, for each type of tourist reception structure. Thus, it can be seen that on average there are a total number of 4,946.8 accommodation places in Alba County, with a growth rate of 4.8%. Most accommodation places are registered in the case of hotels, on average being 1,280 places, but with a growth rate of only 2%.

A significant growth rate of accommodation is found in the case of tourist stops, of 42.2%, this fact being observed taking into account that in 2015-2016 there were 16 units of this kind, and in 2018, 46 tourist stops were classified in Alba County. A significant growth rate is also registered in the case of tourist villas, of 23.9%, on average being 256.8 accommodation places.

A negative result in terms of growth rate is identified in the case of tourist cottages, the number of accommodation being in a downward trend, from 218 places in 2017 to 140 places in 2018. A downward trend of the growth rate is also registered in the case of student and preschool camps and tourist pensions.

Table 2. Tourist accommodation capacity existing in the period 2015-2018- Number of places (beds)

Types of tourist reception structures	2015	2016	2017	2018	Average	2018 vs 2015		Growth rate
	places	places	places	places	places	places	%	%
TOTAL	4,585	4,748	5,176	5,278	*4,946.8*	*693*	115.1	4.8
Hotels	1,240	1,283	1,281	1,316	*1,280.0*	*76*	106.1	2.0
Hostels	100	98	158	147	*125.8*	*47*	147.0	13.7
Motels	220	193	195	234	*210.5*	*14*	106.4	2.1
Tourist villas	182	172	327	346	*256.8*	*164*	190.1	23.9
Tourist cottages	209	215	218	140	*195.5*	*-69*	67.0	-12.5
Campsites	53	53	53	53	*53.0*	*0*	100.0	0.0
Tourist stops	16	16	26	46	*26.0*	*30*	287.5	42.2
Students camps	274	274	219	220	*246.8*	*-54*	80.3	-7.1
Tourist guesthouses	657	625	664	608	*638.5*	*-49*	92.5	-2.6
Agrotourist guesthouses	1,634	1,819	2,035	2,157	*1,911.3*	*523*	132.0	9.7

Source: INSSE, [15] accessed on 16.05.2019 and processed data.

The tourist reception units in Alba County were searched by tourists who called for accommodation services, this being observed from the increase in the number of arrivals in some of these units, between 2015-2018.

"The arrival of a tourist in the structure of tourist reception with accommodation functions occurs when a person enters the register of the tourist accommodation structure to be hosted one or more uninterrupted nights. In each accommodation structure there is only one arrival per tourist, regardless of the number of nights resulting from his uninterrupted stay. Tourists who have been in structure since the month before the reported one are not included in the number of arrivals. For families housed in the tourist accommodation structure, the number of arrivals includes each member of the family for whom at least one place has been paid" [9].Analyzing the data provided by the National Institute of Statistics, it is found that in 2015 there were 154,210 tourists registered as arriving in accommodation units in Alba

County, in 2016 their number increased to 167,970 people, in 2017 the number increased by 4,370, and in 2018 the number of tourists registered as arriving in the accommodation units reaches over 194,800 (Table 3). This fact is encouraging, increasing by 26 percent the number of tourists arriving in the accommodation units in Alba County in 2018 compared to 2015. In the analyzed period 2015-2018, there is a growth rate of 8.1% of people arriving in all accommodation units in Alba County, on average being over 172,300 people.

Table 3. Tourists' arrivals in tourist reception structures in Alba County during 2015-2018

Types of tourist reception structures	2015	2016	2017	2018	Average	2018 vs 2015		Growth rate
	No. of people	No. of people	No. of people	No. of people	No. of people	No. of people	%	%
Total	154,210	167,970	172,340	194,818	*172,334.5*	*40,608*	126.3	8.1
Hotels	73,920	81,126	74,473	84,602	*78,530.3*	*10,682*	114.5	4.6
Hostels	2,569	3,734	4,787	2,909	*3,499.8*	*340*	113.2	4.2
Motels	8,523	6,118	4,601	5,355	*6,149.3*	*-3,168*	62.8	-14.4
Tourist villas	4,624	3,841	7,662	11,638	*6,941.3*	*7,014*	251.7	36.0
Tourist cottages	2,710	2,622	2,245	1,997	*2,393.5*	*-713*	73.7	-9.7
Campsites	483	643	441	558	*531.3*	*75*	115.5	4.9
Tourist stops	9	1,082	986	643	*680.0*	*634*	7,144.4	314.9
Students camps	1,337	1,888	1,404	2,266	*1,723.8*	*929*	169.5	19.2
Tourist guesthouses	28,392	30,714	32,391	33,486	*3,124.8*	*5,094*	117.9	5.7
Agrotourist guesthouses	31,643	36,202	43,350	50,901	*40,524.0*	*19,258*	160.9	17.2

Source: INSSE, [15] accessed on 16.05.2019 and processed data.

Analysing the data in Table 3 it is concluded that most of the tourist reception structures in Alba County are in great demand, especially in the case of tourist stops and tourist villas, which registers a growth rate of 314%, taking into account the fact that in 2015 only 9 tourists arrived and their number increased in 2016 to 1,082 and in 2017 being 986 tourists, with an average of 680 tourists in the 4 years analyzed.

The tourist villas were also sought by tourists in 2015-2018, registering an increasing trend of the growth rate by 36%, from 3,841 tourists in 2016 reaching 11,638 tourists in 2018, so an average of 6,941.3 tourists in the 4 years analyzed.

The school camps in Alba County have hosted more and more students and preschoolers, with a 69% increase in 2018 compared to 2015, with a growth rate of 19.2%. The agrotouristic guesthouses have also been preferred by tourists from Alba County, taking into account the annually increasing trend, from 31,643 people registered in 2015 to 50,901 people in 2018, 61% up in 2018 compared to 2015, the growth rate being over 17 percent, and the average in the period 2015-2018 being 40,524 people who stayed in this accommodation structure.

In the case of motels and tourist cottages there is a downward trend in the number of arrivals, this fact can be due to the decrease of the number of accommodation units of this type in 2018 compared to the reference year 2015.

It is noted that in 2015 over 2,700 people were registered in the 8 cottages in Alba County, the following year their number decreases by 88 people, despite the fact that 9 cottages in the county are classified and opened to the tourist circuit. In 2017, the number of tourists decreases by 377, although 11 cottages are classified, reaching in 2018 only 1,997 tourists registered in the 6 existing cottages, a decrease of 26% in 2018 compared to 2015, the average number of arriving tourists was 2,393.5 people. In Alba County, overnight stays in all types of reception structures in the period 2015-2018 are in an

upward trend, totaling 312,762 overnight stays in 2015 and reaching 364,474 overnight stays in 2018, the average being 335,245 overnight stays.

The National Institute of Statistics defines the notion of tourist accommodation as "the 24-hour interval, starting with the hotel hour, for which a person is registered in the tourist accommodation unit and benefits from accommodation, paying the fee for the occupied space, even if the duration of effective stay is less than the mentioned period. The overnight stays related to the extra installed beds (paid by the customers) are also taken into consideration" [9].

Most overnight stays took place in hotels in Alba County, reaching a total of 143,482 in 2015, and in 2018, 154,427 overnight stays, with an average of 150,265.5 overnight stays, followed by overnight stays in agrotourist guesthouses, 76,117 in 2015 and reaching 109,678 in 2018, the average being 90,564.8 and with a growth rate of 12.9% . Analysing the data in Table 4 regarding the number of overnight stays in the reception structures in Alba County, in the period 2015-2018, we can notice that, overall, the number of overnight stays increased, the increase being by maximum 17 % in 2018 compared to 2015.

Considering the dynamics of the number of overnight stays in 2018 compared to 2015, we can see that most overnight stays are registered in the case of tourist stops, followed at a great distance by tourist villas and students and preschoolers camps.

A decrease in the number of overnight stays is reported in 2018 compared to 2015 in the case of motels by 58%, tourist cottages by 38% and tourist guesthouses by 9%.

Table 4. Overnight stays in tourist reception structures in Alba County during 2015-2018

Types of tourist reception structures	2015	2016	2017	2018	Average	2018 vs 2015		Growth rate
	no	no	no	no	no	no	%	%
Total	312,762	313,415	350,329	364,474	*335,245.0*	*51,712*	116.5	5.2
Hotels	143,482	145,078	158,075	154,427	*150,265.5*	*10,945*	107.6	2.5
Hostels	3,816	6,191	7,526	5,142	*5,668.8*	*1,326*	134.7	10.5
Motels	12,375	8,027	9,020	7,657	*9,269.8*	*-4,718*	61.9	-14.8
Tourist villas	9,960	8,511	18,547	24,502	*15,380.0*	*14,542*	246.0	35.0
Tourist cottages	10,380	6,338	4,747	4,311	*6,444.0*	*-6,069*	41.5	-25.4
Campsites	818	1,340	1,019	894	*1,017.8*	*76*	109.3	3.0
Tourist stops	33	1,993	1,977	1,375	*1,344.5*	*1,342*	4166.7	246.7
Students camps	3,738	3,817	5,038	8,153	*5,186.5*	*4,415*	218.1	29.7
Tourist guesthouses	52,043	52,124	47,912	47,421	*49,875.0*	*-4,622*	91.1	-3.1
Agrotourist guesthouses	76,117	79,996	96,468	109,678	*90,564.8*	*33,561*	144.1	12.9

Source: INSSE, [15] accessed on 16.05.2019 and processed data.

"The net use index of the operating tourist accommodation capacity expresses the relation between the operating capacity of accommodation and its effective use by tourists, in a given period. It results from calculation by dividing the total number of overnights spent at the operating tourist accommodation capacity, from that period" [9].

Table 5 presents the averages of the net use index of accommodation places for each year from 2015-2018. We can notice that in 2015 and 2018 accommodation places were occupied by an average of 24%, with lower values of 22.2% in 2016 and of 23.3% in 2017.

Table 5. Average of the net use index of accommodation places in the period 2015-2018 (%)

Years / Indicator	2015	2016	2017	2018
Average of the net use index of accommodation places	24	22.2	23.3	24

Source: Data processed from www.ccir.ro, [3] accessed on 23.05.2019

Analysing this index of the net use of accommodation in Alba County, between 2015-2018, it is found that on average the accommodation places were used in proportion of 23.4%. Considering the diversity of the existing accommodation

structures at the level of Alba county, it can be said that tourists have the possibility to choose the accommodation unit that meets expectations and meets their needs in all seasons and in all tourist areas of the county.

CONCLUSIONS

The tourism phenomenon in Alba County is in a continuous dynamic, which results from the analysis of the statistical database from 2015-2018.

Following the research of tourism in Alba County, the following were observed:

- the existence in 2018 of a number of 204 tourist reception units with accommodation functions, a value that is in an upward trend;
- the tourist accommodation capacity has an increase of 15% in 2018 compared to the reference year 2015;
- the number of tourists arriving in the reception structures exceeded in 2018 the value of 194,000, representing an increase of 26% compared to 2015;
- the number of tourists who have stayed in all the tourist accommodation units is increasing continuously from year to year;
- the accommodation places were used on an average of 23.3% in the period 2015-2018.

From the present analysis of tourism in Alba County it can be seen that on the one hand there is an increasing tourist flow, and on the other hand the physical degradation of the tangible heritage is observed due to the lack of investments in this region. However, there is an increase in the number of tourists staying in the tourist units in the county.

Taking into consideration the direct observation in the field, through the visits made to the tourist accommodation structures in Alba County, it is noticed that the decrease of the number of qualified young population who could work in the tourism industry, which is a painful thing. That is why local authorities, especially in rural areas, should take measures to help young people stay home, stay in the country and get involved in the hospitality industry, even by encouraging them to access reimbursed funds for opening and managing an agrotourist guesthouse, which would lead to the development of the area and to the increase of the citizens' welfare.

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HOW TO USE PRODUCTION FUNCTIONS CHARACTERISTICS OF ECONOMIC PROCESSES IN AGRICULTURE. PHYSICAL (TECHNICAL) FUNCTIONS

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Abstract

Fundamental to economic analysis is the idea of production function. It and its close concept of utility function form the poles of the neoclassical economy. The producer - one of the main players in the market economy - aims to perform those activities that ensure the desired output. Thus, the production factors intervene, the combination of which results in different levels of production. The classical theory represents this conditionality between the production factors and their result with the help of production functions. In this paper we characterize the phases of the production function specific to agriculture.

Key words: *physical production function, production factor, economic analysis, agriculture, marginal and average production*

INTRODUCTION

Functions can provide valuable information at farm level [1].
A function can be interpreted from the point of view of the influence of the analyzed factor on the result in physical expression, without taking into account the economic aspect [6]. If resources and production are given values, the physical function is transformed into an economic function [9].

MATERIALS AND METHODS

Physical production functions can be grouped into two categories [10]:
The first category includes physical functions whose independent variables cannot be quantified in value and therefore cannot be transformed into economic functions [2]. Functions of this type can give indications on the degree of influence of each natural factor on the production, and knowing the way of manifestation of the culture at the analyzed factors can contribute to their better distribution on the territory in order to obtain as many products per hectare [8].

The second category includes the physical production functions in which the factors and results can be quantified in value.
In order to understand the production function, it is necessary to know some economic notions:
The total physical product (y) represents the total amount of production expressed in physical units.
We explain the function $y = F(x_1, x_2, \ldots, x_n)$ with the hypothetical data in Table 1 which contains the average, marginal production in response to the nitrogen fertilizer.

Table 1. Average and marginal production as response to the nitrogen fertilizer:

Input level	**Δx_1**	**(y)**	**Δy**	**$y/\Delta x$**	**$\Delta y/\Delta x$**
0	40	1,170	-	0	-
1	40	1,750	550	44	14.5
2	40	2,450	700	36	17.5
3	40	2,680	230	22	5.75
4	40	2,870	190	18	4.75
5	40	2,990	120	15	3
6	40	2,890	-100	12	2.5

(y) → Total physical production, corn grains per ha
$y/\Delta x$ → Average physical product
$\Delta y/\Delta x$ → Marginal physical product

Source: [9].

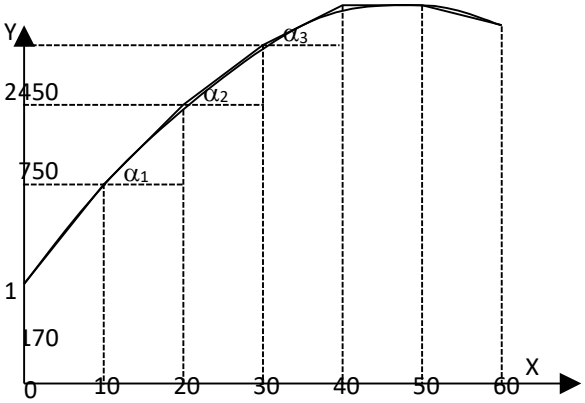

Fig.1. The curve of the marginal physical product
Source: [9].

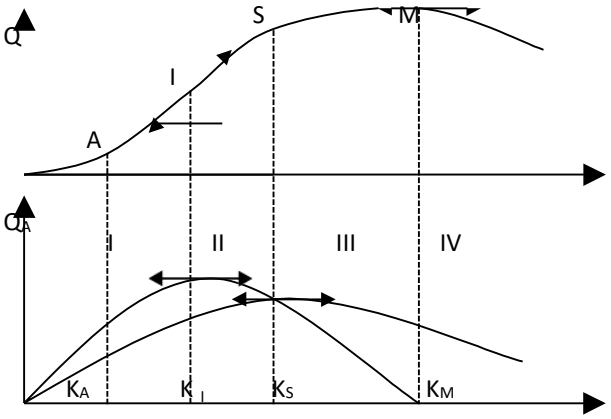

Fig. 2. The three phases of the production function specific to agriculture
Source: [9].

The average physical product or average physical productivity (y_1) represents the production quantity obtained per unit of variable factor consumed at a certain level of the production and at a certain level of the allocated factor. It is calculated as the ratio between the total physical product and the amount of variable factor:

$$y_1 = \frac{y}{x1}$$

The marginal physical product or the marginal physical productivity (y_1) represents the increase or decrease of the physical product as a result of the increase of the consumption of factors starting with a determined level of usage [5], as follows:

$$y_1 = \frac{\Delta y1}{\Delta x1}$$

The curve of the marginal physical product ($\Delta y/\Delta x_1$) derives from the production function and is measured by the slope of the curve of the total physical product (y) [3].

RESULTS AND DISCUSSIONS

The phases of the production function of a single variable factor

In general, in plant culture, production does not react strictly ascending or descending. At the first added quantities, marginal production increases, after which it remains constant, then it begins to decrease until it reaches zero and even negative [4].

Characterization of the three phases of the production function specific to agriculture:

In zone I, as the amount of x1 factor increases, the marginal physical product increases.

In this phase the marginal physical product is higher than the average product per unit factor, while $Ex_1 = \frac{\Delta y}{y} : \frac{\Delta x1}{x1} > 1$ and the maximum value is reached when the marginal product is maximum.

In this area the factor is in insufficient quantities from a technical point of view, its use within this allocation range is detrimental to production and resources are not being fully used either [7].

Zone II is between the maximum marginal production and the average production per resource highest in this zone, although the marginal production decreases, however the average production per resource unit is still increasing The limit of this area is at the point where the marginal production is equal to the average production, namely when the elasticity of the production becomes equal to 1. It is the point of maximum absolute efficiency per resource unit.

Zone III is between the maximum average production and the zero marginal production.

Zone III is an area of intensification of agricultural production, in which a maximum of production per hectare can be obtained but with a growing need for resource quantities per unit of production. The point at which the marginal production is equal to zero, coincides with the maximum of total physical

production and which is also called technical maximum.
The area of technical interest is zone III. At its beginning it is the maximum of average physical production, and at its end the maximum of total physical production.
Zone IV is the area of production losses. The addition of resources becomes harmful, due to which the marginal physical product is negative and due to the negative influence of the marginal product, the production elasticity in this area is negative.

CONCLUSIONS

The analysis of the production function phases provides the manager with the necessary foundations regarding the decision to develop a branch or a product. Knowledge of the technical function is essential for the economic foundation of the decision to allocate factors.

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LEGAL TAX EVASION THROUGH STOCK EXCHANGE GAMES

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Abstract

*Claims related to investments may be a source of tax evasion by granting a loan to a daughter company (in which the parent company holds a majority interest rate) with a higher or lower interest * depending on the need to transfer value between companies, by the limit of expenses allowed by the tax law, as well as other interests, such as the need to cover the interest expenses from the financial and other incomes of the debtor company. Starting from the above, a very large number of value transfer strategies can be conceived between companies belonging to the same holding (a company that holds the majority interest in several companies). This paper refers to the classic case of tax evasion through loans between companies of the same holding company, including those in the agricultural field.*

Key words**:** *stocks exchange, tax evasion, shares, commission, profit*

INTRODUCTION

Stock exchange operations offer participants the opportunity, as well as the purchase of securities whose value is expected to increase over time, and the opportunity to conduct operations [6] as a result of which the taxable profit of the economic agent investing in securities may be significantly reduced. But in order to understand the mechanism of legal tax evasion through the stock market, we will have to present at least the nature of the operations, which are the support of the tax evasion and the financial institutions, which act within them.

MATERIALS AND METHODS

We assume, for a start, the existence of a stock exchange in which brokerage houses operate, which carries out intermediation on securities transactions and an investor (own company), which is endorsed in stock market speculations, it may be a company with agricultural activity [4]. When an investor opens an account with a stock exchange brokerage firm, he may wish and receive some "difference account" privileges, which allow a complete list of services. Having a difference account, he can borrow funds to purchase shares, buy and sell more speculative securities and engage in more complex strategies. Part of this difference account will be the subject of a pledge agreement [8]. This allows the brokerage firm to borrow the investor's shares on behalf of other investors who wish to engage in financial speculation [1]. The shares are held on behalf of the brokerage firm, and in the interest of the investor; that is, they are kept, as the "unofficial name" of the broker says. The brokerage firm holds its shares on its behalf, but with the contractual obligation to offer the shares of the investor, upon request. It allows the brokerage company to lend the shares, periodically, to the speculators, who assume that the share price is going to fall. They engage in "sales without cover". These assume that the investor borrows from the brokerage firm a number of shares at a certain value, for which he pays a commission (and possibly an interest) and sells them on the stock exchange at a certain price [3]. He waits for a while until the share price drops and announces the brokerage firm that it wants to close its position without coverage, meaning he wants to buy back the shares he owes. Thus, with a part of the money he obtained from the sale without coverage, the speculator

purchases the borrowed securities by entering a purchase order on the stock exchange.

After the payment of the acquired shares and the related commissions, the speculator can remain with a positive difference that constitutes his profit. However, there are also situations when the share price increases unexpectedly, and the amounts obtained from the sale of the shares are not sufficient to allow the repurchase of the borrowed shares, causing risks for the intermediary company. Thus, the brokerage firm will call the speculator, requesting to deposit additional funds in the account in order to make the hedging transaction possible. Because these things happen under the condition of the existence of a difference account, such an unwanted event is called a difference request. If the funds required for hedging are not paid on time, the broker may sell other securities from the speculator's account to cover the damage. There are other complications. If the borrowed capital offers its holder a dividend, not the same thing happens during the period corresponding to the sale without cover. In short, two people (at least), believe that they own the shares at the same time, the initial owner (the investor) and the person to whom the shares were sold. The only way in which the initial holder can receive his dividend is for the one who sells without coverage to pay it, giving rise to an additional expense for him. The speculator must give back any income lost to the investor as a result of the sale without coverage. But speculation can be achieved not only by selling without coverage, but also by buying without coverage, which involves contacting a credit from the brokerage firm for the purchase of a volume of shares whose price is expected to increase in the next period. Thus, in exchange for commissions, the speculator now acquires a volume of shares which he sells when their price has increased so as to cover the commissions paid for granting the credit and carrying out the transactions.

Even for long-term investors, these types of transactions are useful either to protect the value of the stock package or to reduce their taxable income at the end of the year. For example, when a period of temporary decline is seen in the business of a company, and the investor knows that they are of limited duration, he can take advantage of this to increase his income [5]. At the beginning of the decline period, the investor sells without cover an amount of shares at least equal to that held by him, without selling his own shares (this bears the name of sale without cover against the box and refers to the fact that the investor has not sold his own shares, he owns at the brokerage firm in a box). When the decline in the share price is maximum, the investor orders the hedging of the position without coverage by mobilizing a part of the amount with which he sold the uncovered shares for the acquisition of new shares. So by purchasing the new shares the investor repays his credit. When it wishes to temporarily reduce its income in order to record a loss at the end of the year, to stop paying income tax, or to reduce its amount, the investor proceeds one month before the end of the financial year to occupy simultaneous positions in front of the course of an action [9]. That is, to buy and sell at the same time without cover a volume of shares that he usually holds effectively at the box (so we are in a case of transactions without cover against the box). By the end of the year, one of the positions is losing (assuming the stock price changes). On December 31st or in any case in the last days when the stock exchange is opened in the respective year, the investor deliberately decides to cover its position in loss, generating in this sense a loss in the account of the year already completed. At the beginning of the year he decides to cover the other position, which transfers his income to the other fiscal year without paying any tax related to them. The price of the tax deferral is the commissions that can be covered from future earnings [10].

RESULTS AND DISCUSSIONS

Operation efficiency calculations: On 30.11.N 1. The investor requests a loan of 6,000,000 m.u., Commission 2% 6,000,000 * 2% = 120,000 m.u.

2. The investor orders the purchase of 1,000 shares of 6,000 m.u., Commission 1% 6,000,000 * 1% = 60,000 m.u.
3.The investor borrows 1,000 shares present value of 6,000,000 m.u., Commission 1% 6,000,000 * 1% = 60,000 m.u. On 31.12.N
4.The investor covers his position at a loss, meaning he buys 1,000 shares to repay them in the account of the loan granted. 1,000 * 9,000 = 9,000,000 m.u., 1% commission 9,000,000 * 1% = 90,000 m.u. So the loss from the sale without cover is 9,000,000-6,000,000 = 3,000,000 m.u. without commissions. On 1.01.N + 1
5.The investor hedges his winning position by selling the acquired shares without cover. 1,000 * 9,000 = 9,000,000 m.u. So he sold the shares with a profit of 9,000,000 - 6,000,000 = 3,000,000 m.u., Commission 1% 9,000,000 * 1% = 90,000 m.u.
Total commissions paid = 120,000 + 60,000 + 60,000 + 90,000 + 90,000 = 420,000 m.u..
The result of the operation = 3,000,000-3,000,000 = 0 m.u.
But at the end of the year he saved the payment of a profit tax of 3,000,000 * 16% = 480,000 m.u. For this he spent 420,000 m.u., so he registered a net profit of 60,000 m.u.
Tax fraud is a means of increasing the performance of the company. However, it should be noted that, as a rule, this performance is no longer highlighted in any way in the accounting of the company, but rather in the own accounting of the owner or administrator [2].
Of course, such accounting is usually conducted according to our own methods, but we can consider the value of the additional gain through the value of taxes and fees evaded to be paid [8].

CONCLUSIONS

Managers, wanting to preserve within the company as much as possible of the added surplus value, resort to tax evasion in order to restrict the company's treasury scores in favor of the state.
Making money (performance) is far from leaving you in the hands of a free market economy, which will protect your value created through the work done in an organization. The current competition requires the use of new techniques much higher than the actual production or marketing process to take value, these are the financial processes by which you protect what you have created. Perhaps not always moral, perhaps often illegal, these processes allow a new way of developing companies, and in this war in which each of us fights alone the winners are those who take advantage first, as long as possible and as much as possible.

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STUDIES CONCERNING THE EVOLUTION OF THE LEADER APPROACH, PART OF THE COMMON AGRICULTURAL POLICY, AS A SUPPORT FOR SUSTAINABLE DEVELOPMENT OF THE RURAL AREA

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Abstract

This article aims to analyze the evolution of the LEADER approach from the pilot project stage to the present. The article aims to the stages of the LEADER approach and their particularities from the timid beginnings of LEADER in Europe and emphasize the relevant aspects of this innovative approach: principles, eligible territory, added value. LEADER has emerged as a necessity of rural development policies regarding the objective of their interventions, interventions aimed at revitalizing rural areas and creating jobs. It follows the evolution of the relevant indicators of the LEADER approach in Europe and in Romania such: covered territorial area, allocated amounts. Also, some data are presented to highlight the LEADER financial allocation compared to the rest of the EAFRD budget allocated to that country. For the first stage LEADER the financial allocation was 442 million euros distributed to a number of 217 local action groups, the success of LEADER being proved over time by the increasing financial allocation, the covered area and the number of local action groups, respectively: 9,400 million euros and 2,784 LAGs in Europe in 2014 – 2020. In Romania, there are 239 LAGs that have financial allocation of 563.50 million euros and an eligible territory of 228,754 km^2.

Key words**:** *LEADER, rural development, sustainable development, bottom-up, innovation, LAG,*

INTRODUCTION

Rural development is a vast, highly topical and very dynamic topic. More than 50% of inhabitants of the European Union live in rural areas, which cover almost 91% of the European territory. CAP acts in the territory through its second pillar named RDP: rural development policy. Rural development is an area with a wide coverage area including elements of financing, management, technology, agriculture, animal husbandry and alternative sources of income, forestry, crafts, ecology, sociology and social assistance. The different approaches to rural development experienced until the 1980s were mainly based on a sectoral concept, with top-down planning and simplistic measures to support beneficiaries instead of measures to involve local people through local development agents. The entry into force of the Single European Treaty entered into force in 1987 in conjunction with the recognition of the need to change the approach of the Treaty of Rome led to the creation of territorial instruments designed to help correct the regional imbalance within the European Community less developed and for the reconversion of declining industrial regions. Thus, on 15 March 1991 (COM/91/C73/14) the first Community initiative for rural development known as LEADER was approved. This acronym comes from the French "Liaison Entre Actions de Développement de l'Économique Rurale" meaning. To cope with the restructuring of the agricultural industry, during the 1990s, rural Europe had many local actions and solutions for local development. [9]. At European level, the need for a LEADER approach arose when public rural development programs in the Member States were limited, in terms of the objective of their interventions [11]. The LEADER policy supports the European objectives for rural

development, this can be interpreted differently in each country [3]. The LEADER program, according to rural policy, takes into account the territorial dimension [5]. The LEADER approach has been at the heart of European rural development policy for the last 20 years, encompassing the principles of bottom-up endogenous development and community empowerment [10]. LEADER is a working methodology, based on a trilogy: strategy, territory and partnership meant to revitalize and enhance the rural environment through prominence, autonomy and responsibility of the rural population [7]. The original purpose of the LEADER community initiative was to develop innovative ideas for model rural development that could be replicated in other areas [4].

The LEADER stages are the following:

1991 - 1993 – LEADER I ;
1994 – 1999 – LEADER II ;
2000 – 2006 – LEADER + ;
2007 – 2013 – LEADER ;
2014 – 2020- LEADER.

LEADER I (1991 - 1993) is characterized by being a pilot experience implemented in several territories of the European Union, marked the beginning of a new conception of rural development policy based on a territorial, integrated and participatory approach. It received a very positive response from the private sector in terms of investment contribution. LEADER II (1994 - 1999) represents the generalization of the LEADER I program, offering a special importance to the innovative character of the projects in rural areas, the emphasis of the LEADER program on rural and agricultural development, being replaced by integrated projects. of the LEADER I program being replaced by integrated projects, through which the development of innovative activities carried out by local agencies in all sectors of activity in the rural world.

LEADER + (2000 - 2006), the last of the three Community rural development initiatives that took place, was presented through Commission Communication C / 139 / C to Member States of 14 April 2000. It aims to develop original strategies of sustainable development and quality, designed to experiment with new forms of capitalization of natural and cultural heritage, improving jobs and the quality of organization of those rural communities.

LEADER + maintains its laboratory function for discovering and experimenting with new approaches to integrated and sustainable development that influence the rural development policy of the European Union. It is meant to support and develop integrated strategies for local rural development. Emphasis should be placed on capitalizing on local products, using new technologies and knowledge, capitalizing on natural and cultural resources (unifying themes), piloting, transnational projects and inter-territorial projects.

Axis 4 LEADER (2007-2013), transversal axis on the other three axes of action within the European Rural Policy which involves the integration of the LEADER methodology in all rural territories of the European Union, its main purpose being to contribute to achieving the objectives of the other 3 axes of rural policy. One of the aspects is in its original essence, and in many Member States it has meant a real innovation: the creation of partnerships as structures of local government. This is a strategic element that makes the difference between the LEADER program and other types of programs, the difference being that it has managed to be based on aspirations and projects created at the local level. LEADER (2014-present) - aims to settle the approaches and actions started in the previous stages through a balanced territorial development, which involves covering the entire LEADER territory by as few LAGs as possible.

The principles of the LEADER approach are governed by Article 61 of Regulation 1698/2005, namely (Figure 1):

-Local development strategies by areas, designed for clearly delimited rural and subregional territories;
-Local partnerships between the public and private sectors or local action groups;
-A bottom-up approach that gives local action groups decisive power in developing and

implementing a local development strategy (bottom-up approach);
-Cooperation and multisectoral application of the strategy, based on the interaction between agents and projects in the different sectors of the local economy;
-Implementing innovative approaches;
-Execution of cooperation projects;
-Creating a network of local partnerships.
These are also called the 7 "good governance key dimensions" [2]. LEADER is an innovative approach through the very principles it applies: bottom-up approach, partnership, cooperation, etc.

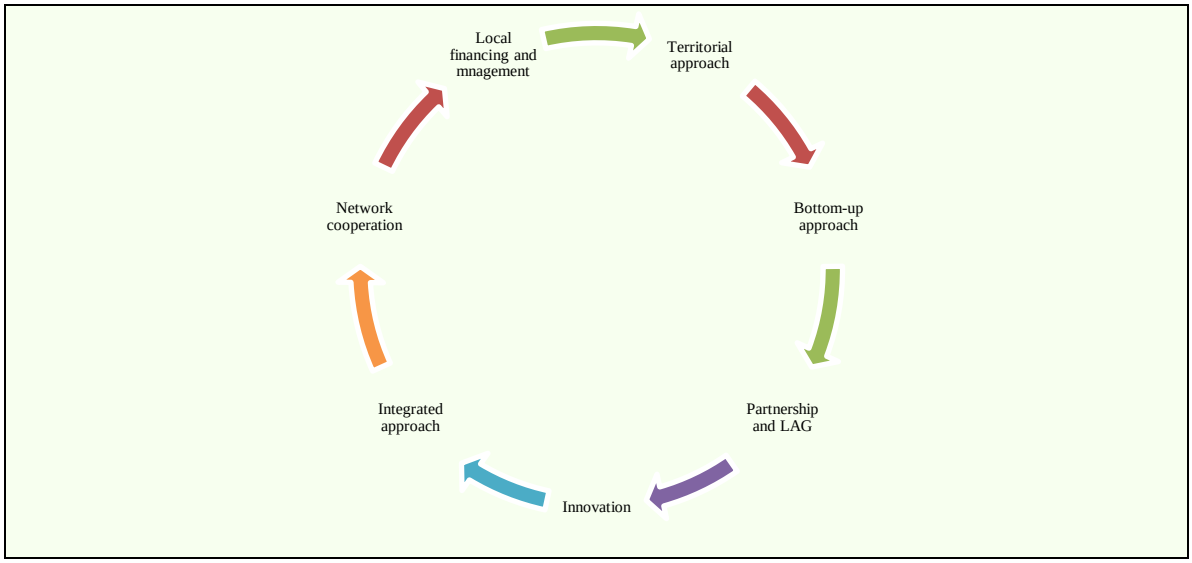

Fig. 1. Leader principles.
Source: Own design.

The LAG (Local Action Group) is the instrument through which the LEADER principles can be implemented. The main feature of LEADER is the local action group (public-private partnership), having the role of managing financial resources and implementing the LAG strategy. It is constituted according to OG 26/2000 on the basis of an agreement, in which the private partners must represent the majority (minimum 51% of the partnership structure). The establishment of Local Action Groups (LAGs) within the framework of LEADER with the participation of public and private actors through a bottom-up approach (i.e., the empowerment of local society) and the management of local development strategies constitutes one of the major innovations in the field of rural policy [8]. In the LEADER I phase, approximately 217 local action groups have been set up at European level, covering an area of 367,000 km^2 and a financial allocation of EUR 442 million. LEADER II contributed to the increase of the number of local action groups previously set up with another 1,000, the covered territory being of 1,375,144 km^2 and the financial allocation of 1,755 million euros. Following the upward trend LEADER + came with an increase in the number of local action groups with another 896 which led to a covered area of 1,577,386 km^2 and a financial allocation of 2,105.10 million euros [11]. LEADER, as it has been called since 2007, led to the existence of 2,451 LAGs in 2013 and 2,784 LAGs in 2019. The LEADER approach in Romania begins in 2006, when the Ministry of Agriculture and Rural Development identified 120 territories as potential LAGs. Through the National Rural Development Program 2007-2013, 163 LAGs were established, on an area of approximately 142,000 km^2 (representing 58% of the population eligible for LEADER and 63% of the territory eligible for LEADER) [1]. In the 2014-2020 programming period, the number of local action groups reached 239, approving all 73 submitted local development strategies, reaching 93% of the LEADER eligible area. The eligible area LEADER was 228,754 km^2

and the eligible population LEADER 11,359,703 inhabitants.

MATERIALS AND METHODS

The data presented in this article are meant to highlight the evolution of the LEADER approach, present evolution of indicators such as: area covered by the total eligible area LEADER, financial allocation and number of local action groups, local action groups being the main tool through which the LEADER approach it can implement your principles. These were centralized from data taken from various sources.

RESULTS AND DISCUSSIONS

As can be seen in Table 1 in the early stage of LEADER (1991 -1993) the area of LEADER territory was 367,000 km^2, with a financial allocation of 442 million euros corresponding to a number of 217 local action groups in Europe. It is observed that, in Europe, the LEADER program had an evolution, in the period 2014-2020, reaching a number of 2,784 LAGs with a financial allocation of 9,400 million euros.

In Romania, the LEADER program starts in the period 2007-2013, with an area of 142,000 km^2 and a financial allocation of 424.20 million euros, with a number of 163 LAGs.

Table 1. LEADER eligible area and financial allocation in LEADER stages

	LEADER I (1991-1993)		**LEADER II (1994 – 1999)**		**LEADER + (2000-2006)**		**LEADER (2007-2013)**		**LEADER (2014-2020)**	
	Europe	Romania	Europe	Romania	Europe	Romania	Europe	Romania	Europe	Romania
Surface [km^2]	**367,000**	-	1,375,144	-	1,577,386	-	4,007,304.94	142,000	-	228,754
Financial allocation [mill. Euro]	442	-	1,755	-	2,105.10	-	8,900	424.20*	9,400	563.50
No. of LAGs	217	-	1,217	-	2,113	-	2,451	163	2,784	239

Source: Own calculation based on data www.enrd.ec.europa.eu.
* allocation resulting at the end of the programming period. (Budgetary changes may occur during the programming period and the amounts allocated may increase).

The LEADER budget comes largely from the European Agricultural Fund for Rural Development. It is important to note that the LEADER budget is at least 2.5% for the new Member States and 5% for the others [6].

In order to highlight this aspect, we analyzed the data of several European states in the 2007-2013 and 2014-2020 programming periods. We note that in Romania and Bulgaria (which joined the European Union on January 1, 2007) the LEADER budget is 2.31% and 2.35% of the total budget of the National Rural Development Program for each state, while in the rest of the analyzed countries the budget exceeds 5% (Figure 2).

In comparison, in the period 2014-2020, when the two states could no longer be considered newly joined, the LEADER budget exceeded the minimum of 5% (Figure 3).

The LEADER eligible territory is characterized by small size [11]; rural character (and cities with less than 20,000 inhabitants) and continuous territory; homogeneity; identity; low density; local identity.

The implementation of the LEADER approach generates added value in the territory through: measure sheet institutional capacity; human resource development and use of know-how; identifying creative local solutions to existing problems at the local level; development of public utility projects and/or with economic, social, cultural and natural impact;

local identity development; exchanges of experience and good practices inter-territorial and trans-national.

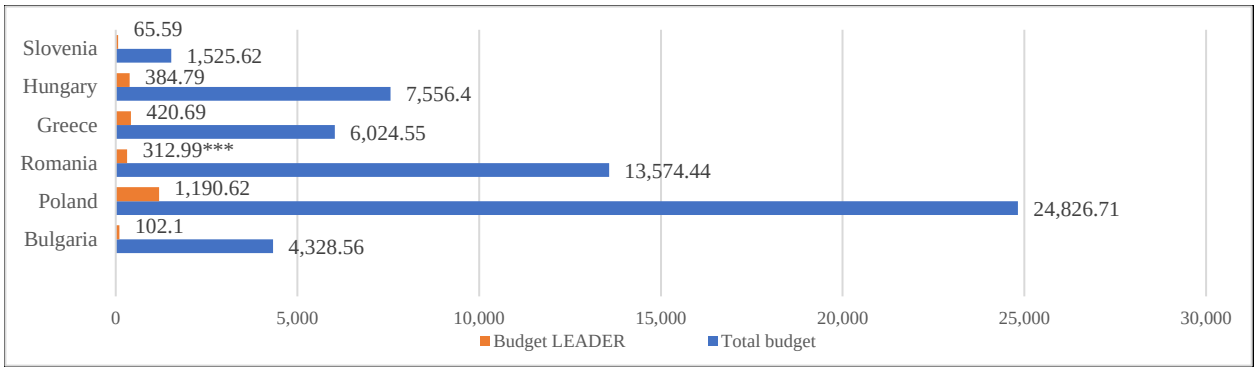

Fig. 2. Examples of LEADER financial allocations 2007-2013 (million Euro)
Source: Own construction based on data taken from www.enrd.ec.europa.eu.

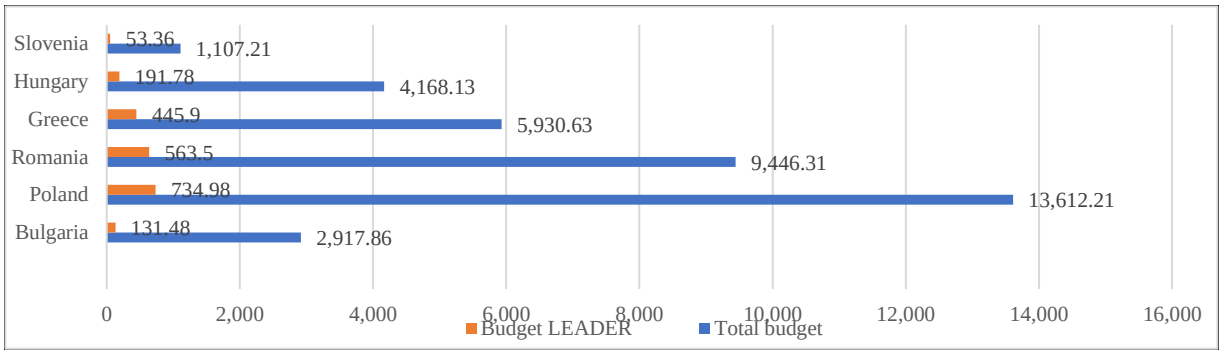

Fig. 3. Examples of LEADER financial allocations 2014-2020 (million euros)
Source: Own processing after data taken from www.enrd.ec.europa.eu.

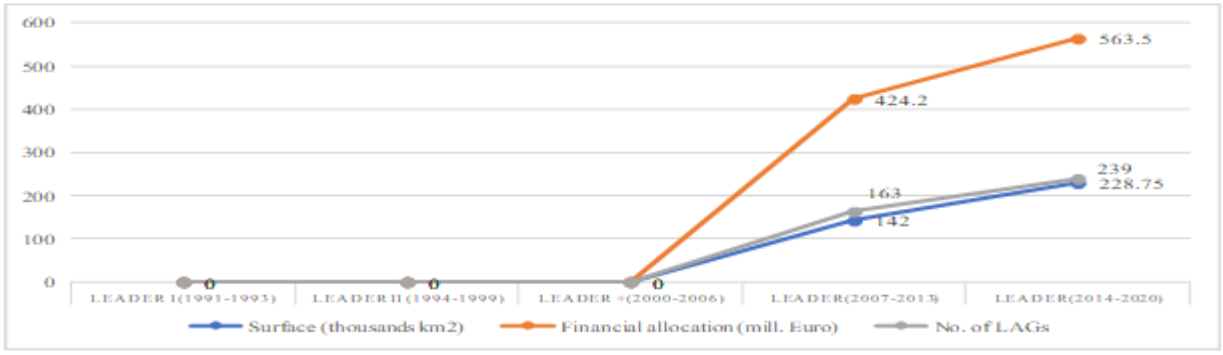

Fig. 4. Total surface, financial allocation and number of LAGs in Romania in different steps of LEADER evolution
Source: Own processing after data taken from www.enrd.ec.europa.eu.

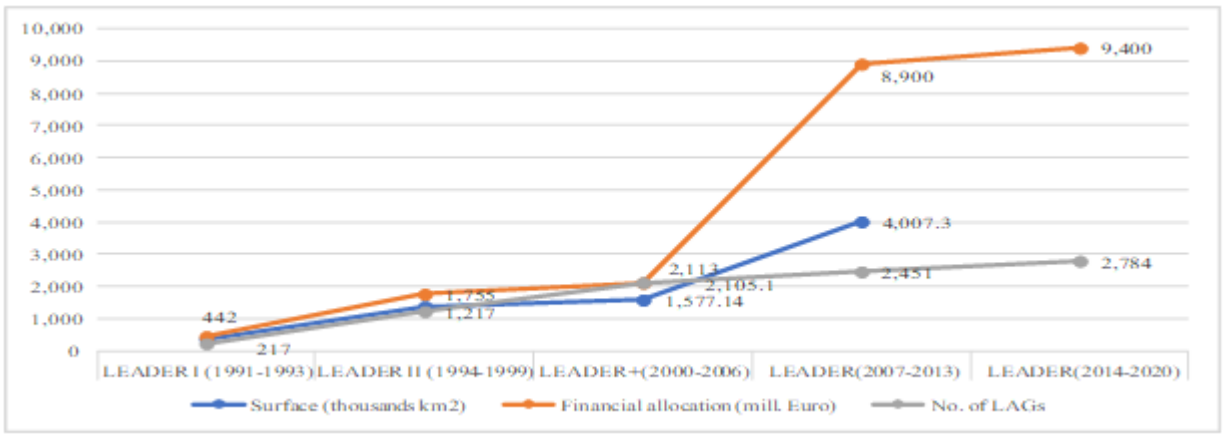

Fig. 5. Total surface, financial allocation and number of LAGs in Europe in different steps of LEADER evolution
Source: Own processing after data taken from www.enrd.ec.europa.eu.

CONCLUSIONS

We can conclude that, although the beginning was timid and at first LEADER was considered a pilot project, the data presented reveal that it has left its mark on rural development in Europe. For the first stage LEADER the financial allocation was 442 million euros distributed to a number of 217 local action groups, the success of LEADER being proved over time by the increasing financial allocation, the covered area and the number of local action groups, respectively : 9,400 million euros and 2,784 LAGs in Europe in 2014 – 2020. In Romania, there are 239 LAGs that have financial allocation of 563.50 million euros and an eligible territory of 228,754 km^2.

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EVOLUTION OF GEOGRAPHICAL INDICATIONS IN EUROPEAN UNION BASED ON eAMBROSIA

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Abstract

The European Union is famous for its safe, nutritious and high-quality food and drinks. Trying to achieve sustainability on food production, at European level are considered also the traditional production methods which contribute together with the standard production methods to assure quality and diversity. The aim of the paper is to underline the evolution of geographical indication based on eAmbrosia. Different regulation at European level, laws, reports and data were used for the paper and the research methods included using statistical methods. The variation of geographical indications can be linked to the European Union' states agricultural potential, to the supporting measures and their cultural and gastronomic inheritance.

***Key words*:** *Geographical indication, European Union, evolution, support*

INTRODUCTION

The European Union is famous for its safe, nutritious and high-quality food and drinks. Trying to achieve sustainability on food production, at European level are considered also the traditional production methods which contribute together with the standard production methods to assure quality and diversity. The aim of the paper is to underline the evolution of geographical indication based on eAmbrosia. Different regulation at European level, laws, reports and data were used for the paper and the research methods included using statistical methods. The variation of geographical indications can be linked to the European Union' states agricultural potential, to the supporting measures and their cultural and gastronomic inheritance. The quality and diversity of production, and here referring to production of agriculture, fisheries and aquaculture activities, represent a key point for European economy. These attributes can be translated into competitive advantages for EU farmers and producers, as they kept the traditions alive while considering new production methods and materials [1, 3].

The producers' efforts to offer diverse quality products are rewarded and so they can continue in offering this type of products. So, in condition of fair competition the buyers and the consumers can be informed about the products characteristics [13].

Currently, our country is listed as having registered at European level 59 wines with a geographical indication, which include 44 Protected Designation of Origin (PDO) wines, 15 protected geographical indication (PGI) wines, 11 foods which include one protected designation of origin (PDO) product, 9 protected geographical indication (PGI) products and one product registered as a traditional specialty guaranteed (TSG) [12, 4].

Referring to the agricultural potential of our country and the cultural and gastronomic heritage, it can be said that the registration of products with geographical indications can be a solution for producers not only to recognize the value and quality of their products, but also a safety net for their activity [11, 2].

MATERIALS AND METHODS

The purpose of the paper is to highlight the evolution of geographical indications in European Union, as the number of products benefiting from geographical indications varies greatly from one state to another.
For producers, quality schemes bring clear benefits in terms of marketing and they contribute to increase the sales because of the high quality and recognition of these products, close to the consumers availability to pay for the products with proven authenticity. The different politics of European Union, starting from trade politics to Common Agricultural Politic, supported and encouraged the producers to register their products in order to obtain more profit and to gain more visibility on the market [6, 7, 10].
The articles study the evolution of the geographical indication in European Union member states for products as wines, food, spirit drinks and aromatised wines. As Romania is a member state, the study is considered necessary in order to underline the country position on a dynamic market and to predict the development potential. The article analyses four different product categories: a) wines, more exactly PDO and PGI wines; b) food, and here the focus is on PDO, PGI and TSG; c) spirit drink with geographical indications and d) aromatised wines with geographical indications. The number of geographical indications registered each year and the trend were calculated based on the date from European Union geographical register. A special attention is paid to each geographical indication category, due to the differences in the same state. The primary data collected for the paper came from various sources.
At European Union level, the releases of the European institution were used, together with the treaties, regulations, directives and other acts, while at national level they were used the agreements signed by Romania and the data from Ministry of Agriculture and Rural Development. Various publications in the field were also used in order to have a better base for our study.

RESULTS AND DISCUSSIONS

Initially, products with a geographical indication were protected under national law, but this was limited to the protecting them in that State. The expansion of trade in the nineteenth century, stressed that national protection is not enough, due to the many situations in which products were imitated in other countries different that the country of origin. So, there was needed that the international cooperation to be established in order to ensure that they are protected internationally and that is reciprocity regarding the protection between states. Paris Convention for the Protection of Intellectual Property, from 1883, represents the results of the first efforts in formulating and adopting a common approach regarding intellectual propriety [14]. The Convention was not limited only to geographical indications, it included covered all aspects regarding the intellectual property (Figure 1).

Fig. 1. The most important treaties related to geographical indication
Source: Authors representation.

In 1920, Romania acceded the Paris Convention for the Protection of Industrial Property and Madrid Agreements Concerning International Registration of Marks, and almost one century later the Lisboa Agreement, in 2015 [17]. In 1998 was adopted in our country the Madrid protocol and WTO TRIPs in 2001 [15, 16, 18].
Over the time, the number of products registered in the European Geographical Indication Register varied a lot (Figure 3) [8]. This fact is due principally to the economic

context, to the support for the producers to register their products but also to trade agreements signed with other countries [5].

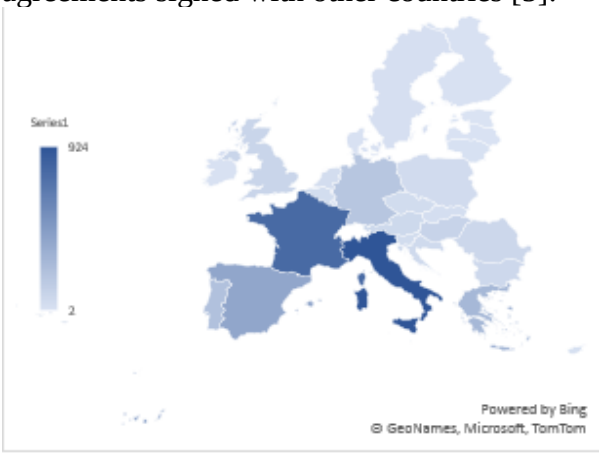

Fig. 2. GI distribution in European Union
Source: Authors' calculation based on eAmbrosia, 2020 [8].

In European Union, Italy has the largest number of products with geographical indication, followed by France, Spain, Greece and Portugal (Figure 2). Together, these five countries have 71.64% from the EU total number of GI from European Union (even the UK left the European Union this year, we consider properly to consider it for our study to the economical bounds) (Figure 4 and 5).
Romania has only 79 products with geographical indication, more precisely only 2.14% from European Union total number of GI (Table 1). Considering the agricultural potential of our country we may affirm that our country can be a better player on this market.

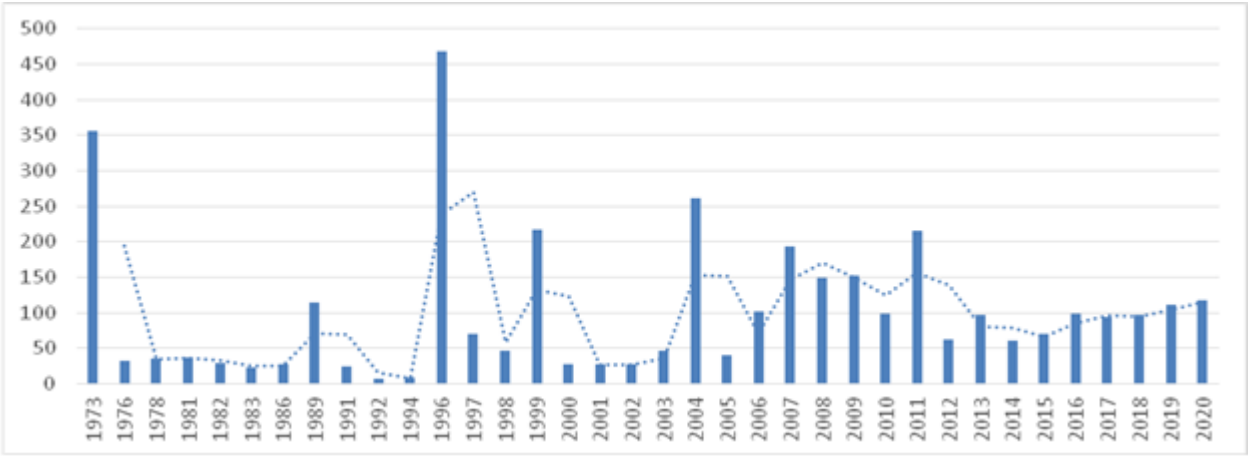

Fig. 3. Evolution of GI in European Union, 1973-2020
Source: Authors' calculation based on eAmbrosia, 2020 [8]

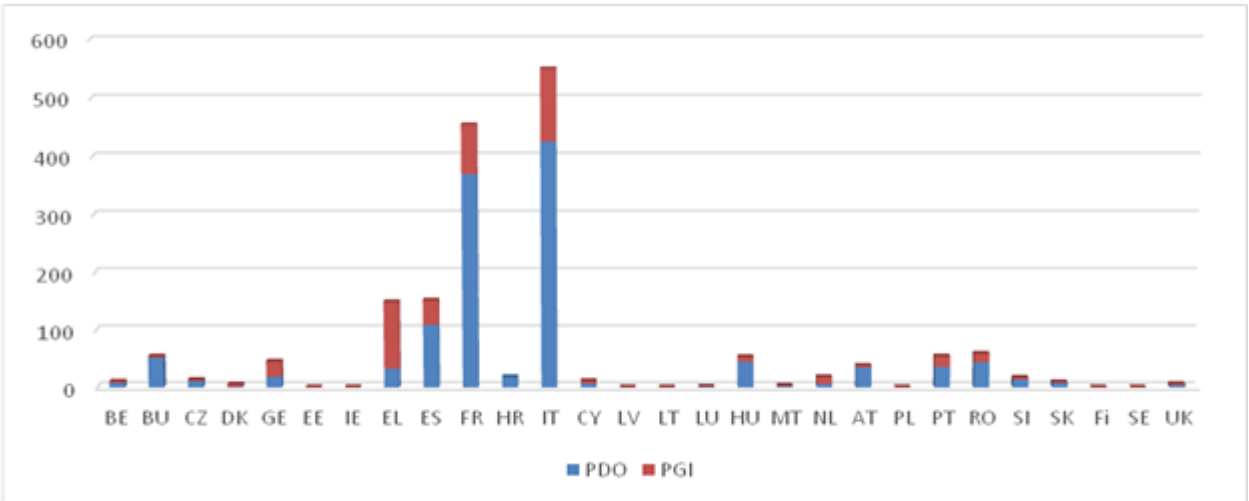

Fig. 4. PDO and PGI for wine in European Union
Source: Authors' calculation based on eAmbrosia, 2020 [8].

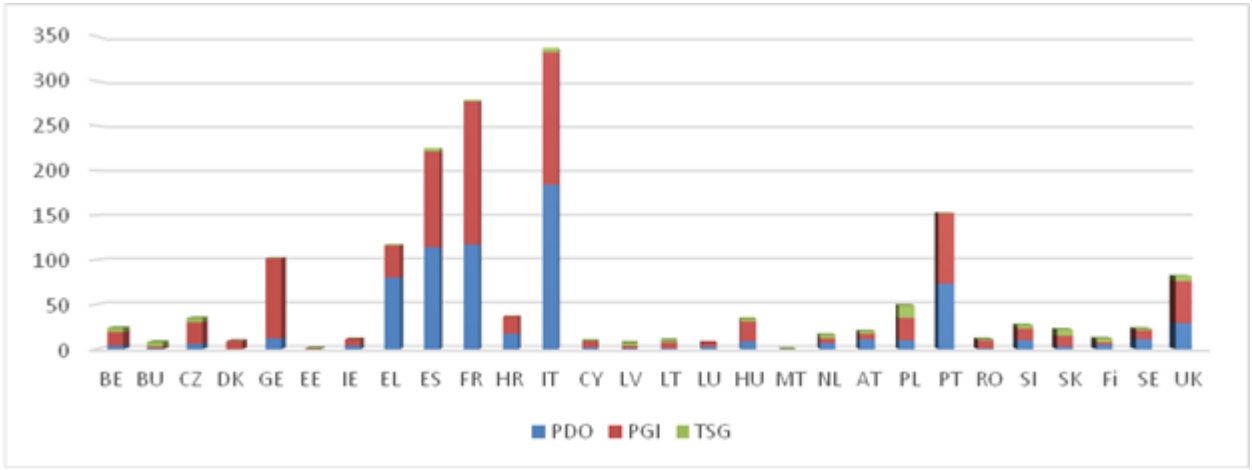

Fig. 5. PDO, PGI and TSG for food in European Union
Source: Authors' calculation based on eAmbrosia, 2020 [8].

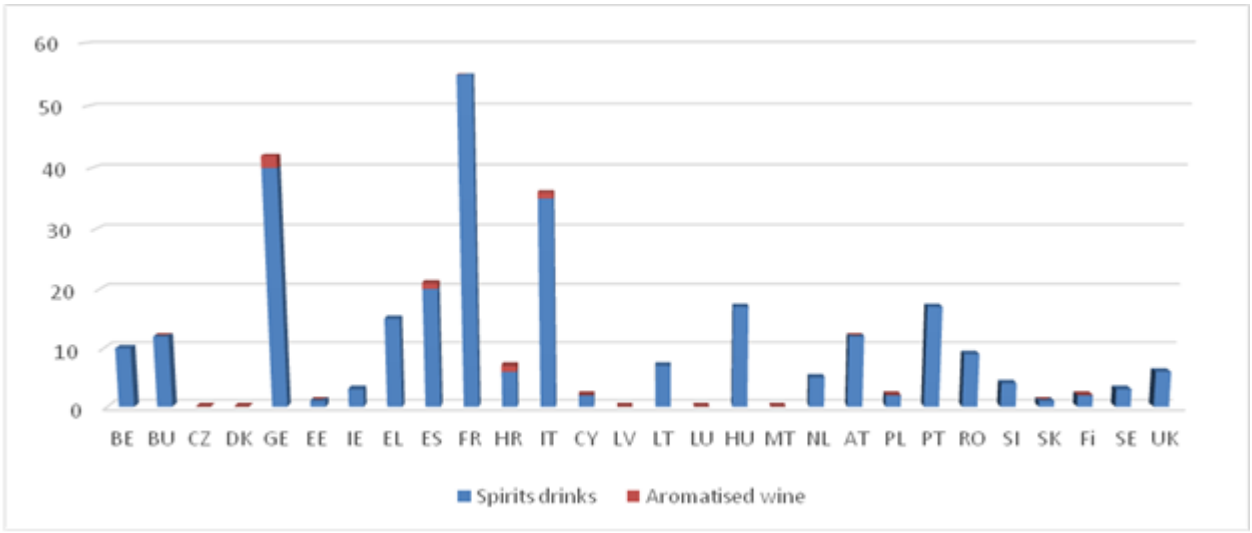

Fig. 6. GI for spirit drinks and aromatised wines in European Union
Source: Authors' calculation based on eAmbrosia, 2020 [8].

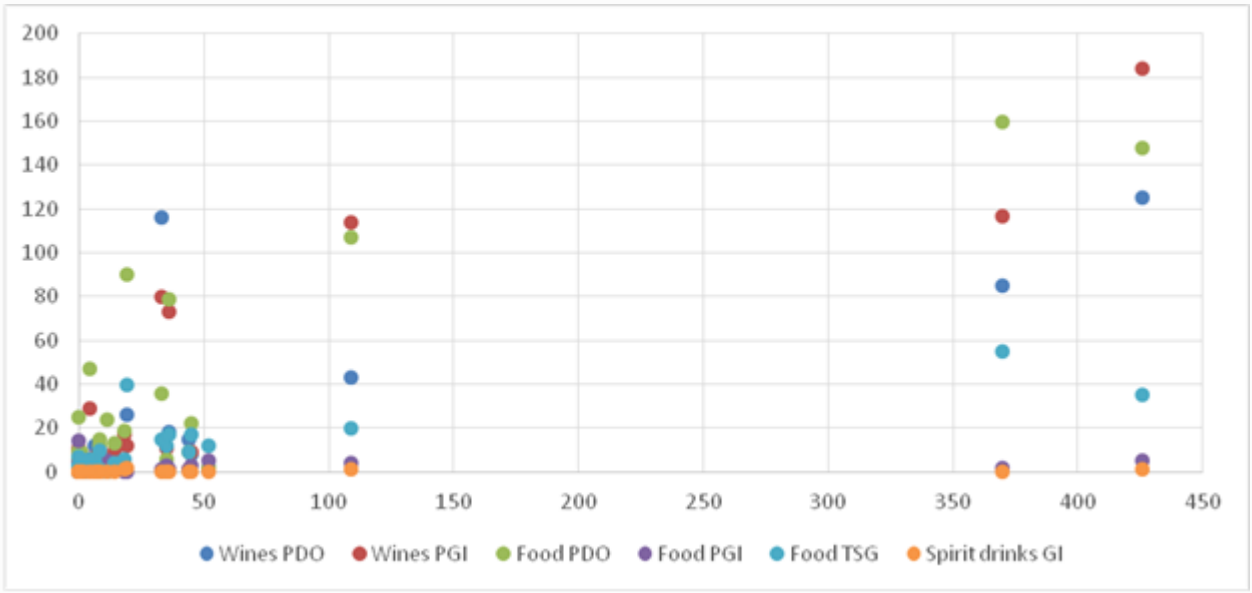

Fig. 7. GI frequency in European Union
Source: Authors' calculation based on eAmbrosia, 2020 [8].

Table 1. Geographical indication by Member States

	Member states	Gi no.	% from total	max no.	min no.
1.	Belgium	44	1.20	F PGI/15	**0**
2.	Bulgaria	74	2.01	W PDI/52	**0**
3.	Czechia	48	1.31	F PGI/ 24	**0**
4.	Denmark	14	0.38	F PGI/ 9	**0**
5.	Germany	189	5.14	F PGI/ 90	**0**
6.	Estonia	2	0.05	F PGI/ 1	**0**
7.	Ireland	14	0.38	F PGI/7	**0**
8.	Greece	281	7.64	W PGI/116	**0**
9.	Spain	398	10.83	F PDO/114	AW1
10.	France	789	21.46	WPDO/370	0
11.	Croatia	61	1.66	F PGI/19	0
12.	Italia	924	25.14	WPDO/426	AW1
13	Cyprus	22	0.60	WPDO/TG/ 7	0
14.	Latvia	7	0.19	F PGI/ 3	0
15.	Lithuania	17	0.46	F PGI/ 7	0
16.	Luxembourg	8	0.22	F PGI/ 4	0
17.	Hungary	104	2.83	WPDO/ 45	0
18.	Malta	3	0.08	WPDO/ 2	0
19.	Netherlands	39	1.06	WPGI/12	0
20.	Austria	70	1.90	WPDO /35	0
21.	Poland	51	1.39	F PGI/25	0
22.	Portugal	224	6.09	F PGI/ 79	0
23.	Romania	79	2.15	WPDO/ 44	0
24.	Slovenia	48	1.31	WPDO/ 14	0
25.	Slovakia	32	0.87	F PGI/12	0
26.	Finland	14	0.38	FPDO/5	0
27.	Sweden	26	0.71	FPDO/11	0
28	UK	94	2.56	FPGI/47	0
	Total UE 28	3,676	100.00	-	-

Source: EC, 2020 [9].

We need to have more products register in order to be able to offer a better protection for our producers in search of stability in the economic global background. Over half of the products registered from our countries are wines from the category protected designation of origin, more precisely 55.70% from the total Romanian products.

At European level, the group of aromatised wines is the one with the lowest entries. There are countries in which not even a product is registered in this category (Figure 6 and 7).

The Italian protected designation of origin represents the category with the highest value, 426 wines registered. The French wines are following with 370 entries and the Greece wines with protected geographical indication. Spain is on the top with protected designation of origin food category with 114.

From the product categories analysed, Italy is leading at PDO and PGI wines, at PDO food and at PGI food, France exceed Italy.

Only four member states have registered over 100 products for at least one category. Italy has over 100 products for 4 categories, followed by France and Spain with three categories, and Greece with one category. Only 25% from members states have over 100 products with registered GI, the rest have under 100 products varying from 94 product (United Kingdom) to only 2 products (Estonia). Near Estonia, Latvia, Malta and Luxembourg represents the states with the lowest number of GI, under 10 GI/state. Spain and Italy are the only states having geographical indication to all seven categories.

CONCLUSIONS

Reporting to European Union level, products with a geographical indication or traditional specialties guaranteed are important. Geographical indication products and can be an opportunity for the development of local economies, and especially in areas where agricultural production is more important in rural areas, but also in disadvantaged areas.

Quality schemes have benefits both for the manufacturer and consumer. The manufacturers can sell the products at a higher price than the rest of the products sold on the market. The consumer has a guarantee of the quality of the buyer products and of them authenticity.

The variation of the products number in European Number states can be related to their agricultural potential, the cultural and gastronomic inheritance, but also the supporting measures for the producers.

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THE ROLE OF THE NEW LAND RELATIONS FOR THE DEVELOPMENT OF VEGETABLE PRODUCTION IN BULGARIA

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Abstract

The impact of the institutional changes on the land relations in Bulgaria over the last 30 years is in response to the number of processes and changes that have taken place before and after the accession of the country to the European Union. The Ownership and Use of Agricultural Land Act, logically, has undergone the most changes (more than 70 changes by 2020). This dynamic of the Ownership and Use of Agricultural Land Act reveals the existence of real issues in the socio-economic system of agriculture and the need to solve them. The existence of favourable soil and climatic conditions, long-standing traditions, rich practical experience, availability and development of new technological solutions and market-oriented innovations, use of modern varieties with improved biological potential, as well as the changes in the Land Act, clarifying the use of agricultural land, outline the future trends for the development of vegetable production in Bulgaria related to the harmonization of the institutional framework in compliance with the requirements of the EU – regulatory framework, strategies and programmes related to land market regulation. The purpose of this article is to analyse the changes in the new Agricultural Land Act, by assessing their impact on the status and dynamic of the vegetable sector, which is one of the most vulnerable sectors in the agricultural industry, as well as the complex processes of fragmentation of agricultural land in Bulgaria. The methodical framework of the study provides a summary overview of the main changes in the new Agricultural Land Act, as well as the degree of fragmentation of the land, which has a direct connection to the position of both parties in negotiation.

Key words**:** *land relations, vegetable production, tendencies.*

INTRODUCTION

In Central and Eastern European countries (CEE) land reform has always been a key element of the agricultural reform during the Transition. The aim of the changes is to create appropriate conditions for the establishment of market economy by means of decentralization of decision-making process and restoration of ownership rights of all former owners and their heirs. In most Central and Eastern European countries the choice of land reform design was unlimited. But the real process of land reform was limited by two factors - "'historical' or 'social' justice." (Swinnen et al.) [8].

Although the countries of Central and Eastern Europe started their reforms at nearly the same point in time, the different application of the chosen design allowed the land reform to be completed at different times. The effect of land reform has led to fully restored agricultural property and a new agricultural system with very small farms and large "monopoly'' agricultural structures. The restitution of agricultural land in some CEE countries has resulted in very fragmented plots of smaller average size, in Bulgaria - 0.54 ha, in Hungary - 2.75 ha, in Romania - 2.28 ha (Dirimanova, 2018) [1].

The impact of the institutional changes on the land relations in Bulgaria over the last 30 years is in response to the number of processes and changes that have taken place before and after the accession of the country to the European Union. Some of these changes are historically determined by the way our society transformed in the 1990s (Yovchevska, 2016) [9].

The results of these changes are that Bulgaria is still in a period of dynamic institutional changes that are actively affecting the state of land relations. The Ownership and Use of Agricultural Land Act, logically, has undergone the most changes (more than 70 changes by 2020). This dynamic of the

Ownership and Use of Agricultural Land Act reveals the existence of real issues in the socio-economic system of agriculture and the need to solve them. In this regard, the latest changes and the adoption of new legislation are a responsible economic and political act that would provide better conditions for the development of agriculture, reduce the administrative costs of farmers and lead to an improvement of the socio-economic environment in the rural areas of the country.

MATERIALS AND METHODS

The purpose of this article is to analyze the changes in the new Agricultural Land Act, by assessing their impact on the status and dynamic of the vegetable sector, which is one of the most vulnerable sectors in the agricultural industry, as well as the complex processes of fragmentation of agricultural land in Bulgaria. The methodical framework of the study provides a summary overview of the main changes in the new Agricultural Land Act, as well as the degree of fragmentation of the land, which has a direct connection to the position of both parties in negotiation (Yovchevska and Dirimanova, 2019)[11].

The Land Act sets out the rules relating to the administrative procedures for creation of land units, voluntary consolidation of agricultural land with change of the ownership right, registration of the relevant documents for the use of agricultural land for the purposes of support under Single Area Payment Schemes, etc. The administration of land relations and, in particular, of land use, sets out important boundary conditions for land markets and the institutional framework is a decisive factor (Yovchevska, Pl. et al., 2019) [10].

In 2019, the new Bulgarian Agricultural Land Act was published. The Act aims at codifying the matter in the field of ownership and use of agricultural land. It represents and further develops much of the existing legislative framework, while introducing some new situations imposed by the practice in view of the evolving public relations. Last but not least, the Act aims at eliminating some discrepancies between the various regulations presently in force. The main changes brought by the new Act are:

(1) *Prohibition on changing the use of agricultural land after its acquisition*, this period shall start all over again after any change of ownership, except in the case of succession. The purpose of this prohibition is to protect agricultural land as a scarce resource and national asset; it is also provided that after the acquisition of ownership of agricultural land, the holders may not change its intended use during that period.

(2) *EU citizens will be able to acquire ownership of agricultural land in Bulgaria*, and the requirement for settlement in the country for at least five years before the purchase is also withdrawn. The new Act provides for restrictions on the acquisition of agricultural land by foreign individuals and legal entities, including those falling within the scope of the Act on the Economic and Financial Relations with Companies Registered in Jurisdictions with Preferential Tax Regime, Persons Related to Them and Their Beneficial Owners, as the explanatory notes to the Act state.

(3) *Maximum duration of contracts for rent and lease of agricultural land and this duration should not exceed ten years,* respectively 30 years, for land used for permanent crops. The requirement for a minimum 5-year period in respect of lease contracts has been retained. The aim is to achieve a better balance in the relations between owners and users of agricultural land by avoiding long-term commitments based on unprofitable contracts, including contracts entered into by co-owners with an insignificant share, which was a widespread negative practice. A requirement has been introduced for the rental contracts to be entered into by at least 25% of the co-owners, while the requirement for the lease contracts to be entered into by at least 50% of the co-owners has been retained.

One of the main changes concerns *young farmers and small-scale producers* and is related to the tenders for renting or leasing agricultural land from the state land fund. It

will be allowed for young farmers, up to 40 years of age, as well as for single-member limited liability companies established by them, to rent or lease land from the State land fund without auction or special tenders, and to do this at market prices. These tenders will be held in case there is a positive result from the surveys conducted by the Regional Directorates of Agriculture for an interest in participating in such a special tender. Similarly, in order to stimulate small-scale producers, it is provided that only applicants who, together with their affiliates, cultivate no more than 10,000 dca of agricultural land, regardless of the form of cultivation, type of ownership or their age, can participate in tenders for rent or lease of state land. The aim is to stimulate young people to stay in the countryside, to establish new farms or expand the existing ones. Land will also be offered without tender procedures to sole traders (ET) and single-member limited liability companies (EOOD) founded by farmers up to 40 years of age. The law also provides for a limit on the land, which will be given to young farmers without tender – up to 10 dca for production and cultivation of vegetable crops, up to 20 dca for perennial crops and up to 50 decars for annual arable crops. The period of renting or leasing land by young farmers for the purposes of growing vegetables and annual arable crops is up to 10 years, and for permanent crops – up to 30 years.

The Land Act sets out the rules relating to the administrative procedures for creation of land units, voluntary consolidation of agricultural land with change of the ownership right, registration of the relevant documents for the use of agricultural land for the purposes of support under Single Area Payment Schemes, etc. It will be made on the basis of a written agreement with notarized signatures of the landowners and a land consolidation plan approved by order of the Minister of Agriculture. The land consolidation plan may include construction of irrigation systems and soil erosion control installations. The plan will include agricultural land owned by the state or municipality and in this case the agreements shall be signed by the minister of agriculture or by the mayors. After the Act enters into force, some other acts will be repealed, such as the Agricultural Lease Act, Agricultural Land Conservation Act and Agricultural Property Conservation Act.

RESULTS AND DISCUSSIONS

By considering some of the main changes laid down in the new Agricultural Land Act, as well as by presenting some pressing issues in vegetable production, we would contribute to 'illuminating' the importance of improving the status of the Vegetable industry in Bulgaria (Stoeva, T., 2019) [7].

The existence of favourable soil and climatic conditions, long-standing traditions, rich practical experience, availability and development of new technological solutions and market-oriented innovations, use of modern varieties with improved biological potential, as well as the changes in the Land Act that clarify the use of agricultural land -all these outline the future trends for the development of vegetable production in Bulgaria related to the harmonization of the institutional framework in compliance with the requirements of the EU – regulatory framework, strategies and programmes related to land market regulation.

Vegetable production has always been a specific sector of agricultural production. It is characterized by possibility of growing a wide range of cultivated plant species, many of which are of important significance for the economic contribution of the plant production sub-sector not only to the agriculture, but also to the national economy.

The graph data (Fig. 1) show a sharp decreasing trend in the economic significance of the vegetable sector in Bulgaria. In 2013, the significance of vegetable production decreased more than 6 times compared to 2006. Direct payments will continue to maintain this level of stagnation (Nikolov et al., 2014 [6].

Given the current development of agricultural industry, the notable significance of vegetable production has not been realized so far.

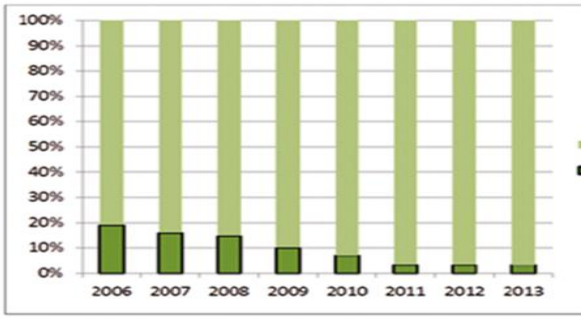

Fig.1. Share of an OP from sector Vegetables compared to an OP from sector Agriculture
Source: Yovchevska, Pl. 'Significance of vulnerable sectors for Bulgarian agriculture', page 19 B: "Analysis of the sectors with coupled support", S. Ministry of Agriculture, Food and Forestry (MAFF) 2015 [9].

In recent years, there has been a steady tendency towards reduction of harvested areas and realization of average yields, which is far from the biological potential of the cultivated vegetable varieties. Often, the production harvested is of weak competitiveness in terms of the increasing quality demands of the national, regional and common European market. After the accession of Bulgaria to the EU-27, despite the overall positive impact that CAP 2007-2013 has on the agricultural business environment, some significant structural changes are registered at sub-sectoral and sectoral level. In terms of the Vegetable sector, the nature of this process is determined by the method of subsidizing under the Single Area Payment System. (Yovchevska, Pl., 2016) [9]. Area Payment needs to be changed and other factors in the farm should be taken into account in addition to the size of the land (Kaneva et al., 2018) [3]. The reasons for the serious drop in the production of vegetables and the relatively weak competitiveness of vegetable production observed after the accession of Bulgaria to the EU in 2007, are rooted in the failure of the land reform. As a result of this reform, small-scale farms which are ineffective due to the low degree of specialization, insufficient availability of agricultural equipment and modest level of production organization, dominate the structure of specialized vegetable outdoor farms. The availability of suitable soil and climatic conditions, the long-lasting traditions, rich practical experience, the existence and development of new technological solutions and market-oriented innovations, the utilization of contemporary varieties of high biological potential - all these outline favorable trends for the development of vegetable production in the country. They reveal opportunities for broader integration of the sector in the economic life of rural areas, a striving to achieve highly efficient and competitive production. Being one of the new EU member states, Bulgaria will apply a simplified system for allocating direct payments to farmers by the end of 2020, known as the Single Area Payment Scheme (SAPS). (6) Compared to the basic direct payment schemes applied in most of the other Member States of the European Union, the amount of basic income support for Bulgarian farmers under this system is linked, in a simpler form, to the area of land declared by each farmer. Bulgarian authorities dedicate13% of the allocated funds for direct payments (the maximum eligible rate) for voluntary coupled support – i.e. payments are linked not only to the number of hectares cultivated, but also to specific products or processes, in this case beef and veal, fruit and vegetables, milk and dairy products, sheep and goat meat and protein crops. Bulgaria has also chosen to apply re-distributive payments that allow it to achieve a fairer distribution of support among farmers by reducing direct payments by 5% for amounts above 150,000 EUR per individual farm (excluding the first 30 declared hectares) (European commission: Bulgaria and CAP, 2016) [2].

Bulgaria also applies the small-scale farmers scheme - a simplified support system for small-scale beneficiaries, with maximum annual payments of 1,250 EUR per farmer. This scheme reduces the administrative burden on those farmers with the smallest land holdings, as well as their obligations in relation to *cross-compliance* (i.e. the obligation to meet certain environmental standards in order to receive their payments), and exempts them from the obligation to apply the greening rules (European commission: Bulgaria and CAP, 2016) [2].

In Bulgaria in recent years, extensive farming has been given a strong impetus at the

expense of the intensive farming, a process that is of a sustainable nature and has a clear causal link. The subsidies per unit area are the main reason for this - they have made it much more profitable to invest in crops which require much larger areas for sowing, but also give much lower yields per decare. Coupled support for vegetables - 2017-2020, offers much more adequate subsidies per unit area to the vegetable producers - 1,121.50 BGN/decare (Yovchevska and Venev, V., 2019) **[**10].

Table 1. Harvested areas of main vegetable crops in Bulgaria, in total and in crops (in Ha)

Years	***Total vegetables***	***Tomatoes***	***Pepper***	***Cucumbers***	***Potatoes***	***Onions***	***Cabbage***
2013	14,440	3,242	4,035	592	12,765	1,225	1,903
2014	11,857	3,024	2,876	345	10,200	1,118	1,943
2015	18,067	2,686	3,681	309	11,017	1,074	1,871
2016	28,543	3,613	3,577	247	8,376	1,365	2,875
2017	19,232	4,376	3,257	282	12,806	2,080	1,692
2018	17,821	3,907	2,854	470	14,096	3,675	1,961

Source: Ministry of Agriculture, Food and Forestry, Agrostatistics Directorate 2013-2018.

The total area planted with vegetables was about 2% of the utilized agricultural area, and the tendency - although at a minimum rate - was towards decreasing, for example in the beginning of the period the share of these areas was around 2.5%, while during the last years under review it fell below 2%. (National strategy, Ministry of Agriculture, Food and Forestry: 119-120) [5]. The total area of agricultural land planted with fresh vegetables in 2014 was 29,394 ha, and 15,101 ha were planted with potatoes, legumes and pulses. The tendency over the last 15 years has been towards a permanent reduction of areas planted with vegetables. The areas planted with fresh vegetables also decreased over the period 2000-2014, with an average annual reduction of -2,2%. However, it should be noted that for the period from 2013 to 2014 the planted areas increased with 8.9%, on average, per year - the increase during the second year having a larger share in relative terms [5]. According to the data provided by Agrostatistics Department at the Ministry of Agriculture, Food and Forestry (MAFF), in 2016 there was a continuation of the trend, that had started the previous year, of a substantial increase of the areas planted with vegetable crops, which was greatly contributed by the coupled support schemes applied to the sector. According to the data provided by Agrostatistics Department at the Ministry of Agriculture, Food and Forestry (MAFF), in 2016 the areas used for vegetable production were over 60 thousand hectares, which was respectively 6% and 30% more than in 2015.

Bulgarian farmers strive to produce outputs which market realization will ensure the highest return on invested resources – land, capital and labor, and the best profit. A significant proportion of farms have as their primary task the reduction of the risk by means of product specialization, where the profitable production compensates for the unprofitable one in order to survive. According to some authors (Kirovski,P., 2015:25) the land planted with vegetables occupies about 2.2-2.3% of the utilized agricultural area in the country. The dynamics of the land planted with vegetables since 2006 shows a definite and pronounced downward trend. The drop in production volumes can be explained not only with the reduced planted areas, but also with the strong competition in the sector [4].

CONCLUSIONS

The new Agricultural Land Act seeks to clarify the use of agricultural land by fixing a maximum duration of contracts, which shall be long enough to allow farmers to plan their future activity in vegetable farms and to protect the producers who have invested in this activity. Thus, the Act will restrict big corporations (foreign legal entities) from purchasing land and will allow young farmers

(up to 40 years) to participate in land-lease tenders of land from the State Land Fund. The Act allows for the consolidation of fragmented agricultural land under the so-called "contracts for use" /consolidation contracts/. Over recent years, the development of vegetable production in Bulgaria has been hampered by numerous disadvantages such as the strong sub-division and fragmentation of agricultural land; low mechanization of production; negative trend of reduction of planted areas; low labour productivity; deteriorated condition of irrigation equipment and infrastructure; low skilled workers; low production profitability. Efforts to support the development of vegetable production need to be consolidated, as in Bulgaria there are natural assets and a number of comparative advantages that would allow the production of products with unique taste qualities (Yovchevska, Pl. 2016:70) [9].

The existence of favourable soil and climatic conditions, the rich practical experience, the availability and development of new technological solutions and market-oriented innovations, as well as the changes in the Land Act that clarify the use of agricultural land, outline the future trends for the development of vegetable production in Bulgaria. Recent trends reveal lasting stagnation processes in vegetable production. The growth that has been registered after the implementation of coupled support is not sustainable yet. The subsequent growth of the areas and production after the sharp decline, upon the implementation of the EU CAP, still lacks the intensity to create a cardinal change, favorable for the vegetable production in Bulgaria.

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THE EFFECT OF COAGULANT TYPE AND CONCENTRATION ON THE QUALITY OF MILK TOFU

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Abstract

Curd is one of the dairy products into a product out using a coagulant, the curd is one source of calcium. The type of coagulant is one important factor in making the curd. This study aims to determine the level of calcium and the organoleptic properties of the curd with variations in the type coagulant treatment. This study uses Completely Randomized Design (CRD) factorial pattern 2 x 3. The first factor is of the type of coagulant calcium carbonate (CaCl2) – P1 and vinegar (CH_3COOH) – P2, and the second factor is three levels concentration : K1 = 0.2 M, K2 = 0.3 M , K3 = 0.4 M, so the following treatment combination are P1K1 = 0.2 M CaCl2, P1K2 = 0.3 M CaCl2, P1K3 = 0.4 M CaCl2, P2K1 = 0.2 M CH3COOH, P2K2 = 0.3 M CH3COOH, and P2K3 = 0.4 M CH3COOH.Each experiment carried out repeat 5 times. After getting/obtained a blob out, filtering and pressed to form the milk curd. The curd. will be used for organoleptic test, to analyze the deterioration the milk tofu quality, with sensory test every 24 hours using 25 student as panelist. This test is performed on color, odor, taste, and texture. ANOVA statistical test research results showed that the treatment that produces tofu milk with the most acceptable in terms of quality, storage capacity and preference test is the treatment (P1K2 - milk tofu made use CaCl2 coagulant with a concentration of 0.3M, has the following composition: 46.7% moisture content, 19.9% protein, 11.8% fat content, 2.8% ash content, 180.8 grams of wet weight and 78.8% yield.

Key words**:** *coagulant, curd, calcium chloride, vinegar, organoleptic properties*

INTRODUCTION

The population growth in the world is so fast, but the existing land area is relatively constant so that it will not be able to catch up the number of food needs for the world's population. That yet in only 50 years, our growing global population will require an estimated 100 percent more food than we produce today. Unfortunately, we will certainly not have 100 percent more high-quality land available to grow twice the amount of grain or two times more livestock. For that, a solution must be found so that all products can be used as a source of food for humans, without sacrificing the health of consumers [8]. Thus, this additional food supply should come from the use of efficiency-enhancing technologies; which can be done by using the concept of collaboration, choice and technologies.

On the other hand, the level of awareness or knowledge of the population is still not evenly distributed, especially in rural areas in developing countries which often still cause some food production to be unacceptable because it does not meet the requirements needed as food that is fit for consumption [9]. For example, the production of fresh milk, due to lack of attention or lack of awareness, so that during the gathering at the collector, there is a product that is not good enough, so that it will affect the quality of the whole milk, as a result, all production that day cannot be accepted for processing at the processing factory.

Even though the milk production is still suitable for consumption, due to an error in the initial collection, it does not meet the requirements to be processed as pasteurized milk or sterilized milk. For this reason, we can find ways to utilize the milk so that it is not wasted, but it is processed into food in

other forms. So we need a technology that can help keep food affordable while ensuring maximum consumer choice, especially in developing nations. Thus, milk that does not meet the requirements to be processed as pasteurized milk or sterilized milk can be found ways to use it as an ingredient for human consumption, for example by producing it into milk products such as milk tofu or other milk-based products. As the dosage increase, it will influence the curd production [5].

Milk is a source of calcium, when making tofu uses some coagulant, pineapple juice, citric acid, vinegar, and CaCl2 [7]. From a nutritional point of view, the composition of milk has consequences for the dairy processing industry. In Table 1, the composition of cow's milk is listed, both Bos Taurus and Bos indicus [9].

Table 1. The composition of milk (g/100g)

Species	Fat	Casein	Whey protein	Lactose	Ash
Cow	3.65	2.5	0.6	4.77	0.7
Bos taurus	4.2	2.6	0.6	4.6	0.7
Bos indicus	4.7	2.6	0.6	4.7	0.7

Source: Own calculation for cow. For both Bos taurus and Bos indicus [9].

Milk tofu or curd is a dairy product obtained from curdling milk with rennet or acids such as lemon juice or vinegar and then removing the liquid part (whey), or processed products made with skim milk as raw material which have very good nutritional value, the shape and color resemble tofu. The curd is one of the dairy products and also the curd is one source of calcium. The curd is a product that using a coagulant, The type of coagulant is one important factor in making the curd.

Most of the needs of milk tofu in Indonesia are met by home industries. On the other hand, according to observations, there are still many home industries that have not implemented hygiene and sanitation standards by state regulation. Regarding the maximum limit of microbial contamination in food, it is said that for fresh, unpasteurized milk for further processing, with Total Plate Count (TPC) 30^0C, in 72 hours with a maximum limit of 1 x 10^6 colony/ml, coliform 2 x 101 colony/ml, the Most Probable Number (MPN) for *Escherichia coli* <3 / ml, *Salmonella* sp negative/25 ml, and *Staphylococcus aureus* 1 x 10^2 colony/ ml [2].

Milk contains two different groups of protein, the casein complex and the whey proteins. The protein milk consist for about 80% of casein. There are two different methods of precipitating the casein, by souring the milk, either by direct addition of acid or by bacterial acid production, and by coagulation using certain enzymes, CaCl2 or CH3COOH.

This study aims to determine the level of Calcium chloride (CaCl2) and vinegar (CH_3COOH), in the organoleptic properties of the curd with variations of coagulant concentration.

MATERIALS AND METHODS

Fresh milk, purchased from KUD - Boyolali Milk Cooperation, CaCl2 and CH_3COOH as coagulant, and chemicals for proximate analysis of milk and milk tofu.

Proximate analysis of fresh milk, determination of lactose content, protein content using the micro Kjeldahl method, fat content using Mojonary method, water content by heating and ash content by Burning method

Tofu milk making. Milk was heated to 90^0 C for 10 minutes and then added with coagulant according to the existing treatment, as much as 200 ml, then stirring slowly. The existing lumps were filtered, poured into tofu molds, and pressed for 10 minutes.

Proximate analysis of milk tofu, to determination protein content using micro Kjeldahl method, fat content using Mojonary method, water content by heating and ash content by Burning method.

Analysis the deterioration of milk tofu quality with sensory test every 24 hours using 25 student as panelist.

Observation data were analyzed with Analysis of variance (ANOVA), with the F test at 5% levels. If it is significantly different, continue with Duncan's multiple distance test at the 5% level.

Experimental Design

Completely Randomized Design (CRD) consisting of two factors, P1 = CaCl2, P2 = CH3COOH, as coagulant with three levels concentration: K1 = 0.2 M, K2 = 0.3 M , K3 = 0.4 M, with the following treatment combination: P1K1 = CaCl2 concentration of 0.2 M, P1K2 = CaCl2 concentration of 0.3 M, P1K3 = CaCl2 concentration of 0.4 M, P2K1 = CH3COOH, concentration of 0.2 M , P2K2 = CH3COOH concentration of 0.3 M, P2K3 = CH3COOH concentration of 0.4 M.

RESULTS AND DISCUSSIONS

Proximate analysis of fresh milk

The results of the proximate analysis of fresh milk, as presented in Table 2, were not significantly different from the composition of fresh milk according to van den Berg (1988).

Table 2. The composition of fresh milk analysis and according to van den Berg (g/100g) (g/100g)

Species	**Fat**	**Casein**	**Whey protein**	**Lactose**	**Ash**
Bos taurus	4.2	2.6	0.6	4.6	0.7
Bos indicus	4.7	2.6	0.6	4.7	0.7
Cow fresh milk	3.65	2.5	0.6	4.77	0.7

Notes: For Bos taurus and Bos indicus [9];
Source: own analysis for fresh milk.

Proximate analysis of milk tofu

The results of measuring the weight of milk tofu as can be seen in Table 3, it turns out that the highest average value was achieved in the P1K2 treatment (180.8 grams) and the lowest average value was achieved by P2K3 treatment (124.6 grams), while the total mean value was 148.9 gram.

Table 3. Proximate analysis of milk tofu

Treat-ments	Weight (gram)	Yields (%)	Water (%)	Protein (%)	Fat (%)	Ash (%)
P1K1	170.5 b	75.8 b	59.6 b	18.1 b	10.9 b	2.7 b
P1K2	180.8 a	78.8 a	60.7 a	19.9 a	11.8 a	2.8 a
P1K3	155.3 c	72.2 c	56.8 c	17.8 c	10.3 c	2.6 c
P2K1	126.6 e	65.9 e	49.8 e	13.4 e	8.7 e	1.4 e
P2K2	135.3 d	67.9 d	52.2 d	14.9 d	9.7 d	1.6 d
P2K3	124.6 e	58.5 f	46.7 e	12.9 e	8.4 e	1.3 e
Means	148.9	69.9	57.1	16.2	9.97	2.1

Source: Own analysis.

Whereas for the measurement of yield of milk tofu, the highest value was achieved in P1K2 treatment (78.8%) and the lowest average value was achieved by P2K3 treatment (58.5%), while the total mean value was 69.9%.

From the analysis of variance, it shows that the treatment has a significantly different effect on obtained weight and yield of tofu milk. Based on the Duncan's test, the coagulant type factor (P) and the concentration factor (K) on the weight and yield of tofu milk, it shows that the coagulant type factor and the concentration both have a very significant effect on the difference in weight and yield of tofu milk obtained. This shows that the use of CaCl2 coagulant has provided a higher weight and yield of milk tofu than the CH3COOH. In addition, the use of a coagulant concentration of 0.3 M has resulted highest weight and yield of milk tofu compared to the concentration of 0.2 M or 0.4 M. ά-S-casein from milk is a part that is very sensitive to Ca ++ ions, meaning that the component will settle in the Ca salt solution [10]. This means that the volume of precipitation caused by the influence of the acid depositing at its isoelectric point is relatively much lower when compared to the use of Ca salt. Therefore, treatment (P1K2) showed the highest yield of wet weight and yield compared to the others [6].

The results of measuring the water content of milk tofu as can be seen in Table 3, the lowest average value was achieved in the P1K2 treatment (43.7%) and the highest average value was achieved by P2K3 treatment (69.8%), while the total mean value was 57.1. %. Whereas for measuring protein content of milk tofu, the highest value was achieved by P1K2 treatment (19.9%) and the lowest average value was achieved by P2K3 treatment (12.9%), while the total mean value was 16.2%. From the analysis of variance, it shows that the treatment has a significant effect on the water content and protein content of the milk tofu obtained. Based on the multiple distance test, the coagulant factor (P) and the concentration factor (K) on the water content and protein content of the tofu showed

that the coagulant factor and the coagulant concentration had a very significant effect on the differences in water content and protein content of milk tofu which is obtained. This shows that the use of the CaCl2 coagulant has resulted in a more compact tofu because the water content is higher than the CH3COOH coagulant. Likewise for protein content, where the use of CaCl2 coagulant, results in higher protein levels compared to CH3COOH coagulant. In addition, the use of a coagulant concentration of 0.3 M also resulted in a more compact quality of milk tofu with a higher moisture content and protein content compared to concentrations of 0.2 M or 0.4 M.

According to the results of measuring the fat content of milk tofu as can be seen in Table 2, show that the highest average value was achieved in the P1K2 treatment (11.8%) and the lowest average value was achieved by P2K3 treatment (8.4%), while the total mean value was 9.9. %. Whereas for measuring the ash content of milk tofu, the highest value was achieved in P1K2 treatment (2.8%) and the lowest average value was achieved by P2K3 treatment (1.3%), while the total mean value was 2.1%. From the analysis of variance, the treatment has a significant effect on the fat content and ash content of the milk tofu obtained. Based on the multiple distance test, the coagulant type factor (P) and the concentration factor (K) on the fat content and ash content of the milk tofu showed that the type and concentration of coagulant, had a very significant effect on the differences in fat content and ash content of milk tofu which is obtained. This shows that the use of CaCl2 coagulant has provided a higher fat content and ash content of milk tofu than the CH3COOH coagulant. In addition, the use of a coagulant concentration of 0.3 M also resulted in higher levels of fat and ash content of milk tofu compared to concentrations of 0.2 M and 0.4 M. The isoelectric points of casein and β-lactoglobulin are not the same, so that the clumps caused by acids will have a relatively low β-lactoglobulin content, when compared to deposition by the influence of Ca ++ ions [4]. This means that the clots due to acid deposition are less compact and less able to bind water. The bond between casein and β-lactoglobulin causes the milk tofu obtained to be more compact, so that it is more able to bind water. The high milk casein that settles is caused not only by the use of Ca ++ ions for clotting, but also due to the iso-electrical point of the casein component [1]. Meanwhile, precipitation due to the influence of acid only occurs at the isoelectric point for certain casein components, because the isoelectric points of protein components in milk are different [3]. This is the reason why the protein content of milk tofu for treatment P1 (CaCl2) is relatively higher compared to treatment P2 (CH3COOH). In addition, the coagulation concentration of 0.3 M for each coagulator also causes a large amount of milk casein to settle.

Tofu milk quality deterioration during storage according to consumer preference test

The results of the consumer preference test for milk tofu during storage can be seen in Table 4.

The results of the preference test for the color, odor, taste and texture of tofu milk at the 48th hour as can be seen in Table 4, it turns out that the highest average value is achieved by the P1K2 treatment (CaCl2) and the lowest average value is achieved by P2K3 treatment (CH3COOH) in 48 hours, it can be seen that all samples can be accepted by consumers, although the most preferred is still the P1K2 treatment (CaCl2, 0.3 M). Likewise for the test results for color, odor, taste and texture at the 72th hour all samples can be accepted by consumers, except the treatment P2K3 (CH3COO-0.4 M) and P2K1 (CH3COOH-0.2 M) whose values were below the normal. From the analysis of variance showed that the treatment had a significantly different effect on the consumer test on color, odor, the taste and texture of the milk tofu.

Different types and concentrations of coagulant have a significant effect on the quality and shelf life of milk tofu. The use of CaCl2 coagulant with a concentration of 0.3 M in general, provides the best quality and shelf life of tofu.

The highest yield was 78.8% (P1K2-CaCl2 coagulant with a concentration of 0.3 M), while the lowest yield was 58.5% (P2K3), namely treatment with CH3COOH coagulant with a concentration of 0.4 M).

Table 4. Tofu milk quality deterioration during storage (0-72 hours) in room temperature, according to consumer preference test

Treatments	Color		Odor		Taste		Texture	
	0 hrs	24 hrs	0 hrs	24 hrs	0 hrs	24 hrs	0 hrs	24 hrs
P1K1	4.5 b	4.3 b	4.4 b	4.3 b	4.3 b	4.3 b	4.4 b	4.3 b
P1K2	4.7 a	4.6 a	4.6 a	4.6 a	4.5 a	4.6 a	4.6 a	4.6 a
P1K3	4.4 b	4.3 b	4.2 c	4.3 b	3.9 c	4.3 b	4.2 c	4.3 b
P2K1	4.2 c	2.9 c	3.9 c	2.7 c	3.8 c	2.6 c	3.6 d	2.6 c
P2K2	4.1 c	3.1 c	4.0 c	3.1 c	4.1 c	3.0 c	4.1 c	3.0 c
P2K3	3.9 c	2.8 c	3.8 c	2.7 c	3.9 c	2.6 c	3.8 d	2.4 c

Treatments	Color		Odor		Taste		Texture	
	48 hrs	72 hrs	48 hrs	72 hrs	48 hrs	72 hrs	48 hrs	72 hrs
P1K1	3.8b	3.6b	3.6b	3.4b	3.6b	3.4b	3.8b	3.6b
P1K2	4.3a	4.1a	4.0a	3.8a	4.2a	3.9a	4.3a	4.1a
P1K3	3.9b	3.5b	3.9b	3.3b	3.8b	3.5b	3.9b	3.5b
P2K1	3.5c	2.4c	3.5c	2.4c	3.5c	2.4c	3.5c	2.4c
P2K2	3.4c	2.6c	3.4c	2.6c	3.4c	2.6c	3.4c	2.6c
P2K3	3.3c	2.6c	3.3c	2.6c	3.3c	2.6c	3.3c	2.6c

Source: Own analysis.

Based on the multiple distance tests on the color, odor, taste and texture of milk tofu during the storage period, it shows that the coagulant type factor and concentrations, both have a very significant effect on consumer acceptance of milk tofu. This shows that the use of the CaCl2 coagulant for the milk tofu clumping process has provided higher consumer acceptance compared to the use of CH3COOH coagulant. In addition, the use of a coagulant concentration of 0.3 M also results in a higher level of consumer acceptance compared to concentrations of 0.2 M and 0.4 M. In general, it can be said that the value of consumer enjoyment of milk tofu during storage has decreased.

CONCLUSIONS

The longest shelf life of milk tofu is 72 hours (P1K2-CaCl2 coagulant with a concentration of 0.3 M), while the shortest is 72 hours (P2K3 - CH3COOH coagulant with a concentration of 0.4 M).

The treatment that produces tofu milk with relatively the most acceptable in terms of quality, storage capacity and preference test is the treatment (P1K2 - milk tofu made use CaCl2 coagulant with a concentration of 0.3M, has the following composition: 46.7% moisture content, 19.9% protein, 11.8% fat content, 2.8% ash content, 180.8 grams of wet weight and 78.8% yield.

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IMPACT OF INNOVATIVENESS ON OPERATIONAL PERFORMANCE OF GOVERNMENT LEVEL COMPANIES (GLCs) IN RURAL PAKISTAN: A MODERATING ROLE OF ORGANIZATIONAL CULTURE

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Abstract

Corporate Entrepreneurship is not a new topic in the field of management however there is a lack of literature on the strategy concerning the eastern side of the world. Therefore, several studies indicated the need of thorough research work on the topic from the eastern side, especially from the context of GLCs working in rural areas as these forms of firms, are not only away from corporate entrepreneurship but are also in need of strategies to deal with competition and external environment. Thus, in order to make the study pragmatically significant, the data has been collected from the top and middle-level managers of GLCs in rural areas of Pakistan. The results of the study indicated that innovativeness is perceived as an effective predictor of CE in GLCs in rural Pakistan. However, moderation of organizational culture is nullifying the perceived impact of innovativeness on the operational performance of the firms.

Key words**:** *corporate entrepreneurship, innovativeness, GLCs in rural communities, organizational culture*

INTRODUCTION

The field of corporate entrepreneurship (CE) is a well-established and significant field of research in the domain of management [35]. This is the process or entrepreneurial behaviour which resides inside the established mid-sized or large organizations [28] [20]. Similar has been indicated by [28] that CE is the entrepreneurial behaviour of employees whether of large or of a small organization.

The CE process is significant in adding value to the organization as well as to its customers through devising & implementing better and new ideas. Significance of the strategy is prevalent for the increase of organizational overall performance, financial betterment and attaining strategic benefits [20]; [8].

Similarly, there are also significant research evidences for the enhancement of financial and non-financial indicators through applying corporate entrepreneurship [42]; [43], [20]. Recent studies in this domain [2]; and [40] also prove the same. One of the initial studies [30] indicated that CE is the hybrid of innovation, risk-taking and proactiveness. However, these parameters are also included in the contemporary model of CE along with new product development, new business venturing, competitive aggressiveness, self-renewal, and strategic renewal [6]. Although innovation has been studied majorly as a characteristics of private sector organizations where organizational growth, development, and productivity mainly linger upon innovation & the phenomenon is not accepted as the predictor of growth and productivity in the public sector especially in rural context. This stance seems to be true as the threat of being exposed by media and opposition parties creates hindrance in the way of innovation by the public sector [25], whereas in rural context, the public sector organizations are deem to be passive and docile.

It has been mentioned by [15] that deprived, and socially disconnected people of underdeveloped economies are less inclined towards corporate entrepreneurship.

Therefore, there is a significant lacking of studies which might reveal the use of corporate entrepreneurship strategy on organizational performance. However, [8] indicated that the relationship of predictors like innovation, strategic-renewal and corporate venturing is not conclusive on the firm's performance.

On the other hand, [29] defined corporate entrepreneurship as "Innovation from an internal organizational perspective, through the assessment of potential new opportunities, alignment of resources, exploitation and commercialization of said opportunities". (p.354). The study further indicated that innovation as a process of corporate entrepreneurship might be able to provide a more significant edge to a firm's performance. Although public sector agencies are monopolies with no pressure to innovate but fostering of corporate entrepreneurship, activities might aid in organizational development and may also lead to economic development and wealth creation [5].

In contrast, public sector companies have more complex and open structures which fervently create hindrance to the process of innovation [25]. However, there are severe lacking studies on corporate entrepreneurship concerning public limited companies [6], especially in rural context. Moreover, it is apparent mainly when there is also a requirement of workable models on corporate entrepreneurship regarding government level companies (GLCs) of Pakistan [32]. Similarly, adoption and diffusion of innovation has mainly been researched previously in farm or agricultural context only and studies related to other sectors in rural context are limited. Therefore, this study will analyze the effect of innovation as the process of corporate entrepreneurship of performance of government level companies (GLC's) which perform in the rural setting of Pakistan.

Theoretical Framework

Regardless of extensive studies regarding internal and external factors which are associated with corporate entrepreneurship the effectiveness of the concept is gauged through its impact on firm's performance [12]. Firm performance is a hybrid of organizational as well as individual behaviour [11] moreover non-financial performance is the effective predictor of organizational aspects, human aspects, and customer aspects. However, employees who are in favor of organized administration place zero value to corporate entrepreneurship, innovation, and creativity. Though getting a competitive edge is quite impossible without incorporating innovation and developing new product strategies create the base of entrepreneurship [38].

Hence, this study will evaluate the impact of innovation in GLCs in rural Pakistan on the perceived operational performance of the firm through the opinion of employees of the strategic (top) level. The top-level employees are the point of reference to support [22] that corporate entrepreneurship might be gauged through its staff level entrepreneurship, also supported by [40] through data collection from top executives only. On the other hand, [32] indicated that organizational culture is one of the most predominant tools for optimization of operational performance. Although state-owned firms are found to be significantly lacking in this regard [31]. Therefore, organizational culture is used as the moderating variable.

Literature Review

Initially, the importance of corporate entrepreneurship has been indicated by [38] who indicated that the strategy is fruitful for taking the competitive edge and optimizing financial performance. Although after that there is a continuous flow of studies emphasizing on the corporate entrepreneurship [14] as the strategy leads to entrepreneurial innovations across the firm i.e. from top management to first-line managers. Innovation is the process to add a fresh breath to work process, offerings of operating services and to principles so to provide value to company, customers, and suppliers [11].

To gain a competitive edge over rivals there is a need to introduce new product and technologies on continuous bases. This is the point where the most important element of corporate entrepreneurship came into play [3] i.e. innovativeness which describes the innovation in products and services through improving technology [38], which will increase profitability and growth [3]. However, innovation in the public sector is treated as a reason to foster conflicts and element to counter organizational values [25] e.g. work process and accountability [16]. On the other hand, since a long period of time studies like [36] is emphasizing on lack of flexibility in managers in the public sector. Similar has been supported by the [25] who indicated that reason for these lacking in innovation in the public sector is not treated as the predictor of organizational growth development and productivity.

Further clarified by [41] that public sector enterprises are large bureaucracies' structures which are focused on their core tasks and not permit in sort of disruption in their work and therefore resist any sort of change. On the contrary [14] indicated that innovation in GLCs is one of the most desirable elements as it not only improves the process of decision making but also has the ability to decrease market pressure and competition. However organizational culture is also an important tool to foster organizational performance.

One of the studies by [32] claimed that there is a significant relationship between organizational culture and organizational performance. The study also indicated that entrepreneurship prevails in the culture where the organization as a whole involved in the process of struggle or push. However, government sector organizations are found to be lacking in this domain. Therefore, efforts must be rendered through an increase of entrepreneurship in organizational through fostering an entrepreneurial culture in the GLCs [31]. This might be difficult as in GLCs most of the programs are managed by formal processes and programs [14]. Hence the study of [31] highlighted that most of the studied GLCs were lacking in organizational entrepreneurship. This is also highlighted by previous studies conducted in Metropolitan cities or urban context that formalization not only diminishes the process of innovation but also produces negative effects on communication process within the firm. Though formalization can foster efficiency in established processes of the firm and might specifically be significant in some forms of innovativeness [33].

Research Hypotheses

H_1A: There is no relationship between innovativeness (as the part of corporate entrepreneurship) in GLCs in rural Pakistan and operational performance of the firm.

H_2A: There is no moderation caused by the organizational culture of GLCs on the relationship between innovativeness and operational performance.

MATERIALS AND METHODS

This research study is descriptive in nature and the method of analysis is mono-method. Non-Probability Sampling was adopted to collect data survey from middle and top-level management from various offices from district Sindh of the Agriculture, Supply and Prices Department, Government of Sindh, Pakistan. The sample size of this study is 100. The questionnaire used in this study is a hybrid of several studies. This has been done to induce a level of understanding of respondents and also to produce effective results for robust applicability of study in rural context. The major contributors in this regard are [24] for elements on innovativeness; and [39] for organizational culture. Similarly, various other studies as [23] are incorporated to make a questionnaire more effective and applicable. In addition to these parameters study incorporated SMART PLS to analyze the effect of innovativeness on the operational performance of GLCs.

RESULTS AND DISCUSSIONS

Statistical Testing and Evaluations

The model which has been developed through reviewing and syntheses of literature is the

reflective model as it is used to indicate the effect of innovative on operational performances of GLCs in rural context.

This is valid as per indications of the reflective model indicated by [1] and as per the study, there are few requirements for assessing reflective models. Table 1 is used to highlight the outer loading for each element in order to show their legitimacy in the model highlighting the effect of innovativeness on the operating performance of GLCs. However, the least acceptable value of outer loading is 0.708 as indicated by [19] to predict 0.50 of variance for each of its indicators. Though 0.60 is the least acceptable value for any variable to be included in the model [1] but the inclusion became more effective with the values getting closer to 1 [26]. However, in Table 1 the least value of outer loading for any element is 0.619 which indicates the elements used to develop model are effective enough to be included in the research model.

Table 1. Outer Loadings

	Innovative Process (Inn)	**Moderating Effect 1**	**Organizational Performance (OP)**	**Operational Culture (OC)**
Inn1	**0.739**			
Inn2	**0.672**			
Inn3	**0.767**			
Inn* OC		**0.944**		
OC1				**0.919**
OC2				**0.908**
OC3				**0.668**
OP1			**0.619**	
OP2			**0.845**	
OP3			**0.887**	
OP4			**0.875**	
OP5			**0.834**	

Source: Data Analysis of this Study.

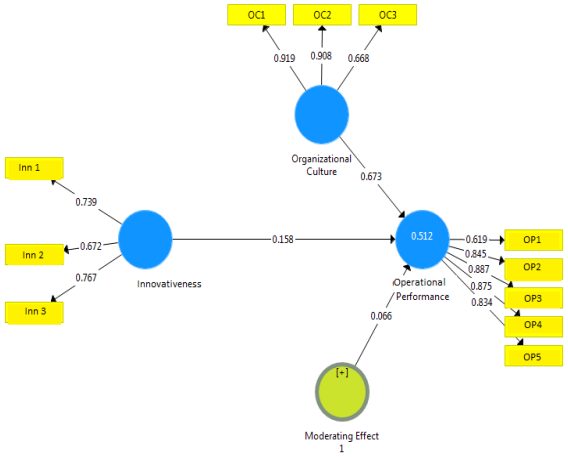

Fig. 1. Outer loadings of elements for the construct of Innovativeness on Operational Performance of GLCs.
Source: Research Model generated for this Study.

Table 2 is used to indicate predictive accuracy through the value of R i.e. the prediction of the dependent variable through a change in the independent variable. Similar has been indicated by [7] that the purpose is to indicate predictive accuracy of a dependent variable through ordinary least square. The method of analysis for the test is the same as the method used to analyze regression [4], & 0.26 is the minimum value required for highlighting predictive accuracy [9].

Though 0.25 is the least acceptable value for indicating predictive accuracy while 0.5 and 0.75 or above are treated as moderate and substantive fit [21]. Here the value of R^2 0.497 is which indicates moderate fit between the independent and dependent variable and hence the predictive accuracy is appropriate enough to be linked with the study.

Table 2. Predictive Accuracy

	R Square	R Square Adjusted
Operational Performance	0.512	0.497

Source: Data Analysis of this Study.

Table 3 indicates the construct reliability through the use of reliability measures as Cronbach's alpha (α) and AVE. Moreover, a combination of composite reliability and AVE also highlight convergent validity.

The table is indicating all types of measures except outer loading (given in Table 1) to indicate model fit as α is lower-tier reliability evaluator and rho is a better predictor than Cronbach's alpha α [37].

Table 3. Construct Reliability and Validity

	Cronbach's Alpha	**rho_A**	**Composite Reliability**	**Average Variance Extracted (AVE)**
Innovativeness	**0.762**	**0.771**	**0.770**	**0.529**
Moderating Effect 1	**1.000**	**1.000**	**1.000**	**1.000**
Operational Performance	**0.872**	**0.888**	**0.909**	**0.669**
Organizational Culture	**0.778**	**0.772**	**0.876**	**0.705**

Source: Data Analysis of this Study.

Table 4 is used to highlight discriminant validity through Heterotrait-Monotrait Ratio (HTMT), the purpose of discriminant validity is to indicate dissimilarity of variables from a single construct.

This is highlighted through values of correlation [10] and the maximum value by which two variables of the same construct (model) can correlate with each other is 0.85 [18].

Table 4. Discriminant Validity via Heterotrait-Monotrait Ratio (HTMT)

	Innovative Process	Moderating Effect 1	Operational Performance	Org. Culture
Innovative Process				
Moderating Effect 1	**0.154**			
Op. Perf	**0.463**	**0.139**		
Org. Culture	**0.393**	**0.300**	**0.831**	

Source: Data Analysis of this Study.

Figure 2 and Table 5 are presented to indicate the impact of innovativeness on the performance of GLCs operating in Pakistan. The actual purpose of the table is to highlight inferential statistics so to clarify the impact and hence treated as one of the most important parts for the analysis of reflective models of SMART-PLS [17].

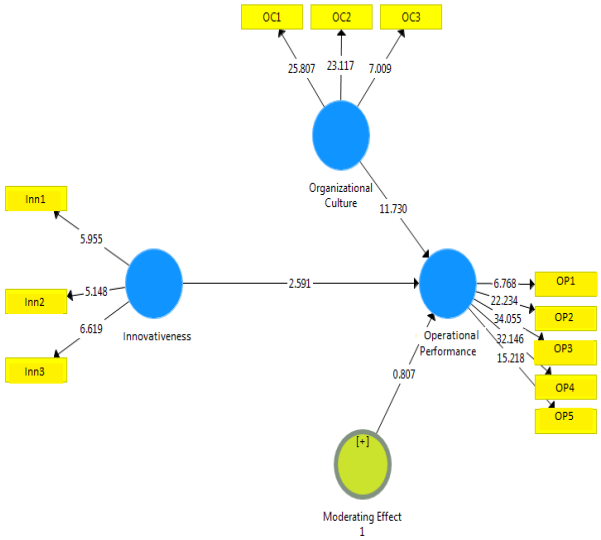

Fig. 2. Path Coefficients and regressions weights for the construct of Innovativeness on Operational Performance of GLCs.
Source: Research Model generated for this Study.

Table 5 uses t-statistics & p-values to clarify the impact. However, the minimal value of t-statistics to indicate the relationship is 1.97 & increase of value will also increase the degree of relationship [13].

However, the p-value must also be lesser than 0.05 for the existence of a relationship between variables [27].
Hence it is legitimate to declare innovativeness as the part of corporate entrepreneurship is perceived as the significant factor which may induce the operational performance of GLCs.

Table 5. Total Effects through Path Coefficient

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Innovativeness -> Operational Performance	**0.158**	**0.163**	**0.061**	**2.591**	**0.010**
Moderating Effect 1 -> Operational Performance	**0.066**	**0.056**	**0.082**	**0.807**	**0.420**
Organizational Culture -> Operational Performance	**0.673**	**0.682**	**0.057**	**11.730**	**0.000**

Source: Data Analysis of this Study.

Similarly, organizational culture is also a potent variable which is perceived as the variable having a significant impact on the operational performance of the firm.
However, in GLCs the moderation of organizational culture is diminishing the impact of innovativeness. Therefore, it is appropriate to believe that innovativeness in GLCs is hindered due to organizational culture.

CONCLUSIONS

On the bases of statistical testing, it has been indicated that innovativeness in GLCs working in rural Pakistan is capable enough to affect the operational performance of the firm. Thus, the findings are coherent with [14] that innovativeness is one of the most effectual elements which might foster the operational performance of GLCs. Organizational Culture is also affecting the operational performance of GLCs which is consistent with [31] and [32].
However, when organizational culture impaired as a moderator then it diminishes the impact of innovativeness in GLCs. These findings are further found consistent with [31] and appropriate to believe the culture of GLCs is not supporting their ability to innovate. Therefore, looks consistent also with [14] as the work procedure in GLCs are too formal

and thus might reduce their ability to innovate.

The study indicated that the culture of governmental companies is diminishing their ability to re-engineer and optimize their products and services [31], especially for GLCs in rural context which operate in remote settings and have lesser access to innovative resources.. This is the resultant of formal work practices in GLCs which may also worsen the process of communication [33].

Although the process of formalization prevents free communication within the members of the firms and hence reduces the chances to become adaptable with unforeseen problems [33]. However, the spread of COVID-19 requires firms to coordinate effectively for taking effective future initiatives & thus there is a need to assess organizational culture that how effective it is to deal with the crises [34]. Thus, government firms need to have valid and updated information in the communication process to increase adaptability and cohesiveness to embrace the emerging change in the organizational workplaces.

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DEVELOPING A PUBLIC-PRIVATE PARTNERSHIPS MODEL FOR SUSTAINABLE MANAGEMENT OF ECOTOURISM SITES IN NIGERIA

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Abstract

Public-Private Partnerships (PPPs) is an agreement between a public organizations and Organized Private Sectors (OPS). Four ecotourism sites in Nigeria were used for this study. Stratified sample technique was used to select 368 respondents. Data collected were analyzed using 5-point Likert-type scale; the contingent valuation method was applied to find the tourists' total willingness to pay the new gate fees and for other recreational facilities and services in the ecotourism sites resulting from the proposed PPPs management model. Maximum likelihood estimation of the Logit regression coefficient was applied to find the factors influencing the tourists' willingness to pay. Results showed that respondents strongly disagreed with the present management system of the ecotourism sites with a mean score of 1.38. Result of the tourists' willingness to pay increased considerably, ranging from 40.59% to 133.83% above the current prices. Result of the logit regression model revealed that bid amount, age^{2,} and estimated annual income, among others, were the variables that influence the tourists' willingness to pay. Anew sustainable and efficient PPPs management model was proposed for the ecotourism sites that can be adopted in Nigeria and Sub-Sahara Africa.

Key words**:** *ecotourism sites, sustainable, public-private partnership, management model, Nigeria*

INTRODUCTION

Impactful economic transformation depends on a well-defined and functional market of natural resources management within a country [11]. Therefore, there is a need for natural resource management development that will ensure the optimum performance of the interactions between the market forces. This is one of the reasons for the inclusive governance of natural resources as a driver of structural transformation [3]. The ultimate aim of economic positive change in the management of natural resources of any nation is to ensure transparency, accountability, and well-defined value chains that will create economic opportunities, which will eventually lead to the national economic development of such a nation. Therefore, to achieve this major objective, there is a need for a paradigm shift in the management of natural resources of such a nation, especially the ecotourism sites. Hence, the need for the private sector as a major player in the market forces to be adequately involved in ecotourism sites management.

Again, improving the level of private sector participation in ecotourism site management to take economic responsibilities would mean establishing a framework for proper economic valuation of the activities of the ecotourism site management [6]. So, using Public-Private Partnerships (PPPs) model between the Government (Public) and the Organized Private Sector (OPS) will create the expected inclusive system of ecotourism site management that will enhance the institutional capacity development of managing Nigeria's natural resources. Partnership which is defined according to [31] as a relationship that ensure power, work, support and information are distributed among the parties involved to enhance achievement of common objectives and mutual benefits. One of the major reason for establishing partnerships is because of its importance as a means of promoting long-term startegic planning.

Many factors are responsible for the formation of partnership. According to [28], various factors that may account for formation of partnership include:

i)the intent to reduce risk and cost of penetrating new market by pooling financial and human resource together,

ii)ensuring expansion of operational performance such as affliation of small organizations with the large companies at the international markets,

iii)possessing competence and technical know-how,

iv) ensuring effecient and effective channel of distributions,

v) the formation of new products or services, and

vi) reaching higher levels of productivity and economies of scale among others.

Four ecotourism sites in Nigeria, namely Cross river national park in Cross river state, Kainji lake national park in Niger and Kwara state, Old Oyo national park in Oyo state and Idanre Hill in Ondo state, Nigeria, were used as a case study of natural resources (Ecotourism sites) that can be managed using the Public-Private Partnerships (PPPs). The Federal and state government were considered as the public sector and the financial institutions/facilities manager as the Organized Private Sector (OPS). The paper presents a new conceptual model for the achievement of Public-Private Partnerships (PPPs) for the positive economic change of Nigeria ecotourism sites management and also considered the willingness of the financial institutions in Nigeria to partner with the Federal and state government to ensure that Nigeria natural resources (Ecotourism sites) are managed sustainably to ensure domestic resource mobilization that will boost economic development in Nigeria.

Again, the paper determined the amount the tourists would pay for the new gate fees and other recreational services provided by the ecotourism sites because of the PPPs management model proposed. From the paper, factors influencing the tourists' willingness to pay the new gate fees and other recreational services were equally determined. Therefore, the findings of the paper will assist the government at all levels on how to harness the new model to sustainably manage the ecotourism sites in the Country and Sub-Sahara Africa generally.

Public-Private Partnerships Concept

Public-Private Partnerships (PPPs) involve collaboration between governments and businesses [30]. Furthermore, PPP can be descibed as a lasting legal association between two or more partners of which at least one is a public organization and the other is a private organization. They both bring resources (e.g., money, property, authority, knowledge) to the partnership, and in which obligations and liabilities (e.g., financial, economic, social) are shared to deliver public infrastructure-based products and services [13]. PPPs are becoming a common phenomenon in the developed and developing countries. [5]. PPPs are expected to achieve effectiveness, ensure improved product quality, better deal and accountability on the part of the government [17], effeciecy in product and service delivery and reduction of cost in project delivery [10]; [19].

Existence of PPPs in infrastructure arises in diverse shapes and sizes [17]. Among the various definitions stated above, scholars were able to distinguish between concession and alliance models [16]; [7]. In the concessional model, there is formal and orderly client–contractor relationship. The private contractor is majorly concerned with the execution; he prepares the blueprint, provides the needed fund, and construct a public sector project. Duties are shared among the partners as stated in the contract [30]. Alliance models are majorly concern with the horizontal relationships between public and private partners. While concessional models majorly considered how to share risks among the partners [31]. The partners are after the same goal, duties, and responsibilities in the project execution. Projects are jointly done by the project partners. In most alliance models, new organization is established where the partners share the customers such as joint venture [26]. Most forms of alliances model have a legal obligation between public and

private partners, where the customers remain with the public partner [30].

Due to limited funding and increasing constraints, many government agencies are looking into different models of Public-Private Partnership (P_3) to maintain updated infrastructures and its application in the management of natural resources such as ecotourism sites is becoming inevitable in most developing countries. These management models can be beneficial, but their costs must be closely controlled to make them cost-effective solutions. Public-private partnerships are considered by many to be the future of management model for the natural resources because they offer solutions to problems of financing, maintenance, and sustainability without sacrificing government finances. There are different public-private partnerships models to fit various operation, ownership, and revenue-generating scenario of natural resources such as ecotourism sites [14].

MATERIALS AND METHODS

Study Area

Cross River National Park

The cross-river national park was founded by the Federal Government of Nigeria in 1991. The park which is surrounded by tropical rainforest in the northern and central parts and mangrove swamps on the coastal fringes. The Okwangwo Division of the Cross River national park is in the Cross-river state, south-south Nigeria, 5°04′–6°25′N and 8°30′–9°30′E and covers an area of 1,000 km². It is ecologically contiguous with the Takamanda forest reserve in the Republic of Cameroon. Okwangwo division is in a region where, for climatic reasons, rainforest persisted throughout the Ice age of the Pleistocene epoch. This explains the area's richness of biodiversity and implies that the Okwangwo Division (OD) of the Cross River national park will contribute disproportionately to the preservation of the world's species [22]. The OD contains the largest intact closed-canopy forest in Nigeria, representing 40% of Nigeria's remaining forest. The primate fauna of the park is diverse, with confirmed existence of at least 2 wildlife sub-species of gorillas [8]. According to [22] that the endangered Cross river gorilla (Gorilla gorilla diehli) resides in this region. Furthermore, the OD is significant for regional watershed protection, prevention of 'savannization', protection of biodiversity and the potential for gorilla-based tourism [8]. The OD is surrounded by 66 villages with a total population of approximately 36,000 people [9].

Idanre Hill

Idanre Hill is in Ondo State, Nigeria. The hills, which can be reached using the six hundred and sixty-seven steps, remain one of the admiration of nature with an awesome view from the top of the hills. The ecotourism destination is estimated to be over 800 years; it is in the ancient town of Idanre, Ondo State, Southwest Nigeria (Ondo State Ministry of Culture and Tourism, 2018). It is fifteen kilometers (15km) Southwest of Akure, the State capital. To complete the ecotourism attraction of the hill, a resort was built around the hill known as Idanre hill resort. The resort has a lot of other attractions. They have lodges available for people who would like to stay overnight. The lodges are wooden chalets that come in different sizes. They also have swimming pools, an outdoor entertainment area, a playground, indoor sport facilities, and hall (Ondo State Ministry of Information [23]; [24].

K**ainji Lake National Park (KLNP)**

Kainji lake national park was founded in 1979 as a result of combination of the two former game reserves – Borgu game reserve (located in Niger and Kwara state) and Zugurma game reserve (located in Niger state), the two components had been gazetted in 1962 and 1971 individually as game reserves by the then Northern Regional Government (NRG) [1]. KLNP was the first national park and the second largest of all the eight national parks in Nigeria. It is located between latitude 9°40'N and 10°30'N and longitude 3°30'E and 5°50'E in Niger and Kwara states. The total landmass of the lake is 5,370.82km^2 and It has a savanna climate. Around Oli river, the night temperature can be as low as 70C^0. Oli, Menai and Doro rivers (Borgu

sector) and Manyara and Nuwa Zurugi Rivers (Zurguma sector) are responsible for the maintenance of the drainage system in the two sectors of Kainji lake national park. The value of the the mean annual rainfall varies from 1,100mm in the eastern part to 1,150mm in the western part [26]. Some of the common animals found in Kainji lake national park are the African elephant (*Loxodonta africana)*, buffalo (*Syncerus caffer*), roan antelope (*Hippotragus equinus*), Senegal kob *(Adenota kob*), lion (*Panthera leo*), leopard (*Panthera pardus*), Nile crocodile (*Crocodilus niloticus*), python (*Python sebae*) and monitor lizards (*Veranus niloticus*) among others [20].

Old Oyo National Park

The old Oyo national park is in Oyo state, Nigeria. Oyo state is one of the 36 states in the Southwest Nigeria. The total land area of the state is 28,454 km^2. The state shared boundary in the East with Osun state, in the South with Ogun State, in the North with Kwara state, and in the west partly with Ogun state and the Republic of Benin. The park covers the Northern part of the state, between latitude 8°15, and 9°0'N and longitude 3°35 and 4°42'E. The park is rich in biodiversity - flora, and fauna that include buffaloes, bushbuck, and a wide variety of birds [27]. Facilities available include chalets, tourist camps, standard restaurants, air-conditioned buses, and facilities for boat cruising and sport fishing. These unique ecosystems and historical relics were changed to Game Reserves in 1952 and ultimately reformed to the current position of National Parks [21]. The outstanding remarkable nature of the Old Oyo National Park is a captivating pocket of archaeological, cultural, and historical sites dotted within and around the Park. Old Oyo National Park is the most distinctive of all the National Parks in the country because it is the only one with the double likelihood of both archaeological as well as cultural/historical Park [20].

Sampling Techniques and Size

A stratified sampling technique was used to select respondents for the study in the host of the ecotourism sites, and other stakeholders were equally interviewed. In each ecotourism site, ten elementary school teachers, ten high school teachers, five clergymen, five youth leaders in the community, ten artisans, ten market women, two community leaders, and twenty tourists were interviewed for this study. Again, ten staff of each ecotourism site who were directly involved in the management of the ecotourism site were interviewed. Ten staff of financial institutions operating around each ecotourism site were interviewed for this study. As shown in Table 1, the total number of respondents who were interviewed for the study were 368 respondents.

Table 1. Distribution of Respondents According to Strata per Ecotourism Site

S/N	Respondents	Number of respondents
1	Primary school teachers	10
2	Secondary school teachers	10
3	Clergymen	5
4	Youth leaders	5
5	Artisans	10
6	Market women	10
7	Community leaders	2
8	Tourists	20
9	Staff of each ecotourism site	10
10	Staff of financial institutions	10
Total		**92 x four ecotourism sites = 368 respondents**

Source: Own research and processing.

Nature and sources of data

Primary data were used for this study. Primary data were obtained by a well-structured questionnaire administered on the respondents to determine the appropriate new inclusive systems of management that will enhance Public-Private Partnerships (PPPs) of the ecotourism sites. Focus Group Discussion (FGD), Key Informant Interview (KII), and in-depth interview were also used to validate the information collected The primary school teachers, secondary school teachers, clergymen, youth leaders, artisans, market women, community leaders, the staff of each ecotourism site and staff of financial institutions around each ecotourism site were

used for the FGD, KII and in-depth interview. The willingness of the financial institutions to partner with the government currently managing these ecotourism sites was equally determined. This is to enhance the development of a PPPs management model that will enhance the profitability and sustainability of ecotourism sites. The information collected from the financial institutions includes their willingness to partner with the Government on the provision of modern facilities befitting an international ecotourism site under the best practices. Information on how to manage the ecotourism sites under the market forces interplay that will ensure profitability, sustainability, and create enabling environment for economic development through value chain effects on both micro and macro-economic indices were collected. Again, the socio-economic profile of the tourists, such as age, household size, education, gender, and occupation, willingness to pay criteria, and estimated annual income, were collected.

Data analysis

Data collected were analyzed using descriptive statistics; the respondents' perception of the new inclusive and sustainable system of management of the ecotourism sites was done using a 5-point Likert-type scale. Respondents were asked to respond to perception statements relating to the new PPPs management model of the ecotourism sites using Strongly Agree (SA), Agree (A) Undecided (U), Disagree (D), and Strongly Disagree (SD). The responses were scored as 5, 4, 3, 2 and 1 for SA, A, U, D, and SD, respectively. The mean from each statement was obtained and used to classify the responses on each statement into SA (>4.50), A (3.50-4.49), U (2.50-3.49), D (1.50-2.49) and SD (<1.50). The respondents were asked to respond to statements relating to the willingness of their financial institutions to partner with the Government in the provision of recent facilities befitting an international ecotourism site under the best practices using frequency distribution mean and simple proportions.

Contingent Valuation Method (CVM) was used to determine the tourists' total Willingness to Pay (WTP) for the new gate fees and other recreational services in the ecotourism sites resulting from the proposed PPPs management model. The maximum likelihood estimation of the Logit regression coefficient was applied to find the mean willingness to pay for the gate fees and other recreational services. The Logit model was equally applied to find the factors influencing the tourists' WTP. The Logit regression model was stated thus:

$$Li = Log \frac{Pi}{1-Pi} = \frac{1}{1+exp-(\beta 0+\beta 1X1)} \quad \ldots\ldots (1)$$

P_i = Respondents probability of acceptance to the bid offered
β_o = Constant/ Intercept
β_i = Coefficients to be estimated
$1-P_i$ = Respondents probability of non-acceptance to the bid offered
X_i = Set of independent variables

$$Li = \frac{1}{1+exp-(\beta 0+\beta 1X1+\beta 2X2+\beta 3X3+\cdots \beta 11X11)} \quad \ldots\ldots (2)$$

X_1 = BID amount (Naira)
X_2 = Gender of the tourist (male = 1, female = 0)
X_3 = Age of tourist (Years)
X_4 = Age^2 of tourist (Years)
X_5 = Frequency of visitation to the ecotourism site (Yearly =1, quarterly =2, bimonthly =3, monthly = 4)
X_6 = Year of formal education (Years)
X_7 = Marital status (married = 1, 0 otherwise)
X_8 = Household size (number of persons)
X_9 = Estimated annual income (₦)
X_{10} = Location of the tourist (Within the state =1, outside the state =2 and outside the country = 3)
X_{11} = Main occupation of the tourist (Government staff =0, private staff =1, self-employed =3)
X_{12} = Knowledge of another ecotourism site within the Country (Yes = 1, No = 0)
X_{13} = Do you visit other ecotourism site within the Country (Yes = 1, No = 0)

X_{14} = Frequency of visitation to another ecotourism site (Yearly =1, quarterly =2, bimonthly =3, monthly =4)
μ = Error term.
Li is a proxy for WTP. It represents the dependent variable, which is a dummy of the binary choice Logit model adopted to determine the factors influencing tourists WTP for the gate fees and other recreational services in the ecotourism sites. It is defined as "1" if respondents accept bids elicited and "0" if not. X_1 represents the bids elicited in the Dichotomous Choice Contingency Valuation Method (DC-CVM) survey. This is the variable price (shadow price).
The unrestricted mean WTP (P+) according to [4] was calculated from the coefficient derived by the model:

$$P^{+}=a/|\beta| \quad \ldots\ldots (3)$$

This has the possibility of producing the undesirable negative WTP, the restricted WTP (P+) adopted for this study was shown as:

$$P^{+}=1/|\beta|*In(1+exp^{bo}) \quad \ldots\ldots (4)$$

where, b_o = intercept,
β = coefficient of the bid
Total WTP = Mean WTP * Total population of respondents.
The results were collated and used to develop a new PPPs management model that will enhance efficient and sustainable management of the ecotourism sites in Nigeria under the best practices and which can be applied to other ecotourism sites in Sub-Sahara Africa (SSA) countries.

RESULTS AND DISCUSSIONS

Table 2 presents the stakeholders' perception of the need for a paradigm shift in the management of the ecotourism sites in Nigeria. It was revealed from the table that respondents strongly disagreed with the present management system of the ecotourism sites with a mean score of 1.38. With the mean score of 4.27, the respondents indicated their desire for a change in the management of the ecotourism sites. Result (4.81) obtained showed that the stakeholders strongly agreed that the government should partner with the organized private sector in the management of ecotourism sites. They believed this will enhance the efficiency and sustainability of ecotourism sites. However, the respondents strongly disagreed (1.42) that the partnership should be with the financial institutions alone. The respondents also opined that the partnership should not be limited to the facilities manager alone (2.46) but agreed that the partnership should be with both the financial institutions and the facilities manager (4.52).

Table 2. Perception of The Stakeholders on The Ecotourism Sites in the Study Area

Questions	SA	A	U	D	SD	Means	Remarks
Do you like the present management system of the ecotourism sites?	37 (10)	44 (12)	15 (4)	88 (24)	184 (50)	1.38	Strongly Disagree
Do you desire a change in the management of the ecotourism sites?	136 (37)	132 (36)	7 (2)	74 (20)	19 (5)	4.27	Agree
Do you think the Government forming partnership with the Organized Private Sector (OPS) in the management of the ecotourism sites will enhance the profitability and sustainability of the ecotourism sites?	239 (65)	129 (35)	0 (0)	0 (0)	0 (0)	4.81	Strongly Agree
Do you agree that the Government should form partnership with only financial institutions in the management of the ecotourism sites?	37 (10)	55 (15)	15 (4)	144 (39)	117 (32)	1.42	Strongly Disagree
Do you think the Government should form partnership with only facilities manager in the management of the ecotourism sites?	44 (12)	74 (20)	52 (14)	81 (22)	117 (32)	2.46	Disagree
Do you think the Government should form partnership with the financial institutions and the facilities manager in the management of the ecotourism sites?	125 (34)	162 (44)	4 (1)	40 (11)	37 (10)	4.52	Strongly agree

Source: Own research and processing.

As shown in Figure 1, 80% of the staff of financial institutions working around the ecotourism sites agreed that their organizations will provide funds for the Government to procure modern facilities that will promote increased patronage of the ecotourism sites. The bureaucratic system of the Government was mentioned in the interview as affecting the performance of the ecotourism sites as it delays funding and the introduction of new and creative ideas. Therefore, the result obtained indicating the willingness of the financial institutions (OPS) to partner with the Government in the management of the ecotourism sites is in line with the findings of [2] who stated that if the Nigerian government will amend the laws that established most of the Government businesses, the organized private sector are equally willing to partner with the Government.

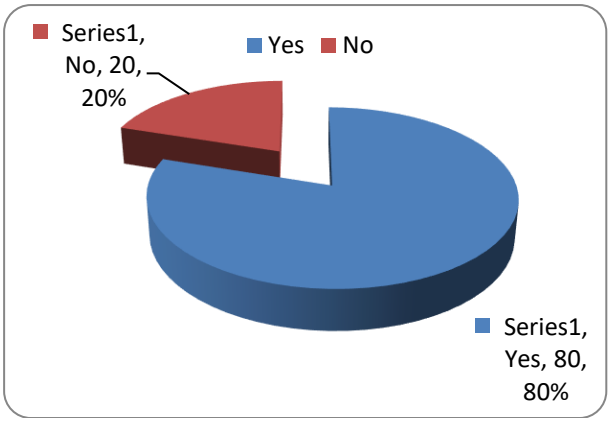

Fig. 1. Willingness of Financial Institutions To Finance Facilities Provision In the Ecotourism Sites
Source: Own research and processing.

The unwillingness of the Government to release part of their equity holding in most businesses owned was the fear expressed by the 20% of the respondents that said they were not willing to partner with the Government. According to them, usually, people in the Government are not always willing to partner with the organized private sector because they often see such businesses as a means of enriching themselves, which may be impossible to do if partners are involved in the management and ownership of such businesses. According to [12], most leaders in Africa often use such businesses to provide jobs for their political cronies, whereas such may not be competent to handle the business. This was the basis for the 20% that said no to partnering with the Government on the management of ecotourism sites. Therefore, since 80% of the financial institutions would form a partnership business with the Government on the management of ecotourism sites, such business will be registered as a separate entity and jointly owned by the Government (Public sector) and the organized private sector. The Public-Private Partnerships (PPPs) will be premised on concurred shareholding, and board members will be constituted by both the Government and the private sector. The profit will be shared on the agreed shareholding between the two sectors (Public and private sector).

Price Tourists are WTP for Ecotourism Sites

The total value for the entrance and park/hill viewing fees, guide fees, and guest house by the tourists based on the proposed PPPs management model were obtained by calculating the restricted mean willingness to pay. To examine the tourists' acceptability of the new entrance gate fees and payment for other recreational facilities and services because of the proposed PPPs management model, we estimated their mean willingness to pay by calculating the restricted means WTP calculated using equation 4. From the result in Table 3, the respondents in the Cross river national park would pay 147.57% increase for the entrance and park view fees, 82.53% increase for the guide fees, 89.20% increase for the standard room in the guest house and 139.57% increase for the executive room in the guest house. Likewise, the respondents would pay 45.08% increase for the entrance fees in Idanre hills. However, the guest house at Idanre Resort Center (IRC) was not functioning at the time of carrying out this study. At Kainji lake national park, the respondents would pay 133.83% increase for the entrance and park viewing fees, for the guide fees, they were willing to pay a 54.10% increase for the standard room in the guest house, they would pay 70.86% increase, and

for the executive room in the guest house they would pay 99.35% increase. In the Old Oyo national park, the respondents would pay 106.69% increase for the entrance and park viewing fees, the respondents would pay 40.59% increase for the guide fees for the standard room in the guest house, they would pay 66.98% increase, and for the executive room in the guest house, they would pay 80.64% increase. The willingness of the respondents to pay the various percentage increases in the fees and the guest house rates was because of the expected improvement in the facilities and services of the ecotourism sites because of the expected change in management based on the proposed PPPs management model.

The findings buttress the assertion of [25] "tourists are willing to pay for tourism facilities and services as long as they can enjoy better services". Natural resources like ecotourism sites provide recreational services for relaxation for those on vacation. Therefore, there is a need to improve the environmental conditions in which such services are being provided. The findings revealed the state of the ecotourism sites and how they have not been properly managed, hence, loss of revenue to the ownership, which is the Government. Therefore, the ecotourism sites can contribute reasonably to the economic if there is an improvement in the facilities and services of the ecotourism sites. According to [15] most ecotourism sites in Sub-Sahara Africa (SSA) needs to be managed efficiently and sustainably to create the expected conducive vacation centers that will enhance reasonable contribution to national economic growth and development.

Table 3. Estimated Mean Willingness to Pay per Tourist

Ecotourism Site	Entrance and park viewing fees			Guide fees			Guesthouse per night (Standard room)			Guest House per night (Executive room)		
	Current (₦)	Estimated (₦)	% Change	Current (₦)	Estimated (₦)	% Change	Current (₦)	Estimated (₦)	% Change	Current (₦)	Estimated (₦)	% Change
Cross river national park	800	1,980.50	147.56	1,000	1,825.30	82.53	3,000	5,675.90	89.20	4,500	10,780.50	139.57
Idanre hill	1,000	1,450.75	45.08									
Kainji lake national park	800	1,870.65	133.83	1,000	1,540.95	54.10	3,000	5,125.85	70.86	4,500	8,970.79	99.35
Old Oyo national park	800	1,653.55	106.69	1,000	1,405.85	40.59	3,000	5,009.45	66.98	4,500	8,128.60	80.64

Source: Own research and processing.

Factors Influencing Tourists' WTP

The factors influencing respondents' willingness to pay for the new entrance fees and other recreational facilities services in the ecotourism sites are presented in Table 4 and were analyzed using logit regression model. The Table revealed that six variables significantly influence the tourist's willingness to pay the new entrance fees and for other recreational facilities and services in the ecotourism sites. These variables are bid amount, Age^2, household size, estimated annual income, location of the tourist, and knowledge of another ecotourism site within the Country. The bid amount poses a significant negative relationship on the tourists' willingness to pay the new entrance fees and for other recreational facilities and services in the ecotourism sites. This implies that as bid amount of the new entrance fees and for other recreational facilities and services in the ecotourism sites increase, there is a probability of a decrease in tourists' willingness to pay. The bid amount was significant at 1% level of significance, which implies that the bid amount positively affects the decision of the tourists' willingness to pay the new entrance fees and for other recreational facilities and services in the ecotourism sites. This is in line with assertions by [29]; because the negative sign indicates that as the bid amount increases, the respondents would be less likely to pay. This implies that a higher bid amount induces a lower likelihood of saying yes to an offered bid.

Age^2 (above 60 years) was statistically significant at 1% probability level with a positive coefficient. This implies that an increase in the age of the elderly tourists above 60 years will probably increase the willingness to pay the new entrance fees and other recreational services in the ecotourism sites. This implies that an increase in the years of tourists above 60 years expected to be retirees had a positive influence on the willingness to pay new entrance fees and other recreational services in the ecotourism sites in the study area. This shows that older people who are retired are always willing to pay for the recreation facilities. Such are always willing to go on vacation and enjoy their retirement. Household size was statistically significant at 10%, meaning that a unit increase in the household size will likely reduce the tourist willingness to pay for the new entrance fees and other recreational services in the ecotourism sites in the study area. This is because the larger the household size, the more expensive to go to relaxation centers like the ecotourism sites. The cost of the entrance fees and other recreational services in the ecotourism sites will be expensive for a larger household compare to a smaller household size.

Estimated annual income was statistically significant at one 1% and the results shows that an increase in the annual income of the tourist will probably lead to an increase in willingness to pay for the new entrance fees and other recreational services in the ecotourism sites. The result shows that the disposable income of the tourist influences their willingness to pay for the improved services in the ecotourism sites. This revealed that tourists are willing to for better and improved recreational facilities if they will enjoy their vacation. The location of the tourist increases their willingness to pay for the new entrance fees and other recreational services in the ecotourism sites. The result indicates that the location of the tourist was statistically significant at 10% and had a positive relationship with the tourists' willingness to pay for the new entrance fees and other recreational services.

Table 4. Factors Influencing Respondents' WTP for Ecotourism Sites

Variables	**Coefficient**	**Std. Error**	**P>/Z/**	**Z values**
Bid Amount	-0.0300049	0.0060219	0.000***	-4.98
Gender	-0.12940719	0.718260	0.798	-0.18
Age	-0.0880310	0.101009	0.372	-0.87
Age^2	0.09012193	0.022811	0.001***	3.95
Frequency of visitation to the ecotourism site	-0.4993589	0.3385821	0.174	-1.47
Years of formal education	1.695781	0.998658	0.098	1.70
Marital status	-2.97882	2.07981	0.290	1.43
Household size	-0.19181475	0.10237	0.076*	-1.87
Estimated annual income	0.1990024	0.041361	0.001***	4.81
Location of the tourist	1.989508	1.108627	0.058*	1.79
Main occupation	-0.9968327	1.8933720	0.717	-0.53
Knowledge of another ecotourism site within the Country	-2.389053	1.298919	0.058*	-1.84
Visit to other ecotourism site within the Country	-1.08968	1.14591	0.417	1.09
Frequency of visitation to another ecotourism sites	0.3909694	0.388792	0.361	1.00
Constant	5.898659	4.907698	0.298	1.20
Number of Observation	80			
Log likelihood	-22.79860			
Prob > chi^2	0.0000			
LR $chi^2(13)$	49.68			
Pseudo R^2	0.5591			

Source: own research and processing.
***Significant at 1%, **Significant at 5%, *Significant at 10%

With the coefficient of 1.989508, which implies that the nearness of the tourists to the ecotourism sites will have a positive influence on the tourists' willingness to pay the new

entrance fees and other recreational services. This buttress the findings of [18] that nearness to the ecotourism sites encourages the tourists to patronize such ecotourism sites for relaxation.

However, as shown in the result, knowledge of another ecotourism site within the Country was statistically significant at 10% but negative. The negative coefficient of -2.389053 implies that when the tourist know there are other ecotourism sites within the Country where they can go for relaxation, their willingness to pay for the new entrance fees and other recreational services will likely reduce. This is in line with the economic principle of competition that says a rational consumer wants to compare the cost of goods and services before buying. The Loglikelihood Ratio (LR) statistics exhibited signs and was significant at 1% probability level, meaning that the explanatory variables included in the model explained the probability of willingness of the tourists and shows there was **a** significant relationship between socio-economic factors and willingness of the tourists to pay for the new entrance fees and other recreational services in the study area.

Therefore, based on the results from Table 2, Figure 1, Table 3, and Table 4 regarding the effective and sustainable management of the ecotourism sites as a partnership between the Government (public sector), the financial institutions, and facilities managers (private sector) led to the proposed Public-Private Partnerships (PPPs) management model in Figure 2. The proposed model has a focal point that comprises of a stakeholder relationship network (Government, financial institutions, facilities manager, tourists, and the host community). With the PPPs management model of the ecotourism sites, taking into consideration the resources and attractiveness of the ecotourism sites, the positive effect of the partnership goals and the major components that may affect the success of the partnership, the goals are based on the products, infrastructure, human resources, marketing, promotion, and funding. The major success elements are based on the formality of the agreements, clear goals definition, organizational structure, leadership and flexibility, social networks, and the effectiveness of the partnership performance. The model represents an interactive PPPs system.

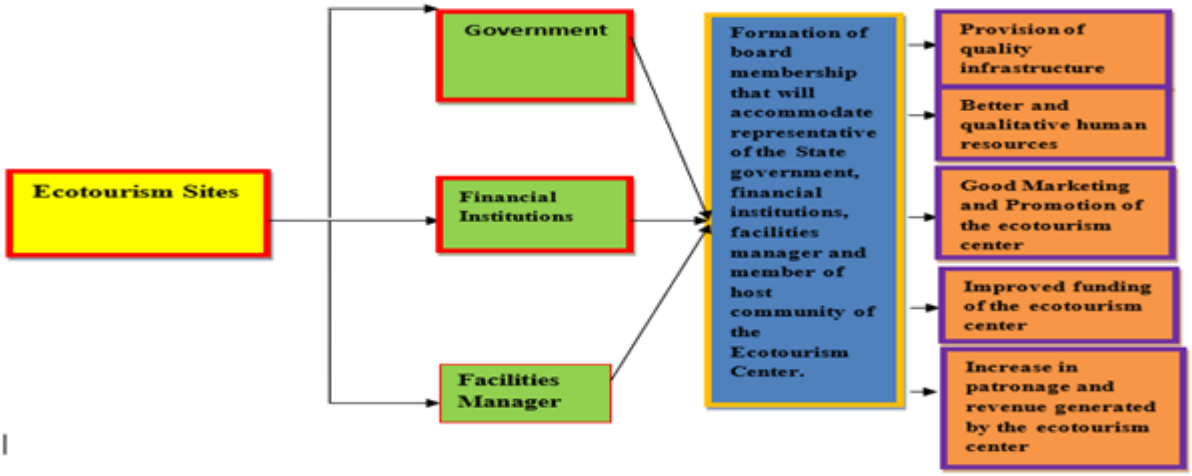

Fig. 2. Proposed Management Model of Public-Private Partnership (PPP) of Ecotourism Sites in Nigeria and Sub-Sahara Africa
Source: Own research and processing.

If there is accord between the relationships and variables, these nexuses will contribute to the success of the partnership and will serve as a model for the Public-Private Partnership of the ecotourism sites management in Nigeria and Sub-Sahara Africa. Figure 2 presents a management model for successful Public-Private Partnerships of ecotourism sites in Nigeria and Sub-Sahara Africa.

CONCLUSIONS

From the study, the respondents who are stakeholders in the ecotourism sites agreed that there is need to change the current management of ecotourism sites. They agreed that the PPPs management model enhances the efficiency and sustainability of ecotourism sites. Most of the staff of the financial institutions interviewed agreed that their organizations will partner with the Government in the management of the ecotourism sites. The result of the tourists' willingness to pay for the new entrance fees and other services of the ecotourism sites based on the proposed PPPs management model of the ecotourism sites increased considerably. Ranges from 40.59% to 133.83% above the current prices being paid. This is because of the expected improvement in the facilities and service of the ecotourism sites based on the new PPPs management model being proposed. The result of the logit regression model revealed that bid amount, age^2, household size, estimated annual income, location of the tourist, and knowledge of another ecotourism site within the country were the variables that influence the tourists' willingness to pay the new entrance fees and for other recreational facilities and services provided by the ecotourism sites.

The policy implication of the study, among others, is that the government should form a partnership with the private sector in the management of the ecotourism sites across the Country. Since this will enhance the efficiency and sustainable management of such natural resource in the country. Again, since bid amount is a critical variable influencing the tourists' willingness to pay, it is pertinent for the new PPPs management to be cautious of the amount they will charge for the entrance fees and other facilities and services provided by the ecotourism sites. Based on the findings of the study that the age^2 above (above 60 years) are positively willing to pay the new entrance fees and for the facilities and services provided by the ecotourism sites. Therefore, the new PPPs management model should design a vacation program in the ecotourism sites for the senior citizens in the country that will make payment flexible for them. For instance, creating a system that would encourage making monthly deposits for the purpose of vacation in the ecotourism sites.

Findings from the paper revealed that the annual income of the tourists also influence their willingness to pay the new entrance fees and for the facilities and services in the ecotourism sites. Hence, government can grant tax subsidy for the ecotourism sites and subsidize the public servants who are willing to patronize the ecotourism sites for vacation. This will make the ecotourism sites attractive to the citizens. There is a need for a new PPPs management model to take into cognizance the location of the tourists in determining the new entrance fees and other facilities and services fees in the ecotourism sites. Price disparity based on location may be adopted by the new PPPs management to encourage tourists from distant places to patronize the ecotourism sites. Additionally, since household size negatively impacted the tourists' willingness to pay the new entrance and fees of other facilities and services in the ecotourism sites, large households (above 6 persons) could be considered for rebates.

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ECOLOGICAL SAFETY OF RURAL AREAS: ECOLOGICAL AND ECONOMIC ASSESSMENT OF LAND USE EFFICIENCY

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Abstract

The study proposes an approach to environmental and economic assessment of land use efficiency in the context of environmental safety. The authors believe that the sites with high environmental risk have a direct impact on the development of rural areas, the economy of natural, including land resources and the environment. The significance of the study is that it shows that ensuring the ecological balance of life in the process of organizing land use directly depends on taking into account and preventing dangerous situations from objects with high, medium and low levels of threats (level of increasing the maximum allowable concentration of air emissions, water pollution facilities with agricultural nitrates, industry, defense facilities, etc.). The analysis shows that the ecological balance depends on the structure of land use and the functional use of land. In particular, the authors noted that the greater the share of subtypes of urban land use that has a negative impact on the environment, the higher the degree of danger to human life. Therefore, threats to the ecological instability of land use and, consequently, to the environmental safety of the population within rural areas, where land plots with dangerous objects are located, has to be considered and assessed.

Key words: *ecological stability, anthropogenic load, ecological danger, economic assessment, threats level.*

INTRODUCTION

In the latest economic conditions, for countries with economies in transition, becomes especially relevant a comprehensive analysis of environmental, economic and social efficiency of the organization and the existing structure of land use in accordance with the natural resource potential and needs of the population in the context of environmental security. This is also due to the fact that there is an unhealthy trend in the current environmental situation in rural areas. Such environmental problems include: pollution of water bodies with nitrates from agricultural sources, as well as discharges and emissions of industrial enterprises, transport and utilities; pollution and clogging of the territory with industrial and household waste; the presence of facilities with high environmental hazards, the possibility of environmental accidents and disasters.

To one degree or another, each of these issues requires research to address the important issue of efficient land use in the context of environmental security.

A general study of the use of land and other natural resources in the context of environmental safety, the works of such scientists as O. Budziak [2], G. Obykhod [13], L. Kupinets, O. Zhavnerchyk [10], O. Sakal, A. Kovalenko [17], A. Stepanenko [21],

O. Barriere [1], A.K. Richmond [15], Z. Yang, X. He, M.A. Ashraf [28], M. Zessner, M. Schönhart, J. Parajka, H. Trautvetter, H. Mitter, M. Kirchner, G. Hepp, A.P. Blaschke, B. Strenna, E. Schmid [29]. We will also note the work on the study of strategic adjustment of land use policy in the context of economic and environmental transformation and the adoption of appropriate measures and decisions related to environmental security in the global dimension, namely: U.E. Chigbu, A. Schopf, W.T. de Vries, F. Masum, S. Mabikke, D. Antonio, J. Espinoza [4], Y. Liu, J. Li, Y. Yang [12], T. W. Hertel, U. L. C. Baldos [9], R. De Grenade, L. House-Peters, C. A. Scott, B. Thapa, M. Mills-Novoa, A. Gerlak, K. Verbist [5], in terms of decision-making on environmental safety of agricultural land, are interesting the studies of H. Li, Y. Zhao, F. Zheng [11], X. Qi, Y. Fu, R. Y. Wang, C. N. Ng, H. Dang, Y. He [14]. The influence of land composition on the ecological stability of the territory I. Ryborski, E. Goyke [16]. As for the methods of assessing environmental sustainability and environmental safety in agriculture, such studies were carried out by G. Dudych, L. Dudych [7], A. Tretyak, R. Tretyak, M. Shkvir [25], O. Shkuratov [18]. S. Tian, S. Wang, X. Bai, D. Zhou, G. Luo, Y. Yang, Q. Lu, [22]. The method of assessing the ecological danger of urban land use for the livelihood of the population was considered by A. Tretyak, N. Tretyak, M. Kirov [24], P. Singh, N. Kikon, P. Verma [19]. In general, ecological and economic assessment of the efficiency of agricultural lands was considered by D. Dobryak, O. Shkuratov, T. Yevsyukov, Y. Sklyar [6], O. Furdychko, R. Gulinchuk, I. Samoilova [8], A. Tkach, A. Stepanov, R. Ilyukhin [23].

From the analysis of scientific works, it is established that the problems of the presence of objects with high environmental danger, the possibility of environmental accidents and catastrophes remains a little-studied issue. Given that environmental safety remains one of the main ways to solve / prevent environmental problems, that is why the authors of the article conducted relevant research in this area on rural areas where dangerous objects are located. Namely, through the ecological and economic assessment of land use, this is one of the forms of reflecting the relationship between nature, man and society.

MATERIALS AND METHODS

To assess the impact of land composition and functional land use on environmental and economic efficiency in the context of environmental safety of land use, the proposed system of indicators was used. In particular, the indication of ecological safety of land use is represented by a system of such indicators: coefficient of ecological stability of land use, coefficient of anthropogenic load [16] and the level of ecological danger of land use [24]. The economic efficiency of changes in the structure and regime of land use is well characterized by the value of land use, which is determined by the method of normative monetary valuation of land [3].

The value of the coefficients of assessment of ecological properties of land is calculated using Table 1 [16], where the formula 1 for different composition of land determines the coefficient of ecological stability of land use in the territory ($K_{ек.\ cm.}$) [16].

$$K_{ек.cm.} = \frac{\sum K_{1i} \times P_i}{\sum P_i} \times K_p, \qquad (1)$$

Where K_{1i} – is the coefficient of ecological stability of lands and lands of the *i*-type by functional use;

P_i – area of land and lands of the *i*-th type by functional use;

K_p – coefficient of morphological stability of a relief (K_p = 1.0 – for stable territories and K_p = 0.7 for unstable territories of land uses.

Accordingly, if the obtained value of $K_{ек.\ cm.}$ is less than 0.33, the land use area is ecologically unstable, if it is between 0.34 to 0.50, it belongs to the stable unstable, if it is in the range from 0.51 to 0.66, it passes to the average stability, if it exceeds 0.67, the land use area is ecologically stable.

The coefficient of anthropogenic load ($K_{а.н.}$) (Table 1) reflects the significance of ohuman

activities impact on the environment, including land resources and is calculated by formula 2 [16].

$$K_{a.н.} = \frac{\sum Б_{1i} \times P_i}{\sum P_i}, \quad (2)$$

Where P_{1i} – is the area of *i* land and lands with the appropriate level of anthropogenic load, ha;

$Б_{1i}$ – the score of the corresponding area of *i* land and land with a certain level of anthropogenic load.

Table 1. Coefficient of assessment of ecological properties and degree of anthropogenic load of land for land use

Name of land	$K_{ек.ст.}$	Name of land use	$Б_{а.н.}$
Built-over lands and roads	0.00	Lands of industry, transport, settlements	5
Arable	0.14	Arable	4
Vineyards	0.29	Natural forage lands	4
Forest belts	0.38	Forest belts	2
Fruit orchards	0.43	Perennial plantings	4
Shrubs		Shrubs	2
Homestead gardens	0.50	Micro reserves	1
Hayfields	0.62	Meadow areas	3
Pastures, fallows	0.68	Under water	2
Ponds and swamps of natural origin	0.79	Natural swamps	2
Forests of natural origin	1.00	Forests of natural origin	2

Source: [16].

To calculate the coefficient of ecological stability of land use ($K_{ек.\ ст.}$) and the score of anthropogenic load ($K_{а.н.}$) and taking into account the author's suggestions, land use was taken within the territory of Desnyanskaya united territorial community, where military facilities are located.

Determining the coefficient of ecological stability allows us to assess the ecological safety (danger) of land use by applying the coefficient of ecological danger ($K_{ек.неб}$), which is determined by formula 3 [24]:

$$K_{ек.неб} = 1 - K_{ек.ст.}, \quad (3)$$

The indicator of the characteristics of ecological safety (danger) of land use is the scale, where the critical level of ecological danger of land use is in the range of 1.00-0.67; high level – 0.66–0.51; average level – 0.50-0.34; low level – 0.33–0.00.

Estimation of the value of land use ($B_н$) is determined by formula 4 [3]:

$$B_н = П_з \times P_з \times C_к \times K_м \times K_в \times K_{мц} \times K_i \quad (4)$$

where $П_з$ – land use area, according to the State Land Cadastre, ha;

$P_з$ – rental income per hectare for the relevant category of land;

C_K – term of capitalization;

$K_м$ – a factor that takes into account the location of land. The assessment uses only a coefficient that takes into account regional differences in the formation of rental income and is determined for land for industry, transport, communications, energy, defense and other purposes in accordance with Annex 8 to the Procedure, and for land of other categories is equal to one;

$K_в$ – coefficient that takes into account the type of land use;

$K_{мц}$ – coefficient that takes into account the affiliation of the land to the lands of environmental, health, recreational, historical and cultural purposes;

K_i is the indexation coefficient of the normative monetary valuation of lands.

Given these methods and transformations which took place over recent decades in Ukraine, namely the change in the structure of land use in all categories of land and land ownership, the study proposed to expand the land and land for functional use. It is also proposed to calculate the coefficient of ecological stability and anthropogenic load taking into account the levels of threats, which in turn will improve the methodological approach to assessing the effectiveness of land use in the context of environmental safety. In particular, the author's additions to the level of threats are made on the basis of expert proposals according to the methodology of the World Bank [26; 27]. The essence of which is that a group of experts conducted an environmental

assessment, which takes into account the ratio of the degree of anthropogenic pressure and ecological imbalance and identified three levels of threats (high, medium, small), which are proposed to be used as a reduction factor. In particular, for objects of high level of threats – reduction of land value is 30%; for objects with an average level of threats – reduction of land value – 20%; for objects with a low level of threats – the reduction in the value of land will be – 10%.

RESULTS AND DISCUSSIONS

The use of indicators that characterize the intensity of the process of land use urbanization (structural, process and dynamic) in the system provide an opportunity to identify sources of danger, current problems and critical areas that should be the priority measures to maintain adequate environmental safety and land use capitalization main indicators of quality of life of the population.

There are different approaches to determining these indicators, which differ in the methods aimed at solving various problems that have arisen, as well as to identify the boundaries of environmentally sustainable development of land use in the areas, which has a direct impact on the economy and where the main attention is paid to identifying the degree of change in natural systems, including agricultural and urban land use.

Most studies carry out environmental assessment using landscape and land management analysis of environmental and natural resource potential for different types of economic use, based on generally accepted or proposed own indicators. This allows you to link to specific areas, which to some extent allows you to objectively assess the use of natural resources, to clarify the natural economic potential for long-term development of land use in rural areas, as well as to develop proposals for environmentally sustainable development. However, the application of only a landscape approach to the environmental assessment of land use development of the territory, in the study case, namely in the context of environmental safety of life, is not enough. The presented methodological approaches are based on determining the optimal, actual and minimum land area required to reduce the level of urbanization of the territory and meet the needs of the population.

However, when they are finalized, they can be used for functional zoning in order to establish the regime of use and protection of lands and other natural resources, which has an impact on the greening and capitalization (increase in value) of land use. Because the sustainability of land use depends on the level of development of land and other natural resources, the intensity of land use and the level of existing anthropogenic threats (the level of MPC, nitrate pollution, industry, defense facilities, etc.).

The ratio of the degree of anthropogenic pressure and ecological imbalance shows that the highest scores have industry built-on lands, and arable lands, forests, meadows, pastures and underwater lands play an ecological stabilizing role. That is, the ecological activity of the population is influenced by the presence of forest plantations, water bodies, natural vegetation on the territory of land use. Nevertheless, the typification of land and land by functional use in Ukraine should be clarified depending on the level of threats to hazardous facilities (level of MAC increase, nitrate pollution, industry, defense facilities, etc.), which directly affects the land. That is why, in order to assess the state of environmental safety of the population, the classification of land and land by functional use has been expanded. In particular, separate subtypes of land use with dangerous objects that have a different functional purpose, but are in the appropriate category to distinguish between high, medium and low levels of threats.

Note that in the approach of the World Bank, and in general in the studies of the World Bank and the International Federation of Land Surveyors, the main idea is that an effective system of natural, including agricultural and urban land use should be formed to meet the needs of the population and human-land relations, guaranteeing the security of all

forms of ownership and sustainable land use and natural resources [26; 27].

The scale of the coefficient of environmental stability and the score of anthropogenic load of land and land for functional use with the author's additions are shown in Table 2. Note that the threat level was made on the basis of expert proposals according to the World Bank methodology, given by the authors using the example of military lands, arable land and forest lands.

Table 2. The value of the assessment of the coefficient of ecological stability and the score of anthropogenic load of land and land by functional use in the context of environmental safety

Lands and lands by functional use *	Coefficient of ecological stability of lands and lands, $K_{ек.ст.}$	Anthropogenic load score $Б_{ан.н.}$
Military lands	-0.23	5.00
Military lands with dangerous objects**:		
high level of threats	*-0.30*	*6.50*
medium level of threats	*-0.28*	*6.00*
low level of threats	-0.25	5.50
Land for road transport (under roads):		
with air emissions above the MAC level	-0.1	5
with an acceptable level of MAC	0	4.5
Industry lands:		
with air emissions above the MAC level	-0.1	5
with an acceptable level of MAC	0	4.5
Three- and more-storey residential buildings, other built-on lands, streets, etc.	0	5
One- and two-storey residential estates	0.1	4.5
Arable	*0.14*	*4*
Arable land with dangerous objects**:		
high level of threats	*0.10*	*5.20*
medium level of threats	*0.11*	*4.80*
low level of threats	*0.13*	*4.40*
Linear greenery	0.38	3.5
Orchards	0.43	4
Shrubs	0.43	2
Area greenery (squares, etc.)	0.45	3.5
Land for health purposes	0.5	3
Other lands and lands with insignificant vegetation cover	0.62	3
Haylands	0.62	3
Pastures, fallows	0.68	3
Land under water	0.79	2
Swamps of natural origin	0.83	1
National natural and regional landscape parks	0.85	2.5
Forests of natural origin	0.95	2
Forests of natural origin with dangerous objects**:		
high level of threats	*0,67*	*2,60*
medium level of threats	*0,76*	*2,40*
low level of threats	*0,86*	*2,20*
Forest reserves	1	1

Source: * expanded by authors using sources [16; 26; 29; 24; 25];

** Author's proposals for differentiation of the coefficient of ecological stability and the score of anthropogenic load of lands and lands according to their functional use taking into account the level of threats of dangerous objects are noted.

For a more representative view, the study used land within the territory of the Desnianska united territorial community, where military facilities are located. Characteristics in terms of territories of councils of military lands by land and by functional use are given in Table 3.

Thus, taking into account the differentiated

values for land use, the coefficient of ecological stability of land use in this area ($K_{ек.см.}$) is determined by formula 1. The analysis of the Table 4 shows that when calculating the coefficient of ecological stability of land use taking into account the differentiation associated with With objects of high level of ecological threats, in particular with military objects, such coefficient will change from 0.71 to 0.65, and such land use will already be characterized by average stability.

Table 3. Characteristics of land use of military units in terms of council territories within the Desnianska united territorial community

Land and land for functional use	Desnianska united territorial community				Total
	village Desna	village Koropie	village Kosachivka	village Morynsk	
1. The total land area of military units, ha	21,056	-	-	-	21,056
1.1. under construction	7,421	-	-	-	7,421
of them under housing	*259.5*	-	-	-	*259.5*
1.2. agricultural land (hayfield)	100	-	-	-	100
1.3. forests	13,535	-	-	-	13,535
including for protective, environmental and biological purposes	1,043	-	-	-	1,043
Of the total area within the settlement, ha	296	-	-	-	296

Source: according to the Desnianska united territorial community.

Table 4. Coefficient of ecological stability of land use within the territory of Desnianska united territorial community

Land and land for functional use	Coefficient of ecological stability of lands *Kli*	Area of lands *Pi*	*Kli x Pi*	Coefficient of ecological stability of land use *(К ек.см.)*
1) Calculation of the coefficient of ecological stability without taking into account differentiation:				
Built-on areas and roads	0	7,931.69	0.00	
Arable	0.14	2,897.54	405.66	
Perennial plantings	0.43	30.96	13.31	
Hayfields	0.62	4,631.03	1,750.56	
Pastures	0.68	3,622.26	2,463.14	
Underwater lands and swamps of natural origin	0.79	18,843.23	14,886.15	
Forests of natural origin	0.95	27,470.69	26,097.16	
Total		**65,427.40**	**46,772.32**	**0.71**
2) Calculation of the coefficient of ecological stability taking into account the differentiation:				
Arable	0.14	2,897.54	405.7	
Perennial plantings	0.43	30.96	13.3	
Pastures	0.68	3,622.26	2,463.1	
Military lands: *average level of threats*	-0.28	7161.5	-2,005.2	
Land under roads: *with an acceptable MAC level*	0	154	0.0	
Three- and more-storey residential buildings, other built-on lands and streets	0	259.5	0.0	
One- and two-storey residential buildings	0.1	356.69	35.7	
Hayfields and other lands with little vegetation	0.62	4,531.03	2,809.2	
Hayfields used for military purposes: *average level of threats*	0.5	100.0	50.0	
Land under water	0.79	17,297.9	13,665.4	
Swamps of natural origin	0.83	1,545.3	1,282.6	
Forests of natural origin	0.95	14,978.69	14,229.8	
Forests of natural origin used for military purposes: *average level of threats*	0.76	12,492	9,493.9	
Total		**65,427.4**	**42,443.4**	**0.65**

Source: calculated by the authors according to formula 1, where: 1) using the source [16]; 2) taking into account the author's suggestions.

In connection with the obtained data of the coefficient of ecological stability, the coefficient of ecological danger for the relevant territory of the Desnyansk united territorial community, where military facilities are located, is calculated according to formula 3. This coefficient will be 0.29 and will be characterized by a low level of ecological danger. Taking into account the author's suggestions, respectively, it will be $К_{ек.неб}$ = 0.35 and will be characterized by an average level of danger. These values confirm the importance of highlighting the presence of objects with high environmental risk, in our case, defense lands.

The score of anthropogenic load ($Б_{а.н.}$) reflects the significance of human activities impact on the environment, including land resources of different categories of land. In this case, the scale of the anthropogenic load, taking into account the proposals for the allocation of areas where dangerous objects are located, namely the allocation of limit values will be as follows: if the obtained value is less than 2.5, then the territory has a low degree of anthropogenic load; if it is in the range from 2.51 to 3.50, the average degree of anthropogenic load; if from 3.51 to 4.50, the territory has a high degree of anthropogenic load; if the coefficient is more than 4.51, then the territory has a critical level of anthropogenic load. The calculation of the score of anthropogenic load of land use is given in Table 5.

Table 5. Calculation of the anthropogenic load of land use within the territory of the Desnianska united territorial community

Land and land for functional use	Anthropogenic load score lands, *Бі*	Lands area, *Pi*	*Бі x Pi*	Score of anthropogenic load of land use ($Б_{а.н.}$)
1) Calculation of the anthropogenic load score without taking into account differentiation:				
Built-on areas and roads	5	7,931.69	39,658.45	
Arable	4	2,897.54	11,590.16	
Perennial plantings	4	30.96	123.84	
Hayfields	3	4,631.03	13,893.09	
Pastures	2	3,622.26	7,244.52	
Underwater lands and swamps of natural origin	1	18,843.23	37,686.46	
Forests of natural origin	2	27,470.69	54,941.38	
Total		**65,427.40**	**165,137.9**	**2.52**
2) Calculation of the coefficient of ecological stability taking into account the differentiation:				
Arable	4	2,897.54	11,590.2	
Perennial plantings	5	30.96	154.8	
Pastures	3	3,622.26	10,866.8	
Military lands: *average level of threats*	6	7,161.5	42,969.0	
Land under roads: *with an acceptable MAC level*	4.5	154	693.0	
Three- and more-storey residential buildings, other built-up lands and streets	5	259.5	1,297.5	
One- and two-storey residential buildings	4.5	3,56.69	1,605.1	
Hayfields and other lands with little vegetation	3	4,531.03	13,593.1	
Hayfields used for miitary purposes: *average level of threats*	3.6	100.0	360.0	
Land under water	2	17,297.9	34,595.9	
Swamps of natural origin	1	1,545.3	1,545.3	
Forests of natural origin	2	14,978.69	29,957.4	
Forests of natural origin used for military purposes: *average level of threats*	2.4	12,492.0	29,980.8	
Total		**65,427.4**	**179208.8**	**2.74**

Source: calculated by the authors according to formula 2, where: 1) using the source [16]; 2) taking into account the author's suggestions.

The analysis of the table shows that the score of anthropogenic load without taking into account the proposals indicates the average level of anthropogenic load of the territory ($Б_{а.н.}$ = 2.52). Taking into account the differentiation associated with dangerous objects, in particular defense objects, the score changed from 2.52 to 2.74, and although this score is within the average degree of anthropogenic load, however, it should be noted that the relevant facilities have an impact on the livelihoods of the population of the territory, and the environmental safety of land use is deteriorating. What, in the opinion of the authors should be taken into account when organizing the territory in the context of environmental safety of the population.

Table 6. The value of land within the territory of the Desnianska united territorial community by types of land use

Types (subtypes) of land use and land	Value, UAH / ha	Area, ha	Total value of land, thousand UAH
1) The value of land use without its structuring by land and functional use:			
Agricultural, of which:		7,496	179,904
agricultural enterprises	24,000	528	12,672
citizens	24,000	6,968	167,232
Residential and public buildings, of which:		326	117,360
citizens under construction	360,000	302	108,720
institutions, establishments	360,000	24	8,640
Industry land	233,914	116	27,134
Lands of transport and communication	194,929	185	36,062
Military land	97,464	21,056	2,052,177
Environmental protection	34,627	-	-
Recreational	18,415	31	571
Forestry	2,804	10,365	29,063
Water management	6,197	128	793
Land stock	6,000	25,724	154,344
Total		**65,427**	**2,597,408**
2) Cost taking into account the differentiation by land use regime:			
Agricultural, of which:		7,496	179,904
agricultural enterprises	24,000	528	12,672
citizens	24,000	6,968	167,232
Residential and public buildings, of which:		326	117,360
citizens under construction	360,000	302	108,720
institutions, establishments	360,000	24	8,640
Industry land	233,914	116	27,134
Lands of transport and communication	194,929	185	36,062
Military land, of which:		21,056	1,097,282
hayfields used for military purposes: *average level of threats*	8,042	100	804
under construction: *average level of threats*	144,000	7,421	1,068,624
of them under housing	180,000	259.5	46,710
forestry:		13,535	27,854
forests used for military purposes average level of threats	2,019	12,492	25,221
forests for protective, conservation and biological purposes	2,524	1,043	2,633
Environmental protection	34,627	15,724	544,488
Recreational	18,415	15,159	279,154
Forestry	2,804	5,365	15,043
Water management	6,197		0
Land stock	6,000		0
Total		**65,427**	**2,296,427**

Source: calculated by the authors using sources [3; 20].

Thus, the general analysis of ecological safety (danger) shows that the ecological stability of land use and the level of anthropogenic load depend on the structure of land use and the functional use of land. In particular, the greater the share of land use that has a negative impact on the environment, the higher the degree of danger of land use. Thus, threats to the ecological instability of land use, and consequently the environmental safety of the population within rural areas where land use with hazardous objects is located, should be assessed according to the proposed methodological approach and taking into account the structure and mode of land use.

The level of capitalization (growth of value) of land use is also influenced by the regime of use and protection of land and other natural resources. That is why it is proposed to take into account the proposals for the differentiation of the functional use of land with dangerous objects, in our study with the threats of defense objects. The total value of land in the existing classification of land and land by functional use and author's suggestions for their improvement for land use with hazardous objects is given in Table 6. For agricultural land use, data from the Directory of indicators of the normative monetary value of agricultural land in Ukraine for the corresponding year (hryvnia per hectare) are used [20].

As the comparative analysis of the data of the assessment of the total value of land use within the territory of the Desnianska united territorial community, where the military objects are located, shows that the value of UAH 2,597,408 thousand is not taken into account. Taking into account the differentiation of anthropogenic load on land use associated with dangerous objects, in particular military objects, located on the territory of the Desnyansk united territorial community, it decreases. The cost of land use, taking into account the differentiation by land use regime is 2,296,427 thousand hryvnias. That is, taking into account the anthropogenic load, namely related to the establishment of the regime of land use associated with the threat to the life of the population, the cost decreased by 300,981 thousand hryvnas, and this is natural, because the environmental situation affects the cost of land use.

CONCLUSIONS

In particular, the analysis of this approach shows that the ecological stability of land use, environmental hazard (safety) and the level of anthropogenic pressure depend on the structure of land, land use functions and land use regime. In particular, the greater the share of land use that has a negative impact on the environment, the higher the degree of danger of land use. Thus, the analysis of these calculations shows that the ecological stability of land use within the territory of the Desnianska united territorial community changes when the impact of dangerous objects on it is taken into account. For example, the calculation of the coefficient of ecological stability taking into account the differentiation of lands related to military lands has changed from 0.71 to 0.65, which in turn characterizes the decrease in the stability of land use. Accordingly, the coefficient of ecological danger without taking into account the proposals will be 0.29 and will be characterized by a low level of ecological danger, taking into account the proposals, respectively, it will be 0.35, which will be characterized by an average level of danger. Similarly, the score of anthropogenic load of land use, taking into account the differentiation, changed from 2.52 to 2.74, which characterizes the increase in the level of anthropogenic load of land use of the respective territory. The analysis of the data of the assessment of the economic efficiency of land use related to the threat to the life of the population shows a decrease in the cost of land use by 300,981 thousand hryvnas.

Thus, the proposed approach of ecological and economic assessment of land use efficiency in the context of ecological safety of life allows determining more objectively the level of ecological danger to the population and the monetary valuation of land with dangerous objects. Also, the conducted

ecological and economic assessment allows applying appropriate measures to improve the typification of land and land for functional use with the allocation of areas of objects with high environmental risk.

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SEED PRODUCTIVITY OF ALFALFA VARIETIES DEPENDING ON THE CONDITIONS OF HUMIDIFICATION AND GROWTH REGULATORS IN THE SOUTHERN STEPPE OF UKRAINE

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Abstract

The aim of the study was to determine the effect of humidification conditions (drip irrigation and no irrigation) and growth regulators (Agrostimulin, Garth, Lucis, Emistim C) on the seed productivity of alfalfa varieties Unitro and Zoryana. The study was carried out during 2012-2015 at the experimental field of the Institute of Irrigated Agriculture of NAAS on the dark-chestnut soil in the conditions of the Steppe zone. The yield of alfalfa seeds in the conditions of natural humidification was (by the years of life) 154; 471; 235 kg/ha, and drip irrigation increased them to 207; 640; 538 kg/ha. Application of the growth regulators favored for the increase in the seed yield: 161-171; 479-492; 245-256 kg/ha without irrigation, and 217-230; 653-668; 559-583 kg/ha at drip irrigation. The highest yield of 175; 497; 261 kg/ha and 236; 674; 594 kg/ha was obtained in the variants with Garth growth regulator application. Drip irrigation increased the root mass from 1.61 to 2.03 t/ha. The preparations stimulated the root mass accumulation, mostly at drip irrigation, by the years of the crop life: Agrostimulin – 2.46; 5.36; 6.78 t/ha, Lucis – 2.50; 5.61; 7.05, Emistim C – 2.42; 5.28; 6.72 and Garth with the maximum indices – 2.53; 5.73; 7.25 t/ha. Atmospheric nitrogen fixation increased from the first to the second year of the crop life, and further decreased to the third year of the herbage life. Strong correlation ties between the seed productivity and root mass accumulation (r= 0.932-0.984), atmospheric nitrogen fixation (r= 0.960-0.975) and between the root mass accumulation and atmospheric nitrogen fixation (r= 0.990-0.996) were determined.

***Key words*:** *alfalfa, variety, seed productivity, root mass, atmospheric nitrogen fixation, natural humidification, drip irrigation, growth regulators*

INTRODUCTION

Alfalfa is the most wide-spread forage crop in the world. The crop is posed as one for solving the problem of plant protein in the forage for cattle. However, the practical value of alfalfa is not limited to its fodder qualities. It also performs other important functions: agrotechnical, biological, agroecological. Alfalfa enriches the soil with nitrogen, accumulates a large amount of post-harvest residues, root mass, improves soil structure, reduces the effects of water and wind erosion, is a good fore-crop for many crops. The lack of sufficient seed material, due to low seed yield, does not allow to expand the sown areas of this valuable crop. Therefore, appropriate technologies are needed, the main elements of which would contribute to the normal growth and development of plants.

The most efficient factors of the influence on the yield of alfalfa seeds are irrigation (drip, sprinkling, surface) and the use of growth regulators [2, 36]. The advantages of drip irrigation over conventional irrigation methods are well known for a long time, and due to high economic efficiency and environmental safety, it is widely used in irrigation of crops. Drip irrigation helps to increase crop yields due to strict control and maintenance of optimal soil moisture throughout the growing season while reducing irrigation rates and reducing the cost of

irrigation water per unit of yield. Studies have shown that the production of alfalfa seeds at drip irrigation required half less irrigation water [17], while the seed yield was by 20-25% higher than at conventional methods of irrigation [26]. But the main advantage of drip irrigation use on the seed crops is the possibility of more precise control of soil moisture at the necessary interphase periods.

At the same time, higher doses of mineral fertilizers are used to increase yields, but they lead to environmental pollution and, in the end - to the deterioration of plant products quality. Taking into account significant increase in the cost of basic resources, depletion of natural resources, it is necessary to reduce the use of mineral fertilizers and at the same time increase the use of microbiological preparations, plant growth regulators, micronutrients [4, 27]. In the conditions of climate change, with increasing food shortages, it is necessary to ensure sustainable agricultural production, the support of which is possible with the widespread use of biostimulants. Therefore, in most developed countries, biological methods of agriculture are intensively developed and mastered , based on the reduction or abandonment of synthetic fertilizers and chemical plant protection products with maximum use of biological factors of the increase in soil fertility, disease, pest and weed control, and implementation of a set of other measures that do not have an adverse effect on the environment, but improve the conditions of crop formation [3, 27]. For example, according to the European Council of the Biostimulator Industry (EBIC), more than 6.2 million hectares were treated with biostimulants in Europe in 2012, with an overall annual growth rate of 12.5% between 2013 and 2018 [5, 7], and by 2026 the market of biostimulants is estimated to be about 5 billion US dollars.

The use of plant growth regulators is an efficient element of energy-saving agricultural technologies, which contributes to the creation of appropriate conditions for growth and development of plants of different crops and is an important reserve for the improvement in productivity and quality of agricultural products for human health insurance, animals, useful fauna of agrocenoses safety, are the most economical and do not require additional material resources [1, 9, 12, 32, 35].

In its turn, growth regulators have a positive effect on plant life processes, stimulate seed germination, photosynthesis, transport of substances, formation processes, resistance to abiotic stresses (lack of moisture, high and low temperatures) [10,20,23,29]. Today, their application is one of the important and prospective areas of management of the production process of crops that regulate the growth and development of plants [15]. Biostimulants increase the resistance of crops to adverse weather conditions and to their damage by pests and diseases. In general, under their influence, the genetic potential of plants created by nature and breeding work is more fully opened, and at the same time they play as important role as the use of mineral fertilizers [21]. The high efficiency of these preparations is due to the content of a balanced complex of biologically active substances, which accelerates the growth of vegetative mass and root system, and therefore more intensive use of nutrients, increase the resistance of plants to diseases, stresses and adverse weather conditions. This allows to reduce the use of pesticides by 20-30% without reducing the protective effect [34].

Analysis of the literature showed that in the nearest future stimulants will be no less important in agricultural production than mineral fertilizers. In this regard, the search for new forms of effective growth regulators and optimal ways of their use is a relevant problem in the crop's cultivation technology, and alfalfa for seed purposes is not an exception.

The aim of the study was to identify the effect of different growth regulators on seed productivity of alfalfa varieties, root mass accumulation and fixation of atmospheric nitrogen under different conditions of humidification.

MATERIALS AND METHODS

The study was conducted during 2012-2015 at the research field of the Institute of Irrigated Agriculture of NAAS. In terms of soil and climate, it is in the Steppe zone (Kherson oblast, the South of Ukraine), around the Ingulets irrigated array.

The field experiment was carried out by the method of split plots. The main areas (factor A) – humidification conditions (without irrigation and drip irrigation); sub-plots (factor B) – alfalfa varieties (Unitro and Zoryana); sub-subplots (factor C) – foliar treatment in the interphase period "beginning of flowering – massive flowering" with growth regulators: 1 – control 1 (without treatment); 2 – control 2 (water treatment); 3 – Agrostimulin; 4 – Garth; 5 – Lucis and 6 – Emistim C. The crop was sown in the early spring by the wide-row method with a row spacing of 70 cm. The area of a sowing plot – 60 m^2, accounting – 50 m^2. The study was conducted in four replications.

Agrostimulin is a plant growth regulator. The preparation is represented by a balanced composition of a complex of growth substances of natural origin (extract of endophytic mycorrhizal fungi) and a synthetic analogue of phytohormones – 2,6-dimethylpyridine-1-oxide (N-oxide-dimethylpyridine – Ivin), 26 g/L + Emistim C – 1 g/L. The preparation combines the physiological activity of its components – auxin activity of Ivin and cytokinin activity of Emistim C. It is a transparent colorless aqueous-alcoholic solution [11].

Garth is a plant growth regulator, aqueous solution of a mixture of preparations Triman (a crystalline powder of light pink or gray color ($C_6H_6NOMnCl_2$ – aqua-N-oxide-2-methylpyridine manganese (II) chloride) – 500 g/L) and Tetran (white crystalline powder ($C_{12}H_{14}N_2O_2ZnCl_2$ – bis-N-oxide-2-methylpyridine zinc (II) chloride) – 500 g/L) in the ratio of components 1:1.

Lucis is a plant growth regulator. The preparation is a white crystalline powder. Active substance: 2,6 dimethylpyridine-1-oxide with succinic acid, 990 g/kg and ammonium molybdate, 1.0 g/kg. It is recommended for application on alfalfa and clover.

Emistim C is a highly efficient plant growth regulator of natural origin with a wide range of action – a product of biotechnological cultivation of fungi-epiphytes from the root system of sea buckthorn and ginseng, obtained on the basis of metabolites of endomycorrhizal fungi. It contains a balanced set of regulators of auxin, cytokinin nature and amino acids, carbohydrates, fatty acids, microelements [11].

Treatment with growth regulators was carried out with a knapsack sprayer in the phase of plant development "beginning of flowering": Agrostimulin and Emistim C at a rate of 10 ml/ha, Garth – 50 ml/ha and Lucis – 10 g/ha.

Watering was carried out by drip irrigation with the laying of drip tape in each row. The estimated root-containing layer of soil was taken according to the interphase periods: "seedling-stalking" – 0.3 m, "stalking-budding" – 0.5 m, "budding-ripening of seeds" – 0.7 m. Soil moisture in the interphase period "seedlings-beginning of flowering" was maintained at 70-75% FC (field capacity) and from the interphase period "beginning of flowering-ripening of seeds" we reduced it to 50-55% FC.

The study of root distribution was performed by the method of washing, which allowed to determine their weight and percentage distribution (after harvesting) by the soil layers for every 10 cm [30]. Nitrogen fixation was determined by the balance method [22].

Statistical processing of yield data was performed by the method of analysis of variance according to V.O. Ushkarenko et al. [33].

RESULTS AND DISCUSSIONS

The obtained experimental data by the years of life indicate a different reaction of alfalfa varieties on the seed productivity to the studied factors: humidification and growth stimulants. It should be mentioned that the seed yield is maximized from the first year of the herbage life to the second, and it remains

high in the third, regardless of humidification conditions. So, in particular at irrigation, seed productivity by Unitro and Zoryana varieties averaged to 203 and 212 kg/ha (1st year), 643; 649 (2nd year), 555; 559 kg/ha (3rd year) against the variant without irrigation, respectively, 152; 158; 463; 473; 239 and 243 kg/ha (Table 1).

Table 1. Alfalfa seed yield by the years of life depending on irrigation, variety, and application of growth regulators (average for 2012-2015)

Humidification conditions (factor A)	Variety (factor B)	Application of plant growth regulators (factor C)	Years of life		
			first	second	third
No irrigation	Unitro	control 1 (no treatment)	145	451	227
		control 2 (water treatment)	146	452	229
		Agrostimulin	149	460	236
		Garth	162	477	251
		Lucis	158	472	247
		Emistim C	154	465	242
		Average	**152**	**463**	**239**
	Zoryana	control 1 (no treatment)	154	471	235
		control 2 (water treatment)	154	471	235
		Agrostimulin	161	479	245
		Garth	175	497	261
		Lucis	171	492	256
		Emistim C	166	485	251
		Average	164	483	247
	Average		**158**	**473**	**243**
Drip irrigation	Unitro	control 1 (no treatment)	191	628	530
		control 2 (water treatment)	193	628	531
		Agrostimulin	200	641	549
		Garth	217	661	584
		Lucis	212	655	573
		Emistim C	207	645	562
		Average	**203**	**643**	**555**
	Zoryana	control 1 (no treatment)	207	640	538
		control 2 (water treatment)	208	641	538
		Agrostimulin	217	653	559
		Garth	236	674	594
		Lucis	230	668	583
		Emistim C	224	658	572
		Average	220	656	564
	Average		**212**	**649**	**559**
Partial differences estimation					
LSD_{05}	A		22.9	22.5	27.5
LSD_{05}	B		3.6	4.0	1.6
LSD_{05}	C		2.5	2.2	3.2
Main effects differences estimation					
LSD_{05}	A		7.3	7.1	8.7
LSD_{05}	B		1.1	1.3	0.5
LSD_{05}	C		1.2	1.1	1.6

Source: Own study.

Analysis of the data shows that a significant impact on seed yields is made by irrigation and the application of growth stimulants that improve the plants growth and development, which generally has a positive effect on the formation of their generative bodies and, consequently, seed yield. Treatment of crops with growth regulators Agrostimulin, Lucis, Emistim C increased the yield of alfalfa seeds, compared to the control, by 1.2-11.7% (without irrigation) and by 2.1-13.6% (with irrigation) in the varieties Unitro, and 1.6-13.6% and 2.0-14.0% ─ in the variety Zoryana, respectively.

This is confirmed by the studies with the application of stimulants Agrostimulin and

Emistim C on other crops, which increased the yield of peas by 5.4-11.0%, soybeans - by 7.0-11.0, winter wheat - by 15.0-20.0%, clover seeds, alfalfa up to 23.0% [6,16,19]. Having used the preparation Garth a positive effect was also recorded, the increase in yield of spring wheat grain was 0.53 t/ha, of corn - 0.77 t/ha, of soybeans – 0.58 t/ha. In our studies, the highest efficiency was determined at the use of the preparation Garth, for three years of the herbage life, regardless on humidification conditions. This ensured the highest yield of alfalfa seeds in the conditions of natural humidification - 162; 175 and 477; 497 and 251; 261 kg/ha against the yield on the control, respectively, 146; 452; 229 and 154; 471; 235 kg/ha. Drip irrigation and treatment of alfalfa herbage with this growth regulator provided the maximum seed productivity for Unitro and Zoryana varieties: 217; 236 and 661; 674 and 584; 594 kg/ha, respectively, at the yield on the control: 193; 208 and 628; 641; 584 and 594 kg/ha. It is noteworthy that in the conditions of natural humidification, the tested stimulants provided a significant increase in the seed yield compared to the control. This indicates an important aspect of their action, namely, enhancement of the crop resistance to adverse environmental factors, lack of moisture. Further, we have analysed the relationships between alfalfa seed productivity and root mass accumulation and nitrogen fixation, taking into account the importance of alfalfa as a fore-crop. Moreover, it is referred that there is a strong relationship between green mass productivity and root mass in alfalfa and other crops [14,24,28]. Our study has shown that there are close links between the seed yield and root mass accumulation and nitrogen fixation. In particular, the correlation coefficient between the seed yield and root mass accumulation in the conditions of natural humidification in Unitro variety was r = 0.973, and in Zoryana variety r = 0.958, at drip irrigation the correlation coefficients were higher in Unitro variety – r = 0.984 than in Zoryana variety – r = 0.932 (Fig. 1).

The amount of accumulated root mass of the alfalfa varieties tended to increase from the first year of life to the second and third years of the crop life (Table 2).

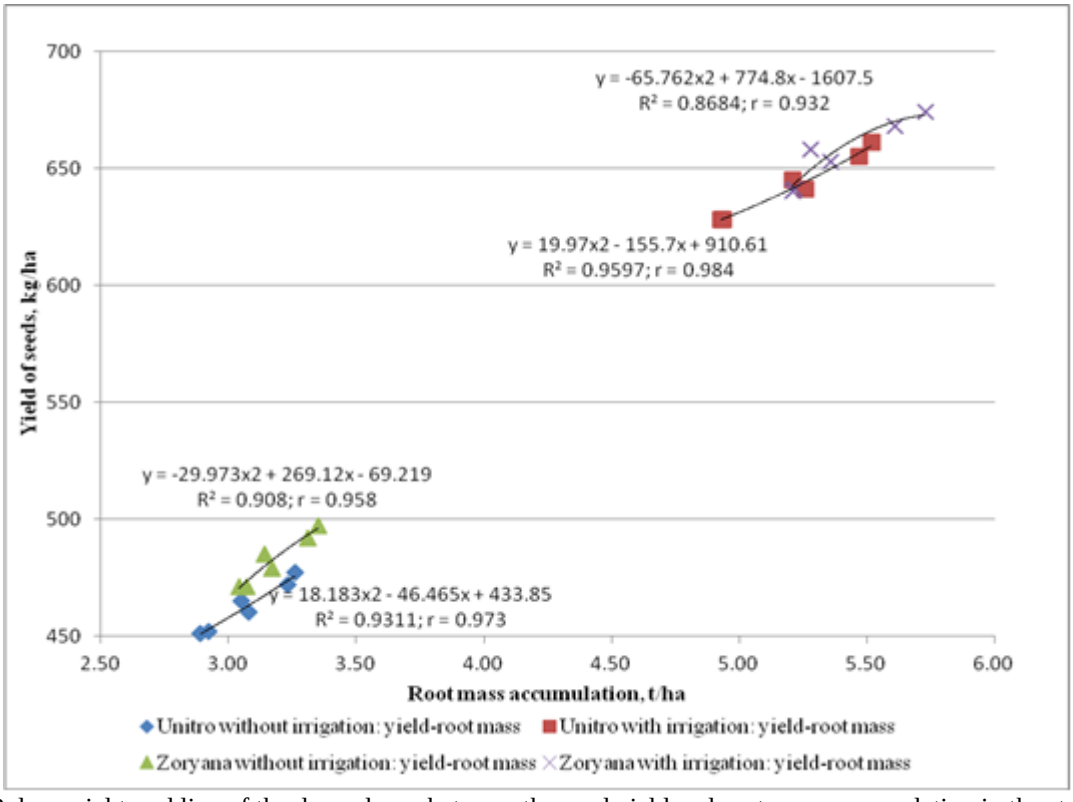

Fig. 1. Polynomial trend line of the dependence between the seed yield and root mass accumulation in the studied alfalfa varieties in the second year (average for 2012-2014)
Source: Own study.

Table 2. Accumulation of the air-dry alfalfa root mass by the years of life depending on irrigation, variety and application of growth regulators, t/ha (average for 2012-2015)

Humidification conditions (factor A)	Variety (factor B)	Application of plant growth regulators (factor C)	Years of life		
			first	second	third
Without irrigation	Unitro	control 1 (no treatment)	1.55	2.89	3.44
		control 2 (water treatment)	1.57	2.92	3.46
		Agrostimulin	1.88	3.08	3.57
		Garth	2.01	3.26	3.70
		Lucis	1.99	3.23	3.66
		Emistim C	1.82	3.05	3.53
		Average	1.80	3.07	3.56
	Zoryana	control 1 (no treatment)	1.61	3.04	3.50
		control 2 (water treatment)	1.62	3.07	3.51
		Agrostimulin	1.96	3.17	3.62
		Garth	2.01	3.35	3.76
		Lucis	1.99	3.31	3.71
		Emistim C	1.93	3.14	3.56
		Average	1.85	3.18	3.61
	Average		1,83	3.13	3.59
Drip irrigation	Unitro	control 1 (no treatment)	1.95	4.93	6.42
		control 2 (water treatment)	1.95	4.94	6.44
		Agrostimulin	2.33	5.26	6.75
		Garth	2.54	5.52	7.13
		Lucis	2.51	5.47	6.97
		Emistim C	2.27	5.21	6.61
		Average	2.26	5.22	6.72
	Zoryana	control 1 (no treatment)	2.03	5.21	6.55
		control 2 (water treatment)	2.04	5.22	6.56
		Agrostimulin	2.46	5.36	6.78
		Garth	2.53	5.73	7.25
		Lucis	2.50	5.61	7.05
		Emistim C	2.42	5.28	6.72
		Average	2.33	5.40	6.82
	Average		2,29	5.31	6.77
Partial differences estimation					
LSD_{05}	A		0.003	0.20	0.12
LSD_{05}	B		0.030	0.41	0.22
LSD_{05}	C		0.016	0.08	0.09
Main effects differences estimation					
LSD_{05}	A		0.001	0.06	0.04
LSD_{05}	B		0.009	0.13	0.07
LSD_{05}	C		0.008	0.04	0.05

Source: Own study.

Analyzing the obtained experimental data, it should be mentioned that the studied growing conditions and agricultural practices had a significant impact on the degree of development of the root system. Thus, in the conditions of natural moisture supply, the accumulation of root mass ranged within 1.55 and 1.61 t/ha, drip irrigation increased the trait to 1.95 and 2.03 t/ha in the varieties Unitro and Zoryana, respectively. Agrostimulin, Lucis, Emistim C and Garth had a stimulating effect on the root system mass. The most positive effect of growth regulators was obtained at drip irrigation. Their use contributed to the accumulation of the root mass over the years of life: Agrostimulin – 2.46; 5.36; 6.78 t/ha, Lucis – 2.50; 5.61; 7.05, Emistim C – 2.42; 5.28; 6.72 and Garth – 2.53; 5.73; and 7.25 t/ha in the variety Zoryana. As the above data testify, the use of the preparation Garth was particularly effective and ensured the maximum accumulation of the root mass. The same regulation is reported by Sheliuto et al., who recorded that the use of growth regulators increased up to 10% the size of root mass of legumes and root supply of plants [25].

Alfalfa, due to its biological property – nitrogen fixation, fixes nitrogen from the atmosphere and is an active storage of

nitrogen in the soil with the increase in this process in the second year of life. According to Tikhonovich et al., the efficiency of symbiosis increases from the 1st to the 3rd year of alfalfa cultivation [31]. But its level depends on the variety, namely, on the varietal characteristics of the location and development of the root system of the plants, growing conditions. It is possible to create favourable conditions for symbiotic nitrogen fixation by influencing bean-rhizobia symbiosis with growth regulators [8,12,13]. Growth stimulating substances activate microbiological processes in the area of the root system, significantly affect the symbiosis, which is manifested in the participation of these substances in the inoculation process, the genesis of nodules, regulation of nitrogen fixation activity [18, 37].

Determination of the atmospheric nitrogen fixation showed that it also varies depending on growing conditions and years of the herbage life. Thus, its increase took place from the first to the second year of life. However, in the third year, the reaction in both varieties was different. So, without irrigation nitrogen fixation on the control from 131.94 kg/ha in the second year, decreased to 123.45 kg/ha in the third, in the conditions of drip irrigation there was a slight increase - from 193.86 to 200.84 kg/ha, respectively. The same was also observed with the use of growth stimulants (Table 3).

Table 3. Fixation of the atmospheric nitrogen depending on irrigation, application of growth regulators and alfalfa variety by the years of life (average for 2012-2015)

Humidification conditions (factor A)	Variety (factor B)	Application of plant growth regulators (factor C)	Years of life		
			first	second	third
Without irrigation	Unitro	control 1 (no treatment)	69.53	131.94	123.45
		control 2 (water treatment)	70.05	133.12	123.89
		Agrostimulin	76.81	139.20	133.07
		Garth	86.62	148.72	145.07
		Lucis	86.07	144.60	139.65
		Emistim C	75.06	136.94	130.15
		Average	77.36	139.09	134.28
	Zoryana	control 1 (no treatment)	76.75	138.31	128.43
		control 2 (water treatment)	78.14	139.27	129.04
		Agrostimulin	87.11	148.55	136.97
		Garth	95.06	161.72	155.78
		Lucis	92.98	156.99	148.08
		Emistim C	84.64	147.32	133.19
		Average	85.78	148.69	139.69
	Average		85,78	143.86	136.98
Drip irrigation	Unitro	control 1 (no treatment)	118.51	193.86	200.84
		control 2 (water treatment)	119.31	195.16	213.39
		Agrostimulin	139.54	206.04	213.81
		Garth	149.72	219.01	227.33
		Lucis	144.91	210.60	220.51
		Emistim C	141.12	202.32	211.43
		Average	135.52	204.50	214.70
	Zoryana	control 1 (no treatment)	122.46	200.40	208.21
		control 2 (water treatment)	122.96	200.97	208,96
		Agrostimulin	147.72	212.84	218.17
		Garth	154.43	222.54	232,25
		Lucis	149.83	217.79	226,23
		Emistim C	144.73	210.15	212,99
		Average	140.36	210.78	219,57
	Average		137,94	207.64	217.14
Partial differences estimation					
LSD_{05}	A		0.867	26.02	0.849
LSD_{05}	B		0.455	9.84	6.563
LSD_{05}	C		0.708	2.63	3.609
Main effects differences estimation					
LSD_{05}	A		0.274	8.23	0.268
LSD_{05}	B		0.144	3.11	2.076
LSD_{05}	C		0.354	1.31	1.804

Source: Own study.

Analysis of the data, presented in the Table 3, indicates a positive effect of the studied growth regulators on the rate of fixation of atmospheric nitrogen under different humidification conditions. The use of Agrostimulin, Lucis and Emistim C helps to increase the fixation of atmospheric nitrogen in comparison with the control. In particular, they accumulated atmospheric nitrogen: without irrigation, in the first year 76.81; 86.07; 75.06 kg/ha, in the second year – 139.2; 144.6; 136.94 kg/ha and in the third year – 133.07; 139.65; 130.15 kg/ha against 69.53; 131.94; 123.43 kg/ha at the control. At drip irrigation, this figure was sufficiently higher and averaged to 139.54 in the first year; 144.91; 141.12, in the second year – 206.04; 210.60; 202.32 and in the third year – 213.39; 220.51; 211.43 kg/ha, at the control – 118.51; 193.86; 13.98 kg/ha, respectively.

The highest efficiency was at the application of the preparation Garth. It provided the maximum fixation of atmospheric nitrogen: 95.06; 161.72; 155.78 kg/ha without irrigation and 149.72; 219.01; 227.33 kg/ha in the irrigation conditions.

The study has found out a strong relationship between the seed yield and nitrogen fixation, it was in the variety Unitro at irrigation – correlation coefficient r = 0.965 and without irrigation r = 0.960, and in the variety Zoryana – r = 0.975 and r = 0.975, respectively (Fig. 2).

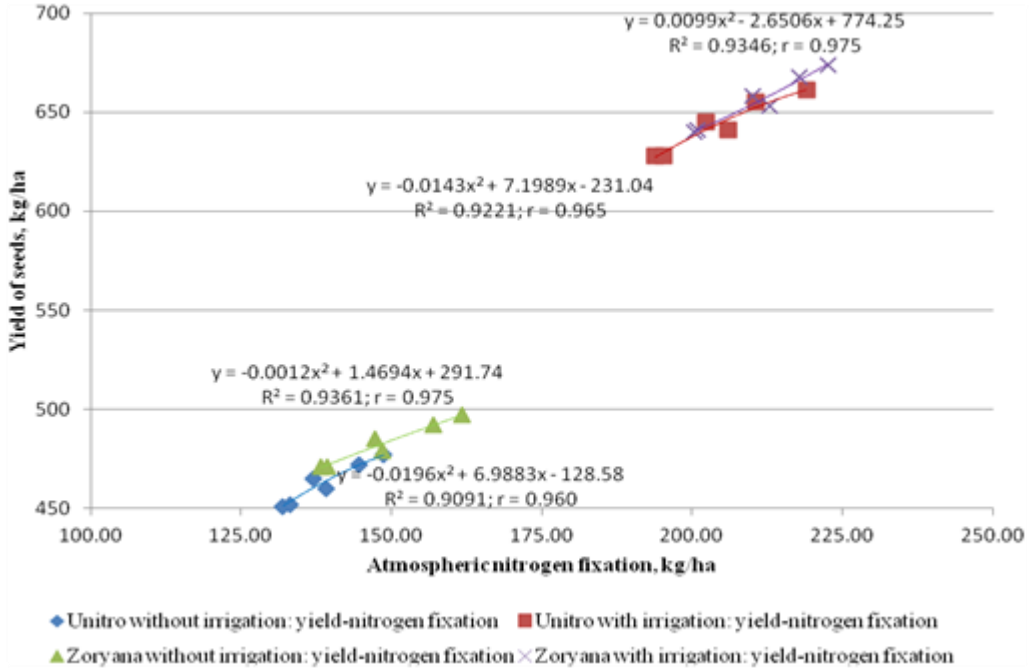

Fig. 2. Polynomial trend line of the dependence between the seed yield and atmospheric nitrogen fixation in the studied alfalfa varieties in the second year (average for 2012-2014)
Source: Own study.

At the increase in seed productivity of the plants, the root mass and nitrogen fixation of the varieties of alfalfa increases. However, the better developed the root system is, i.e. more in size, the stronger the nitrogen-fixing ability of the plants is, which is confirmed by the high correlation coefficient. Thus, under the conditions of natural humidification, the relationship between the accumulation of root mass and the fixation of atmospheric nitrogen in the cultivar Unitro was r = 0.985 and r = 0.993 in the cultivar Zoryana, and under drip irrigation r = 0.971 and r = 0.937, respectively (Fig. 3).

Economic efficiency estimation of the irrigation and growth stimulants application in the cultivation technology of seed alfalfa testifies that they payback (Table 4).

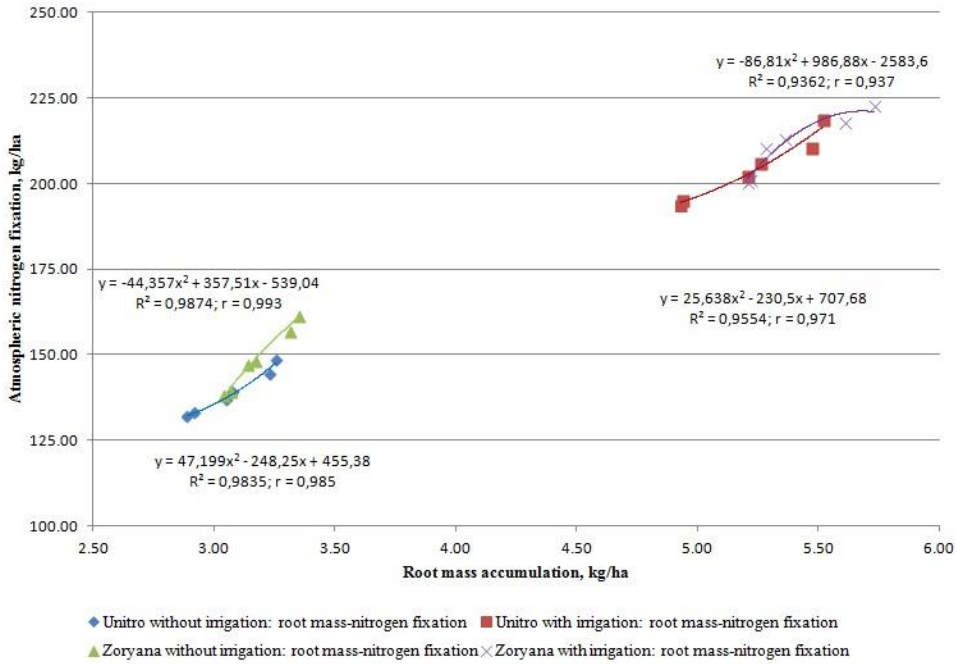

Fig. 3. Polynomial trend line of the dependence between the root mass accumulation and atmospheric nitrogen fixation in the studied alfalfa varieties in the second year (average for 2012-2014)
Source: Own study.

Table 4. Economic evaluation of alfalfa seed cultivation depending on humidification conditions and application of growth regulators (average for 2012-2015)

Variety (factor B)	Application of growth regulators (factor C)	Cost of seeds, EUR	Expenditures per 1 ha, EUR	Conditionally pure profit, EUR/ha	Prime cost of 1 kg of seeds, EUR	Profitability, %
Without irrigation (factor A)						
Unitro	control 1 (no treatment)	2,992.73	722.73	2,270.00	0.88	314.1
	control 2 (water treatment)	3,007.27	729.73	2,277.55	0.88	312.1
	Agrostimulin	3,072.73	737.27	2,335.45	0.87	316.8
	Garth	3,236.36	739.27	2,497.09	0.83	337.8
	Lucis	3,189.09	736.00	2,453.09	0.84	333.3
	Emistim C	3,130.91	738.73	2,392.18	0.86	323.8
	average	3,104.85	733.95	2,370.89	0.86	**323.0**
Zoryana	control 1 (no treatment)	3,127.27	722.73	2,404.55	0.84	332.7
	control 2 (water treatment)	3,127.27	729.73	2,397.55	0.85	328.6
	Agrostimulin	3,218.18	737.27	2,480.91	0.83	336.5
	Garth	3,392.73	739.27	2,653.45	0.79	358.9
	Lucis	3,341.82	736.00	2,605.82	0.80	354.1
	Emistim C	3,280.00	738.73	2,541.27	0.82	344.0
	average	3,247.88	733.95	2,513.92	0.82	**342.5**
Average		3,176.36	733.95	2,442.41	0.84	***332.8***
Drip irrigation (factor A)						
Unitro	control 1 (no treatment)	4,905.45	1,220.30	3,685.15	0.91	302.0
	control 2 (water treatment)	4,916.36	1,227.30	3,689.06	0.91	300.6
	Agrostimulin	5,054.55	1,234.85	3,819.70	0.89	309.3
	Garth	5,316.36	1,236.85	4,079.52	0.85	329.8
	Lucis	5,236.36	1,233.45	4,002.91	0.86	324.5
	Emistim C	5,141.82	1,236.30	3,905.52	0.88	315.9
	average	5,095.15	1,231.51	3,863.64	0.88	**313.7**
Zoryana	control 1 (no treatment)	5,036.36	1,220.30	3,816.06	0.88	312.7
	control 2 (water treatment)	5,043.64	1,227.30	3,816.33	0.88	311.0
	Agrostimulin	5,196.36	1,234.85	3,961.52	0.86	320.8
	Garth	5,469.09	1,236.85	4,232.24	0.82	342.2
	Lucis	5,385.45	1,233.45	4,152.00	0.83	336.6
	Emistim C	5,287.27	1,236.30	4,050.97	0.85	327.7
	average	5,236.36	1,231.51	4,004.85	0.86	**325.2**
Average		5,165.76	1,231.51	3,934.25	0.87	***319.5***

Source: Own study. Note: the cost of 1 kg of the alfalfa seeds was 3.64 EUR.

Over the years of the study in Unitro and Zoryana varieties of alfalfa, the cost of 1 kg of seeds under the cultivation in the conditions of natural humidification depended on the weather conditions of the year, and averaged to 0.86 EUR/kg and 0.82 EUR/kg, respectively. At drip irrigation, the cost of 1 kg of seeds for the variety Unitro was 0.88 EUR/kg and for Zoryana ─ 0.86 EUR/kg. The use of growth regulators, regardless the conditions of humidification, reduced the cost of 1 kg of seeds.

The highest pure profit was obtained in the variety Zoryana at drip irrigation and application of the growth regulator Garth ─ 4,232.24 EUR/ha, while in the variety Unitro this figure was lower and averaged to 4,079.51 EUR/ha. Under the conditions of natural humidification, the highest pure profit from the cultivation of Unitro and Zoryana varieties was also obtained under the application of the growth regulator Garth ─ 2,497.09 and 2,653.45 EUR/ha, respectively.

CONCLUSIONS

The yield of conditioned seeds of the first, second and third years of life of the varieties of alfalfa depended on the cultivation conditions. Drip irrigation, regardless of the year of its application, favored for a significant increase in the yield. Zoryana variety had an advantage over Unitro variety both under irrigated and non-irrigated conditions. Application of the growth regulators Agrostimulin, Lucis, Emistim C, Garth increased seed yield, root mass accumulation, the rate of atmospheric nitrogen fixation in the alfalfa varieties. The best results by all the traits were obtained under the application of the preparation Garth. Its application is an effective technological measure allowing increase the production of alfalfa seeds, the accumulation of root mass and biological nitrogen in the soil.

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STUDIES ON THE CURRENT SITUATION OF PROJECTS UNSELECTED FOR FINANCING, IN THE MEAT PROCESSING SECTOR, THROUGH THE NATIONAL RURAL DEVELOPMENT PROGRAM IN ROMANIA

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Abstract

Through the National Rural Development Program (NRDP), applicants have the opportunity to create or develop a business, with public support of up to 100% of the project value, depending on the type of investment and beneficiary. The projects submitted online on the Agency for Financing Rural Investments (AFRI) website will be selected based on the "Regulation on the organization and functioning (ROF) of the process of selection and verification of appeals for projects related to the measures of the National Rural Development Program (NRDP) 2014–2020. The application for funding will be declared eligible without funding, ineligible or withdrawn by the beneficiary. The purpose of this study is to analyze the situation of submitted and unfunded projects through sub-measure 4.2 of NRDP 2014-2020, in the analysis period 2015-2019, in the field of meat processing. An analysis will be made from the point of view of the number of unfunded projects, their eligible value and their public value, and in order to have an overview, the connection between the consulting companies and the number of unfunded projects in this field will be obvious. In the period 2015-2019, 96 projects in the field of meat processing were submitted and unfunded, in which 73 were eligible without funding, 15 ineligible and 8 withdrawn projects, with a total eligible value of 76,060,938 euros (public value 40,558,548). From the correlations between the number of consulting firms and the number of unfunded projects, it results that the projects were submitted randomly, independently of the consulting firms from each county of the respective regions.

Key words**:** *unfunded projects, eligible value, processing meat, consulting firms, measure*

INTRODUCTION

In the 2014-2020 funding period, Romania received over 8.12 billion euros from the Agricultural Fund for Rural Development (EAFRD), through the National Rural Development Program (PNDR) [2]. The increase and modernization of meat processing capacities through the use of funds provided by the NRDP aims to increase the added value of agricultural products of animal origin (meat processing). Sub-measure 4.2 ("Support for investments in the processing / marketing and/or development of agricultural products") refers to the modernization and creation of processing units and the introduction of new technologies in this field [10]. The EU food system needs to change throughout the system as it faces a number of fundamental challenges such as socio-economic issues, and strong leadership is needed to integrate these changes into the food system [3]. European funds are a good consequence of the great economic union of which we are a part, and their purpose is to increase each area that contributes to the growth of gross domestic product [7]. The development of rural entrepreneurship in Romania is strongly influenced by European funding. The European Union provides support for various areas, including rural development and agriculture [6]. In recent

years, Romania has made significant progress in meat processing and production, however, the financial performance of local companies is lower than that of EU companies [8]. The number of slaughtered animals, the average live weight on delivery, meat production, meat consumption and also exports have increased, Romania is still a net importer of meat, but a net exporter of live animals [4]. Meat imports are increasing, also the consumption of meat per capita is increasing, but also the companies in the field of meat processing are growing, in Romania [9]. As long as domestic production is not enough to cover consumption, pig farmers should be supported to increase production, otherwise they will fail and imports will continue to cover market demand due to overproduction in Western countries [5].

MATERIALS AND METHODS

For this paper we determined the situation of the projects submitted and not financed by Sub-Measure 4.2 of the National Rural Development Program 2014-2020, in the field of meat processing, in the period 2015-2019, in Romania. Data on the situation of submitted and unfunded projects were extracted from the selection reports of the Agency for Financing Rural Investments. The data thus extracted regarding the situation of unfunded projects were processed and divided in the 8 development regions of Romania. In order to have a better picture of the situation of unfunded projects, they were divided into three categories, according to the reason for non-financing: eligible without funding, ineligible, withdrawn. Correlations will be made between the number of consulting firms (x) and the number of unfunded projects (y) at the level of the counties in each region, in order to analyze whether the consulting firms had any influence on the submitted and unfunded projects.
The equation used for the correlation coefficient is:

$$r = \frac{\sum(x_i - \overline{X})(y_i - \overline{Y})}{\sqrt{\left(\sum(x_i - \overline{X})^2\right)\left(\sum(y_i - \overline{Y})^2\right)}}$$

where: $\bar{X}$ and $\bar{Y}$ - are the averages for samples, average (matrix1) and average (matrix2).
In the analysis, the values of the correlation coefficient (r) and of the coefficient of determination will be presented (R^2).

RESULTS AND DISCUSSIONS

In the period 2015 - 2019, through sub-measure 4.2 of NRDP 2014-2020, a total of 53 projects were financed, in the field of meat processing capacity development, with a total eligible value of 125,982,731 euros and a total public value of 62,696,276 euro. Most of the projects were financed in the North-West Development Region (13 projects), and in the Bucharest Ilfov Development Region only one project was financed (Table 1).
In the period 2015-2019, at national level were submitted and unfunded, through Submeasure 4.2 of PNDR 2014-2020, a total of 96 projects, where 73 were eligible without funding, 15 were ineligible and 8 were withdrawn, having the value eligible amount of 76,060,938 euros and the public value of 40,558,548 euros. Most submitted and unfunded projects are in the West Region with a number of 16 (eligible value 6,252,458 euros), and the fewest are in the Bucharest Ilfov Region with 4 unfunded submitted projects (eligible value 1,364,166 euros, projects submitted and unfunded by Submeasure 4.2, in the period 2015-2019, through PNDR 2014-2020 (Table 2 and Table 3). In the period 2015-2019, in the North-East Region, a total of 7 projects were submitted and unfunded, through Sub-Measure 4.2 of PNDR 2014-2020, where 5 were eligible without funding, 2 were ineligible, having the eligible value of 3.86,6247 euros and the public value of 1,960,868 euros (Table 4 and Table 5). In the South-East Development Region, 15 projects were submitted and unfunded through sub-measure 4.2, of which 12 eligible without funding, 1 ineligible and 2 withdrawn projects, with a total eligible value

of 10,169,454 euros, and the public value of 5,136,359 euros, through PNDR 2014-2020, in the period 2015-2019 (Table 6 and Table 7). In the South Muntenia Development without funding, 1 ineligible project and one withdrawn project, with total value eligible amount of 21,427,236 euros, and the public value having the value of 10,171,172.5 euros (Table 8 and Table 9). In the South-West Oltenia Development Region, a total of 11 projects were submitted and unfunded in the field of processing through Sub-Measure 4.2 of PNDR 2014-2020, of which 7 were eligible without funding, 2 ineligible projects and 2 withdrawn projects, with value total eligible amount of 13,165,461 euros, and public value of 6,424,906 euros, between 2015-2019 (Table 10 and Table 11). In the West Development Region, a total of 16 projects were submitted and unfunded, in the field of processing by Sub-Measure 4.2 of PNDR 2014-2020, of which 15 were eligible without funding and one withdrawn project, with a total eligible value of 6,252,458 euros, and public value of 3,162,356 euros, in the period 2015-2019 (Table 12 and Table 13).

In the North West Development Region, a total of 12 projects were submitted and Region were submitted and unfunded by sub-measure 4.2 of PNDR 2014-2020, in the period 2015-2019, a total of 15 projects, of which 13 are eligible unfunded, in the field of processing by Sub-Measure 4.2 of PNDR 2014-2020, of which 10 were eligible without funding, and 2 ineligible projects, with a total eligible value of 8,064,956 euro, and the public value of 5,694,614 euro, in the period 2015-2019 (Table 14 and Table 15). In the Center Development Region were submitted and unfunded, in the field of meat processing through Sub-Measure 4.2 of PNDR 2014-2020, a total of 16 projects, of which 9 were eligible without funding, 6 ineligible projects and 1 a withdrawn project, with value eligible total of 9,989,136 euros, and the public value of 6,114,786 euros, in the period 2015-2019 (Table 16 and Table 17).

In the Bucharest Ilfov Development Region, a total of 4 projects were submitted and unfunded, in the field of meat processing through Sub-Measure 4.2 of PNDR 2014-2020, of which one eligible without financing and 4 withdrawn, with an eligible value of 1,364,166 euros, and the public value of 682,082 euros (Table 18 and Table 19).

Table 1. Situation of funded projects at national level

Year	Development Region								Total Projects	Total Eligible Value (Euro)	Total Public Value (Euro)
	North East	South East	South Muntenia	South-West Oltenia	West	North West	Center	Bucharest Ilfov			
2015	1	1	1	0	0	1	0	0	**4**	**2,185,556**	**1,092,778**
2016	2	0	1	1	2	0	2	0	**8**	**27,066,427**	**12,439,399**
2017	5	0	1	1	2	4	4	1	**18**	**41,183,117**	**18,969,048**
2018	1	3	0	1	2	4	1	0	**12**	**27,678,971**	**15,599,513**
2019	1	2	1	1	1	4	1	0	**11**	**27,868,660**	**14,595,538**
Total	**10**	**6**	**4**	**4**	**7**	**13**	**8**	**1**	**53**	**125,982,731**	**62,696,276**

Source: Own calculation according to the data www.afir.info (02.08.2020) [1].

Table 2. Value of unfunded projects at national level (euro)

Year	Value	Development Region								Total
		North East	South East	South Muntenia	South-West Oltenia	West	North West	Center	Bucharest Ilfov	
	Eligible	0	0	0	0	0	0	0	0	**0**
2015	**Public**	0	0	0	0	0	0	0	0	**0**
	Eligible	0	2,554,580	659,646	0	5,000,000	0	171,780	0	**8,386,006**
2016	**Public**	0	1,267,080	329,823	0	2,500,000	0	85,890	0	**4,182,793**
	Eligible	2,210,063	0	941,850	0	0	0	94,986	0	**3,246,899**
2017	**Public**	1,105,01	0	470,925	0	0	0	47,493	0	**1,623,449**
	Eligible	0	3,528,355	0	0	0	675,315	0	0	**4,203,670**
2018	**Public**	0	1,764,177	0	0	0	270,126	0	0	**2,034,303**
	Eligible	3,418,008	4,086,519	19,825,740	13,165,461	1,252,458	7,389,641	9,722,370	1,364,166	**60,224,363**
2019	**Public**	2,067,241	2,105,102	9,370,424.5	6,424,906	662,356	5,424,488	5,981,403	682,082	**32,718,003**
	Eligible	**5,628,071**	**10,169,454**	**21,427,236**	**13,165,461**	**6,252,458**	**8,064,956**	**9,989,136**	**1,364,166**	**76,060,938**
Total	**Public**	**3,172,272**	**5,136,359**	**10,171,173**	**6,424,906**	**3,162,356**	**5,694,614**	**6,114,786**	**682,082**	**40,558,548**

Source: Own calculation according to the data www.afir.info (02.08.2020) [1].

Regarding the situation of the financed projects, it is observed that in 2017 there were 18 projects submitted and financed, with an eligible value of 41,183,117 euros and a public value of 18,969,048 euros, being the year with the highest number of projects and

the invested value the higher In the first reference year, respectively 2015, there were only 4 projects submitted and financed, with an eligible value of 2,185,556 euros, and the public value of 1,092,778 euros. Out of the total projects financed, in this analyzed period, in the North - West Region there were 13 projects, and the fewest projects financed were in Bucharest - Ilfov, only one project financed (Table 1).

Table 3. Number of unfunded projects at national level

		2015		2016		2017		2018		2019		Total	
	E.V.F.[1]	0		0		0		0		4		**4**	
	I.[2]	0	**0**	0	**0**	2	**2**	0	**0**	1	**5**	**3**	**7**
North- East	W.[3]	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		12		**12**	
	I.	0	**0**	1	**1**	0	**0**	0	**1**	0	**13**	**1**	**15**
South- East	W.	0		0		0		1		1		**2**	
	E.V.F.	0		0		0		0		13		**13**	
	I.	0	**0**	0	**1**	1	**1**	0	**0**	0	**13**	**1**	**15**
South Muntenia	W.	0		1		0		0		0		**1**	
	E.V.F.	0		0		0		0		7		**7**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	2	**11**	**2**	**11**
South-West Oltenia	W.	0		0		0		0		2		**2**	
	E.V.F.	0		0		0		0		15		**15**	
	I.	0	**0**	0	**1**	0	**0**	0	**0**	0	**15**	**0**	**16**
West	W.	0		1		0		0		0		**1**	
	E.V.F.	0		0		0		0		10		**10**	
	I.	0	**0**	0	**0**	0	**0**	1	**1**	1	**11**	**2**	**12**
North West	W.	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		9		**9**	
	I.	0	**0**	1	**2**	1	**1**	0	**0**	4	**13**	**6**	**16**
Center	W.	0		1		0		0		0		**1**	
	E.V.F.	0		0		0		0		3		**3**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**4**	**0**	**4**
Buch. - Ilfov	W.	0		0		0		0		1		**1**	
	E.V.F.	**0**		**0**		**0**		**0**		**73**		**73**	
	I.	**0**	**0**	**2**	**5**	**4**	**4**	**1**	**2**	**8**	**85**	**15**	**96**
Total	W.	**0**		**3**		**0**		**1**		**4**		**8**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (02.08.2020) [1].

Table 4. Value of unfunded projects in the North-East Region (Euro)

Year	Value	North-East Region						Total Eligible Value	Total Public Value
		Bacău	Botoșani	Iași	Neamț	Suceava	Vaslui		
	Eligible	**0**	**0**	**0**	**0**	**0**	**0**		
2015	**Public**	0	0	0	0	0	0	**0**	**0**
	Eligible	0	0	0	0	0	0		
2016	**Public**	0	0	0	0	0	0	**0**	**0**
	Eligible	1,246,673	0	0	0	963,390	0		
2017	**Public**	623,336	0	0	0	481,695	0	**2,210,063**	**1,105,031**
	Eligible	0	0	0	0	0	0		
2018	**Public**	0	0	0	0	0	0	**0**	**0**
	Eligible	67,650	138,726	0	0	0	1,449,808		
2019	**Public**	33,825	97,108	0	0	0	724,904	**1,656,184**	**855,837**
	Eligible	**1,314,323**	**138,726**	**0**	**0**	**963,390**	**1,449,808**		
Total	**Public**	**657,161**	**97,108**	**0**	**0**	**481,695**	**724,904**	**3,86,6247**	**1,960,868**

Source: Own calculation according to the data www.afir.info (05.08.2020) [1].

Table 5. Number of unfunded projects in the North East

		2015		2016		2017		2018		2019		Total	
	E.V.F.[1]	0		0		0		0		1		**1**	
Bacău	I.[2]	0	**0**	0	**0**	1	**1**	0	**0**	0	**1**	**1**	**2**
	W.[3]	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		1		**1**	
Botoșani	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		0		**0**	
Iași	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		0		**0**	
Neamț	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		2		**2**	
Suceava	I.	0	**0**	0	**0**	1	**1**	0	**0**	0	**2**	**1**	**3**
	W.	0		0		0		0		0		**0**	
	E.V.F.	0		0		0		0		1		**1**	
Vaslui	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
	E.V.F.	**0**		**0**		**0**		**0**		**5**		**5**	
Total	I.	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**5**	**2**	**7**
	W.	**0**		**0**		**0**		**0**		**0**		**0**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (05.08.2020) [1].

Table 6. Value of unfunded projects in the South-East Region (Euro)

Year	Value	South – East Region						Total Eligible Value	Total Public Value
		Brăila	Buzău	Constanța	Galați	Tulcea	Vrancea		
	Eligible	**0**	**0**	**0**	**0**	**0**	**0**		
2015	**Public**	0	0	0	0	0	0	**0**	**0**
	Eligible	0	0	2,554,580	0	0	0		
2016	**Public**	0	0	1,267,080	0	0	0	**2,554,580**	**1,267,080**
	Eligible	0	0	0	0	0	0		
2017	**Public**	0	0	0	0	0	0	**0**	**0**
	Eligible	0	0	0	0	0	3,528,355		
2018	**Public**	0	0	0	0	0	1,764,177	**3,528,355**	**1,764,177**
	Eligible	0	3,229,076	277,943	231,000	348,500	0		
2019	**Public**	0	1,676,381	138,971	115,500	174,250	0	**4,086,519**	**2,105,102**
	Eligible	**0**	**3,229,076**	**2,832,523**	**231,000**	**348,500**	**3,528,355**		
Total	**Public**	**0**	**1,676,381**	**1,406,051**	**115,500**	**174,250**	**1,764,177**	**10,169,454**	**5,136,359**

Source: Own calculation according to the data www.afir.info (02.09.2020) [1].

Table 7. Number of unfunded projects in the South East

		2015		2016		2017		2018		2019		Total	
Brăila	E.V.F.[1]	0		0		0		0		0		**0**	
	I.[2]	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.[3]	0		0		0		0		0		**0**	
Buzău	E.V.F.	0		0		0		0		4		**4**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**4**	**0**	**4**
	W.	0		0		0		0		0		**0**	
Constanța	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	1	**1**	0	**0**	0	**0**	0	**2**	**1**	**3**
	W.	0		0		0		0		1		**1**	
Galați	E.V.F.	0		0		0		0		4		**4**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**4**	**0**	**4**
	W.	0		0		0		0		0		**0**	
Tulcea	E.V.F.	0		0		0		0		3		**3**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**3**	**0**	**3**
	W.	0		0		0		0		0		**0**	
Vrancea	E.V.F.	0		0		0		0		0		**0**	
	I.	0	**0**	0	**0**	0	**0**	0	**1**	0	**0**	**0**	**1**
	W.	0		0		0		1		0		**1**	
Total	E.V.F.	**0**		**0**		**0**		**0**		**12**		**12**	
	I.	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**0**	**13**	**1**	**15**
	W.	**0**		**0**		**0**		**1**		**1**		**2**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (02.09.2020) [1].

Table 8. Value of unfunded projects in the South Muntenia Region (Euro)

Year	Value	South Muntenia Region							Total Eligible Value	Total Public Value
		Argeș	Călărași	Dâmbovița	Giurgiu	Ialomița	Prahova	Teleorman		
	Eligible	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
2015	**Public**	0	0	0	0	0	0	0	**0**	**0**
	Eligible	0	0	0	0	0	659,646	0		
2016	**Public**	0	0	0	0	0	329,823	0	**659,646**	**329,823**
	Eligible	0	0	0	0	0	941,850	0		
2017	**Public**	0	0	0	0	0	470,925	0	**941,850**	**470,925**
	Eligible	0	0	0	0	0	0	0		
2018	**Public**	0	0	0	0	0	0	0	**0**	**0**
	Eligible	9,748,709	0	6,036,306	67,695	86,823	3,716,559	169,648		
2019	**Public**	5,148,344	0	2,414,522	33,847.5	60,776	1,594,182	118,753	**19,825,740**	**9,370,424.5**
	Eligible	**9,748,709**	**0**	**6,036,306**	**67,695**	**86,823**	**5,318,055**	**169,648**		
Total	**Public**	**5,148,344**	**0**	**2,414,522**	**33,847.5**	**60,776**	**2,394,930**	**118,753**	**21,427,236**	**10,171,172.5**

Source: Own calculation according to the data www.afir.info (02.09.2020) [1].

Table 9. Number of unfunded projects in South Muntenia

		2015		2016		2017		2018		2019		Total	
Argeș	E.V.F.[1]	0		0		0		0		4		**4**	
	I.[2]	0	**0**	0	**0**	0	**0**	0	**0**	0	**4**	**0**	**4**
	W.[3]	0		0		0		0		0		**0**	
Călărași	E.V.F.	0		0		0		0		0		**0**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.	0		0		0		0		0		**0**	
Dâmbovița	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
Giurgiu	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
Ialomița	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
Prahova	E.V.F.	0		0		0		0		4		**4**	
	I.	0	**0**	0	**1**	1	**1**	0	**0**	0	**4**	**1**	**6**
	W.	0		1		0		0		0		**1**	
Teleorman	E.V.F.	0		0		0		0		2		**2**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**2**	**0**	**2**
	W.	0		0		0		0		0		**0**	
Total	E.V.F.	**0**		**0**		**0**		**0**		**13**		**13**	
	I.	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**85**	**1**	**15**
	W.	**0**		**1**		**0**		**0**		**0**		**1**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (02.09.2020) [1].

Table 10. Value of unfunded projects in the South West Oltenia Region (Euro)

Year	Value	South West Oltenia Region					Total Eligible Value	Total Public Value
		Dolj	Gorj	Mehedinți	Olt	Vâlcea		
2015	Eligible	0	0	0	0	0		
	Public	0	0	0	0	0	**0**	**0**
2016	Eligible	0	0	0	0	0		
	Public	0	0	0	0	0	**0**	**0**
2017	Eligible	0	0	0	0	0		
	Public	0	0	0	0	0	**0**	**0**
2018	Eligible	0	0	0	0	0		
	Public	0	0	0	0	0	**0**	**0**
2019	Eligible	345,000	0	0	3,525,769	9,294,692		
	Public	230,000	0	0	2,457,038	3,737,868	**13,165,461**	**6,424,906**
Total	Eligible	**345,000**	**0**	**0**	**3,525,769**	**9,294,692**		
	Public	**230,000**	**0**	**0**	**2,457,038**	**3,737,868**	**13,165,461**	**6,424,906**

Source: Own calculation according to the data www.afir.info (03.09.2020) [1].

Table 11. Number of unfunded projects in South West Oltenia

		2015		2016		2017		2018		2019		Total	
Dolj	E.V.F.[1]	0		0		0		0		4		**4**	
	I.[2]	0	**0**	0	**0**	0	**0**	0	**0**	0	**6**	**0**	**6**
	W.[3]	0		0		0		0		2		**2**	
Gorj	E.V.F.	0		0		0		0		0		**0**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.	0		0		0		0		0		**0**	
Mehedinți	E.V.F.	0		0		0		0		0		**0**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	W.	0		0		0		0		0		**0**	
Olt	E.V.F.	0		0		0		0		2		**2**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**2**	**0**	**2**
	W.	0		0		0		0		0		**0**	
Vâlcea	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	2	**3**	**2**	**3**
	W.	0		0		0		0		0		**0**	
Total	E.V.F.	**0**		**0**		**0**		**0**		**7**		**7**	
	I.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**11**	**2**	**11**
	W.	**0**		**0**		**0**		**0**		**2**		**2**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (03.09.2020) [1].

Table 12. Value of unfunded projects in West Region (Euro)

Year	Value	West Region				Total Eligible Value	Total Public Value
		Arad	Caraș-Severin	Hunedoara	Timiș		
2015	Eligible	0	0	0	0		
	Public	0	0	0	0	**0**	**0**
2016	Eligible	5,000,000	0	0	0		
	Public	2,500,000	0	0	0	**5,000,000**	**2,500,000**
2017	Eligible	0	0	0	0		
	Public	0	0	0	0	**0**	**0**
2018	Eligible	0	0	0	0		
	Public	0	0	0	0	**0**	**0**
2019	Eligible	478,505	94,930	501,607	177,416		
	Public	256,394	66,451	250,803	88,708	**1,252,458**	**662,356**
Total	Eligible	**5,478,505**	**94,930**	**501,607**	**177,416**		
	Public	**2,756,394**	**66,451**	**250,803**	**88,708**	**6,252,458**	**3,162,356**

Source: Own calculation according to the data www.afir.info (03.09.2020) [1].

Table 13. Number of unfunded projects in the West Region

		2015		2016		2017		2018		2019		Total	
Arad	E.V.F.[1]	0		0		0		0		7		**7**	
	I.[2]	0	**0**	0	**1**	0	**0**	0	**0**	0	**7**	**0**	**8**
	W.[3]	0		1		0		0		0		**1**	
Caraș Severin	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**1**
	W.	0		0		0		0		0		**0**	
Hunedoara	E.V.F.	0		0		0		0		6		**6**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**6**
	W.	0		0		0		0		0		**0**	
Timiș	E.V.F.	0		0		0		0		1		**1**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.	0		0		0		0		0		**0**	
Total	E.V.F.	**0**		**0**		**0**		**0**		**15**		**15**	
	I.	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**16**
	W.	**0**		**1**		**0**		**0**		**0**		**1**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (03.09.2020) [1].

In the West Development Region, a total of 16 projects were submitted and unfunded, in the field of processing by Sub-Measure 4.2 of PNDR 2014-2020, of which 15 were eligible without funding and one withdrawn project, with a total eligible value of 6,252,458 euros, and public value of 3,162,356 euros, in the period 2015-2019 (Table 12 and Table 13).

Table 14. Value of unfunded projects in the North West Region (Euro)

Year	Value	North West Region						Total Eligible Value	Total Public Value
		Bihor	Bistrița-Năsăud	Cluj	Maramureș	Satu-Mare	Sălaj		
2015	**Eligible**	**0**	**0**	**0**	**0**	**0**	**0**	0	0
	Public	0	0	0	0	0	0		
2016	**Eligible**	0	0	0	0	0	0	0	0
	Public	0	0	0	0	0	0		
2017	**Eligible**	0	0	0	0	0	0	0	0
	Public	0	0	0	0	0	0		
2018	**Eligible**	0	0	675,315	0	0	0	675,315	270,126
	Public	0	0	270,126	0	0	0		
2019	**Eligible**	0	68,425	3,640,151	57,000	1,502,674	2,121,391	7,389,641	5,424,488
	Public	0	47,897	2,534,360	39,900	762,877	2,039,454		
Total	**Eligible**	**0**	**68,425**	**4,315,466**	**57,000**	**1,502,674**	**2,121,391**	**8,064,956**	**5,694,614**
	Public	**0**	**47,897**	**2,804,486**	**39,900**	**762,877**	**2,039,454**		

Source: Own calculation according to the data www.afir.info (05.09.2020) [1].

Table 15. Number of unfunded projects in the North West

		2015		2016			2017		2018		2019		Total	
Bihor	E.V.F.[1]	0	**0**	0	**0**		0	**0**	0	**0**	0	**0**	**0**	**0**
	I.[2]	0		0			0		0		0		**0**	
	W.[3]	0		0			0		0		0		**0**	
Bistrița Nasaud	E.V.F.	0	**0**	0	**0**		0	**0**	0	**0**	1	**1**	**1**	**1**
	I.	0		0			0		0		0		**0**	
	W.	0		0			0		0		0		**0**	
Cluj	E.V.F.	0	**0**	0	**0**		0	**0**	0	**1**	2	**2**	**2**	**3**
	I.	0		0			0		1		0		**1**	
	W.	0		0			0		0		0		**0**	
Maramureș	E.V.F.	0	**0**	0	**0**		0	**0**	0	**0**	1	**1**	**1**	**1**
	I.	0		0			0		0		0		**0**	
	W.	0		0			0		0		0		**0**	
Satu Mare	E.V.F.	0	**0**	0	**0**		0	**0**	0	**0**	3	**3**	**3**	**3**
	I.	0		0			0		0		0		**0**	
	W.	0		0			0		0		0		**0**	
Sălaj	E.V.F.	0	**0**	0	**0**		0	**0**	0	**0**	3	**4**	**3**	**4**
	I.	0		0			0		0		1		**1**	
	W.	0		0			0		0		0		**0**	
Total	E.V.F.	**0**	**0**	**0**	**0**		**0**	**0**	**0**	**1**	**10**	**11**	**10**	**12**
	I.	**0**		**0**			**0**		**1**		**1**		**2**	
	W.	**0**		**0**			**0**		**0**		**0**		**0**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.

Source: Own calculation according to the data www.afir.info (05.09.2020) [1].

Table 16. The value of unfunded projects in the Center (Euro)

Year	Value	Center Region						Total Eligible Value	Total Public Value
		Alba	Brașov	Covasna	Harghita	Mureș	Sibiu		
2015	**Eligible**	**0**	**0**	**0**	**0**	**0**	**0**	0	0
	Public	0	0	0	0	0	0		
2016	**Eligible**	0	171,780	0	0	0	0	171,780	85,890
	Public	0	85,890	0	0	0	0		
2017	**Eligible**	94,986	0	0	0	0	0	94,986	47,493
	Public	47,493	0	0	0	0	0		
2018	**Eligible**	0	0	0	0	0	0	0	0
	Public	0	0	0	0	0	0		
2019	**Eligible**	2,400,440	3,797,652	0	52,056	3,472,222	0	9,722,370	5,981,403
	Public	1,627,709	2,591,555	0	26,028	1,736,111	0		
Total	**Eligible**	**2,495,426**	**3,969,432**	**0**	**52,056**	**3,472,222**	**0**	**9,989,136**	**6,114,786**
	Public	**1,675,202**	**2,677,445**	**0**	**26,028**	**1,736,111**	**0**		

Source: Own calculation according to the data www.afir.info (05.09.2020) [1].

Table 17. Number of unfunded projects in the Center

		2015		2016		2017		2018		2019		Total	
Alba	E.V.F.[1]	0	**0**	0	**0**	0	**1**	0	**0**	5	**8**	**8**	**9**
	I.[2]	0		0		1		0		3		**4**	
	W.[3]	0		0		0		0		0		**0**	
Brasov	E.V.F.	0	**0**	0	**2**	0	**0**	0	**0**	3	**3**	**3**	**5**
	I.	0		1		0		0		0		**1**	
	W.	0		1		0		0		0		**1**	
Covasna	E.V.F.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	I.	0		0		0		0		0		**0**	
	W.	0		0		0		0		0		**0**	
Harghita	E.V.F.	0	**0**	0	**0**	0	**0**	0	**0**	1	**1**	**1**	**1**
	I.	0		0		0		0		0		**0**	
	W.	0		0		0		0		0		**0**	
Mures	E.V.F.	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	I.	0		0		0		0		1		**0**	
	W.	0		0		0		0		0		**0**	
Sibiu	E.V.F.	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	**0**	**0**
	I.	0		0		0		0		0		**0**	
	W.	0		0		0		0		0		**0**	
Total	E.V.F.	**0**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**9**	**13**	**9**	**16**
	I.	**0**		**1**		**1**		**0**		**4**		**6**	
	W.	**0**		**1**		**0**		**0**		**0**		**1**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.

Source: Own calculation according to the data www.afir.info (05.09.2020) [1].

Table 18. The value of projects in Bucharest - Ilfov

Year	Value	Bucharest	Ilfov	Total Eligible Value	Total Public Value
	Eligible	**0**	**0**		
2015	**Public**	0	0	0	0
	Eligible	0	0		
2016	**Public**	0	0	0	0
	Eligible	0	0		
2017	**Public**	0	0	0	0
	Eligible	0	0		
2018	**Public**	0	0	0	0
	Eligible	1,066,646	297,520		
2019	**Public**	533,323	148,759	1,364,166	682,082
	Eligible	**1,066,646**	**297,520**		
Total	**Public**	**533,323**	**148,759**	**1,364,166**	**682,082**

Source: Own calculation according to the data www.afir.info (10.09.2020).

Table 19. Number of projects in Bucharest Ilfov

		2015		2016		2017		2018		2019		Total	
Bucharest	E.V.F.[1]	0		0		0		0		1		**1**	
	I.[2]	0	**0**	0	**0**	0	**0**	0	**0**	0	**1**	**0**	**1**
	W.[3]	0		0		0		0		0		**0**	
Ilfov	E.V.F.	0		0		0		0		2		**2**	
	I.	0	**0**	0	**0**	0	**0**	0	**0**	0	**3**	**0**	**3**
	W.	0		0		0		0		1		**1**	
Total	E.V.F.	**0**		**0**		**0**		**0**		**3**		**3**	
	I.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**4**
	W.	**0**		**0**		**0**		**0**		**1**		**1**	

[1]eligible without funding; [2]ineligible; [3]withdrawn.
Source: Own calculation according to the data www.afir.info (10.09.2020) [1].

Table 20. Number of consulting companies, number of unfunded projects

Region	County	Number of consulting companies *	Number of unfunded projects
Nord Est	Bacau	273	2
	Botosani	62	1
	Iasi	503	0
	Neamt	181	0
	Suceava	185	3
	Vaslui	80	1
Sud Est	Braila	112	0
	Buzau	199	4
	Constanta	530	3
	Galati	244	4
	Tulcea	70	3
	Vrancea	139	1
Sud Muntenia	Argeș	323	4
	Călărași	67	0
	Dâmbovița	191	1
	Giurgiu	74	1
	Ialomița	67	1
	Prahova	540	6
	Teleorman	72	2
Sud Vest Oltenia	Dolj	344	6
	Gorj	90	0
	Mehedinti	60	0
	Olt	107	2
	Valcea	130	3
Vest	Arad	331	8
	Caraș-Severin	80	1
	Hunedoara	171	6
	Timiș	861	1
Nord-Vest	Bihor	624	0
	Bistrița-Năsăud	129	1
	Cluj	1309	3
	Maramureș	199	1
	Satu-Mare	157	3
	Sălaj	102	4
Centru	Alba	193	9
	Brașov	585	5
	Covasna	80	0
	Harghita	160	1
	Mureș	334	1
	Sibiu	381	0
București Ilfov	București	7729	1
	Ilfov	1190	3
Total		**19258**	**96**

Source: Own calculation.
*https://www.topfirme.com/judet/caen/7022/numar-agenti-economici/(10.09.2020) [1].

There is a correlation coefficient of -0.2705 between the number of consulting firms and the number of unfunded projects, respectively a low inverse dependence between the two aspects. The determination coefficient R2 has the value of 0.0732 for the linear function and the values of 0.33, 0.35. 0.36 and 1 for polynomial functions of degree 2, 3, 4 and 5, respectively. Consequently, there is a correlation between the analyzed factors, but

no mathematical model can be recommended for use (Figure 1).

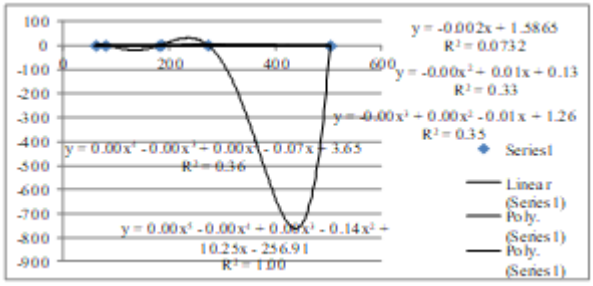

Fig. 1. Correlation between the number of consulting firms and the number of unfunded projects in the North-East Region
Source: Own design.

Between the number of consulting firms and the number of funded projects there is a correlation coefficient of 0.3490, so a direct dependence, reduced between the two aspects. The coefficient of determination R2 has values of 0.12, 0.27, 0.71 and for the linear and polynomial functions of degree 2, 3 and 4, it highlights the connection between the two variables (Figure 2).

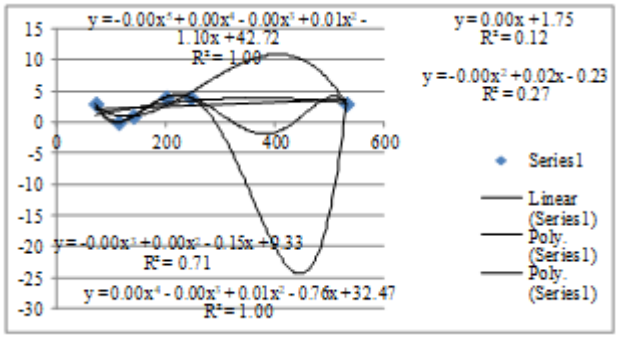

Fig. 2. Correlation between the number of consulting firms and the number of unfunded projects in the South-East Region.
Source: Own design.

Between the number of consulting firms and the number of funded projects there is a correlation coefficient of 0.9338, so a direct, strong dependence between the aspects.
The coefficient of determination R2 has values of 0.872 for the linear function and 0.88, 0.92, 0.95 and 0.98 respectively for the polynomial functions of degree 2, 3, 4 and respectively 5. Starting with the polynomial function of degree 2 an increasing correlation can be considered stronger between the 2 aspects (Figure 3).

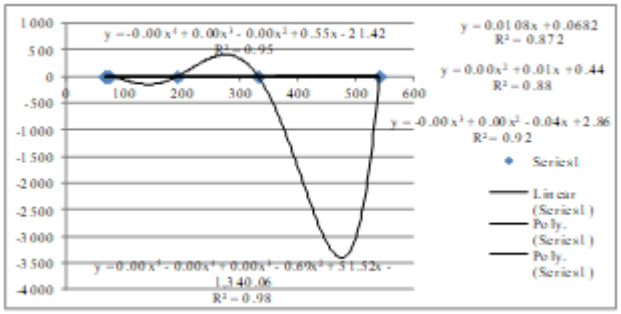

Fig. 3. Correlation between the number of consulting firms and the number of unfunded projects in the South Muntenia Region
Source: Own design.

Between the number of consulting firms and the number of funded projects there is a correlation coefficient of 0.9376, so a dependency direct, strong between the aspects. The determination coefficient R2 has values of 0.8792 for the linear function and 0.9439, 0.9753, respectively 1 for the polynomial functions of degree 2, 3 and 4 respectively. Starting with the polynomial function of degree 2 we can consider an increasingly strong correlation between the 2 aspects (Figure 4).

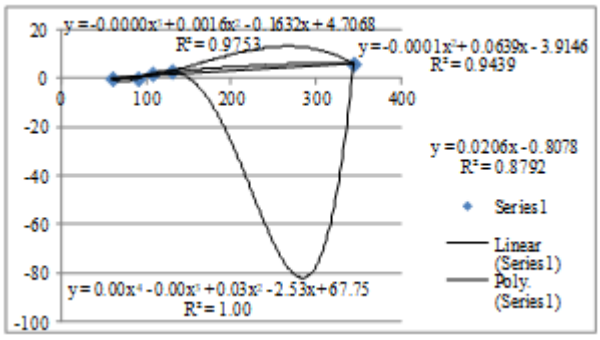

Fig. 4. Correlation between the number of consulting firms and the number of unfunded projects in the South West Oltenia Region
Source: Own design.

Between the number of consulting firms and the number of financed projects there is a correlation coefficient of -0.3102, respectively a strong inverse dependence between the 2 variables. The coefficient of determination R2 has values of 0.0963 for the linear function and 0.9506 respectively 1 for the polynomial functions of degree 2. Starting with the polynomial function of degree 2, an increasingly strong correlation between the 2 aspects can be considered (Figure 5).

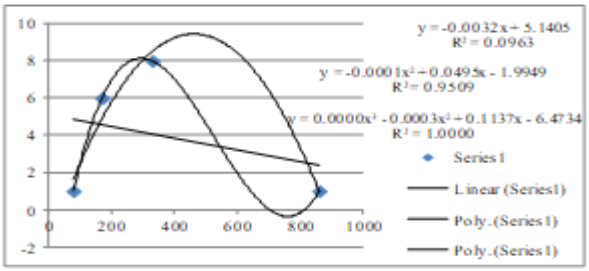

Fig. 5. Correlation between the number of consulting firms and the number of unfunded projects in the Western Region
Source: Own design.

Between the number of consulting firms and the number of funded projects there is a correlation coefficient of 0.0251, so a direct dependence, reduced between the aspects. The coefficient of determination R2 has values of 0.006, 0.5739, 0.6536, 0.6670 and 1 for the linear and polynomial functions of degree 2, 3, 4 and 5 highlight the connection between the two variables (Figure 6).

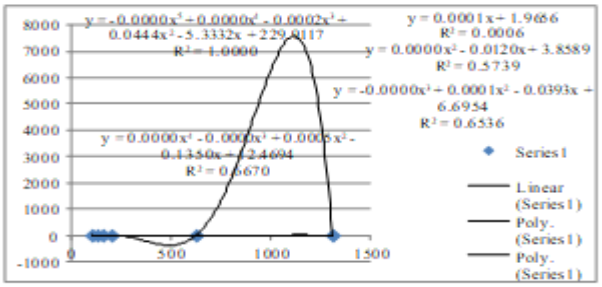

Fig. 6. Correlation between the number of consulting firms and the number of unfunded projects in the North West Region
Source: Own design.

Between the number of consulting firms and the number of funded projects there is a correlation coefficient of 0.1615, so a direct dependence, reduced between the aspects.

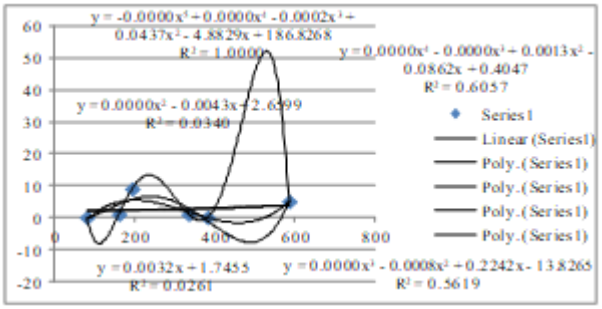

Fig. 7. Correlation between the number of consulting firms and the number of unfunded projects in the Center Region
Source: Own design.

The coefficient of determination R2 has values of 0.0261, 0.0340, 0.5619, 0.6057 and 1 for the linear and polynomial functions of degree 2, 3, 4 and 5 highlight the connection between the two variables (Figure 7).

CONCLUSIONS

In the period 2015-2019, at national level were submitted and unfunded, through Submeasure 4.2 of PNDR 2014-2020, a total of 96 projects, where 73 were eligible without funding, 15 were ineligible and 8 were withdrawn, having the value eligible amount of 76,060,938 euros and the public value of 40,558,548 euros. Most are in the West Region with a number of 16 (eligible value 6,252,458 euros), and the fewest are in the Bucharest Ilfov Region with 4 unfunded projects submitted (eligible value 1,364,166 euros).
From the correlations between the number of consulting firms and the number of unfunded projects, it results that the projects were submitted randomly, independently of the consulting firms from each county of the respective regions.
In the period 2015 - 2019, through sub-measure 4.2 of PNDR 2014-2020, a total of 53 projects were financed, in the field of meat processing capacity development, with a total eligible value of 125,982,731 euros and a total public value of 62,696,276 euros.

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ADOPTION CHALLENGES OF INTEGRATED PEST MANAGEMENT (IPM) TECHNOLOGY AND COCOA PRODUCTION IN CROSS RIVER STATE, NIGERIA: THE ELUCIDATION AND WAY FORWARD

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Abstract

Efforts to mitigate the effect of pest had been through the use of chemicals, which often leave residues in cocoa beans. The International Institute of Tropical Agriculture (IITA) in collaboration with Sustainable Tree Crop Programme (STCP) promoted Integrated Pest Management (IPM) in Nigeria. There is dearth of information on the challenges confronting cocoa farmers to use IPM hence a need for investigation. The study utilised a three-stage sampling procedure to select respondents from Cross River state. Trained farmers (10%) were selected using a systematic random sampling to obtain a total sample of 271. Field data were collected with Interview schedule on socio-economic, enterprise characteristics, and challenges faced by respondents in IPM adoption. Analysis was done with descriptive and inferential statistics. Pearson Product Moment Correlation (PPMC) was used to test hypothesis. The male respondents were 83.4% while the female were 16.6%. Very few (2.6%) of the respondents produced more than 4,000 kg of cocoa beans per annum. Age of farm with a weighed score of 244.5 was rated as the highest severe factor affecting IPM adoption. Negative relationship exists between challenges and adoption behaviour which was significant (r=-0.236, p=0.000). Challenges had high effect on adoption of IPM by cocoa farmers and yield was low. There is need for farm rehabilitation due to old age to boost yield and sustain cocoa production in the study area.

Key words**:** *cocoa production, insect pest, farmers, sustainable, yield*

INTRODUCTION

Cocoa is native to the Amazon basin and other tropical areas of South and Central America. Cocoa bean is used to produce chocolate and cocoa powder [11]. Apart from serving as source of livelihood to smallholder farmers, it plays tremendous role in the health sector. Lots of discoveries through researches reported that the consumption of cocoa products reduces fatigue, prevents malaria, diabetes and hypertension among others [6].

Globally, cocoa production increased from 4,651 million metric tonnes in 2017/2018 to 4,745 million metric tonnes in 2019 with a production forecast of 4,824 million metric tonnes in 2020 [12] (Table 1). However, there is no linear change in production but there was fluctuation in various patterns among different regions. Africa has remained the main cocoa producer with West Africa: Cote d' Ivoire, Ghana, Nigeria and Cameroon, together account for about two-thirds of world cocoa production. Other notable producers outside West Africa are Indonesia, Brazil, Malaysia, Ecuador, and Papua New Guinea [10].

In the 70s, Nigeria used to be the second leading cocoa producer in the world but due to varied factors, such as farmers' inadequate fund to acquire inputs, ageing cocoa farmers and ageing cocoa trees which occupy a large proportion of established plantations led to decrease in cocoa production [15]. In Nigeria, the decline in cocoa production is mainly due to the incidences of insect pests and diseases along with other factors [7]. The major insect pests of cocoa are brown mirids; *Sahlbergella singularis and* black mirids; *Distantiella theobroma.* The damage caused by the aforementioned pests is up to an estimated loss of 100,000 tonnes. The main disease of cocoa is the 'Black pod' caused by *Phytophthora palmivora* and *Phytophthora megakarya* which resulted to 100% total loss

in some cocoa producing countries and in Nigeria with a loss of 75% [7].

Table 1. Production of cocoa beans (thousand tonnes)

	2017/18		Estimates		Forecast	
			2018/19		2019/20	
Africa	**3,496**	**75.2%**	**3,624**	**76.4%**	**3,693**	**76.6%**
Cameroon	250		280		290	
Côte d'Ivoire	1.964		2,154		2,180	
Ghana	905		812		850	
Nigeria	250		250		250	
Others	127		128		123	
America	**836**	**18.0%**	**838**	**17.7%**	**853**	**17.7%**
Brazil	204		176		190	
Ecuador	287		322		325	
Others	345		340		338	
Asia & Oceania	**319**	**6.9%**	**283**	**6.0%**	**277**	**5.7%**
Indonesia	240		200		200	
Papua New Guinea	36		40		35	
Others	43		43		42	
World total	**4,651**	**100.0%**	**4,745**	**100.0%**	**4,824**	**100.0%**

Source: ICCO, 2019/20.

There are about 1,500 different species of insect pests attacking cocoa; only less than two percent are of genuine economic importance [16]. The brown cocoa mirid, *Sahlbergella singularis*, Haglund (Hemiptera: Miridae) could derease yield as low as 30% minimum per season. So far in Nigeria, there is no organic cocoa, as synthetic pesticides spray application must be adopted to keep plantations productive. However, with the idea of IPM, the number of spray applications has been further reduced [14].

The application of IPM helps to monitor and target destructive pests and various cultural field operations including sanitation, early harvest and disease symptoms identification. The use of IPM leads to improved and safe yields from farmers' field. In order to achieve this level, some costs will be involved on the part of producers and consumers. IPM goal seeks to use research in investigating the right methodology that will assist farmers minimise regular use of pesticides. IPM practices protects the environment, promotes crop quality and profit potentials of stakeholders.

Research problem statement on IPM

Globally, insects pests and diseases cause economic loses in damages to crops such as cocoa every year [4]. Nigerian cocoa farmers use a lot of agro-chemicals (insecticides, herbicides and fungicides) to increase production, but they often do not consider the negative impacts of this on the cocoa beans and the environment. Environmental protection is now a serious problem.

This study focused on the various factors, which influence the decision of Cocoa farmers to adopt IPM practices. The research paid special attention to the implementation process of IPM and its adoption by a group of farmers whose need for the program was considered important and possibly as a test case for comparable crop growers in a vital Nigerian sector with export capability. IPM has passed through a period of rapid expansion with the development of a whole

host of agents and measures available for pest control. In recent years, there seems to have been a move towards consolidation of principles, approaches and practices in IPM. Part of this process of consolidation has focused attention on the details of individual control measures, intervention of CRIN-institutional control measures such as the Good Agricultural Practices on pesticides use and more on practical requirements of moving the ideas and the techniques to the field, and dealing with the problems of IPM implementation.

Adoption of technological innovations in agriculture has attracted much attention in literature for decades, since technologies have long been perceived as the key to rapid agricultural growth in many countries. The majority of the population in Nigeria derive their livelihood from agricultural production, and new technology offers opportunities to increase production substantially.

The study of challenges facing IPM adoption on the part of farmers is crucial to developing a practical guide to the principles, approaches and techniques involved in implementing an IPM program. Such a guide would emphasize the need for, and the means of good management, and the integration of factors necessary to produce a complete IPM program to fit the needs of farmers and their farming practices.

The general objective of the study is to assess the challenges of adoption of integrated pest management among trained cocoa farmers in Cross River State of Nigeria.

Specifically, the study addressed the following objectives:

(i) Describe the socio-economic characteristics of the respondents.

(ii) Identify the enterprise characteristics of the respondents.

(iii) Examine the challenges experienced by the respondents in adopting IPM.

(iv) Investigate the IPM adoption behaviour of the trained cocoa farmers.

Statement of hypothesis

There is no significant relationship between challenges and adoption behaviour of the trained cocoa farmers.

MATERIALS AND METHODS

A three-stage sampling procedure was used to select respondents during data collection. The study was conducted in Cross River State. It is a Tropical Rainforest zone out of three agro-ecological zones where cocoa production is prominent in Nigeria and a training on IPM was done by IITA/STCP for 2,714 farmers who were selected purposively. The next stage was to select 10% respondents from the state using systematic random sampling technique to obtain a total 271. Field data was collected with interview schedule on socio-economic, enterprise characteristics, and challenges experienced by respondents in adopting IPM.

Data collected were analysed with descriptive and inferential statistics. Pearson Product Moment Correlation (PPMC) was used to test the hypothesis of the study.

Data and description of variables

The following independent variables were used in the study: sex, age, farming experience, yield, farm size and challenges to IPM adoption while dependent variable is adoption behaviour.

Table 2. Description of explanatory variables

Explanatory variables	Type of variables	Description
Sex	Dummy	Male=1 Female=2
Age	Continuous	Actual age
Farming experience	Continuous	Actual years of experience
Yield	Continuous	Actual kg per bag (64kg bag)
Farm size	Continuous	Actual size in hectares
Challenges to IPM adoption	Categorical	Very severe=2, Severe=1, Not severe=0

Source: Field survey, 2015.

RESULTS AND DISCUSSIONS

Sex of Respondents

Result in Table 3 revealed that 83.4% were males while 16.6% were females. This is an indication that more males practiced IPM technology than the females. This finding is in line with [2] who opined that rural women farmers are constrained by social and institutional factors including access to inputs, modern technologies, education and land ownership.

These factors limit rural women's ability to adopt improved agricultural technologies which affects their contributions to agricultural production.

Age of respondents

Table 3 reveals that few of the respondents (29.5%) were between the ages of 21 and 40 years, (8.5%) 61 and 80 while majority (62.0%) were between 41 and 60 years which indicates that most of them are still in their prime age and would be ready to learn and apply IPM techniques on their farms.

Youths are more zealous to acquire information than older farmers and are likely to take risk in implementing new technologies utilization.

Older farmers tend to adhere to their conservative ways of farming and are hardly convinced to adopt newly introduced technologies [1] posited that younger farmers have much more energy and are more likely to invest in long term production.

Farming experience of the respondents

Respondents' farming experience as shown in Table 3 reveals that some (46.9%) had between 11 and 20 years of experience. Adoption of IPM technology could be affected moderately due to the fact that older farmers with long years of experience want to avoid risk and are not likely to be flexible than younger farmers and thus have a lesser likelihood of information utilization. According to [5] the relationship between adoption of agricultural technologies and farming experience remains mixed.

Table 3. Percentage distribution of respondents' according to socio-economic characteristics

Socio-economic variables	(n=271) Frequency	Percentage
Sex		
Male	226	83.4
Female	45	16.6
Age		
21-40	80	29.5
41-60	168	62.0
61-80	23	8.5
Farming experience		
1-10	66	24.3
11-20	127	46.9
21-30	62	22.9
31-40	13	4.8
41-50	3	1.1

Source: Field survey, 2015.

Respondents' enterprise characteristics

Respondents' yield

The result in Fig. 1 shows that majority of the farmers are small scale farmers as 61.9% of the respondents produced less than 1,000kg in the last one year.

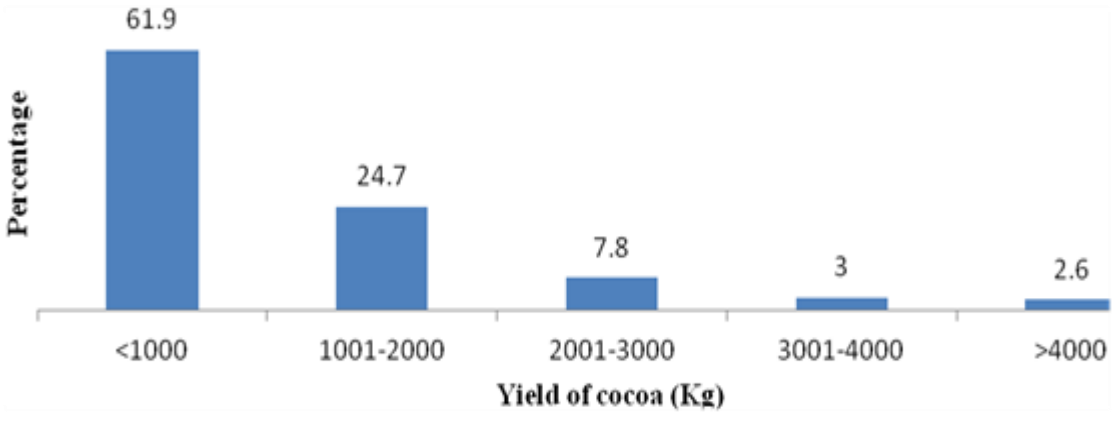

Fig. 1. Percentage distribution of respondents according to yield
Source: Field survey, 2015

The result also reveals that 24.7% produced between 1,001-2,000 kg/annum, 7.8% between 2,001-3,000 kg/annum, 3.0% between 3,001-4,000 kg/annum while very few (2.6%) produced more than 4,000 kg/annum.

The low yield of cocoa could have been affected by the level of IPM adoption by the respondents. This result is corroborated by [8] that production of cocoa farm is low due to inappropriate use of chemical, farm age and age of trees.

Size of farm

Fig. 2 shows that most of the respondents (93.0%) own farm size of between 1 and 5 ha, 5.9% had 6 and 10 ha while only 1.1% had above 10 ha with a mean value $\bar{x}$=2.97. This implies that majority of the farmers own small farms, which could have effect on IPM adoption. The farm size owned by the cocoa farmers showed that most of them were smallholders growing cocoa on less than 10 hectares of farmland. This may be attributed to land tenure system in the country which favours land fragmentation through inheritance. A farmer having large cocoa farms could harvest more cocoa which may translate into higher income for the purchase of the relevant inputs to implement the technologies. Cocoa farm size could have a positive effect on adoption due to availability of large expanse of land for cocoa cultivation resulting to increase in cocoa output and income would increase, enhancing the probability of technology adoption. This finding is similar to an earlier report by [14], who posited that 75.5% of the cocoa farmers in Nigeria were either small or medium scale farmers. Also, [3] observed that farmers own an average farm size of six hectares that are scattered in different locations in the area.

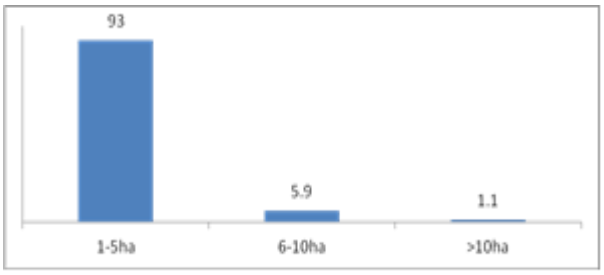

Fig. 2. Percentage distribution of respondents' according to farm size
Source: Field survey, 2015.

Respondents' challenges to IPM adoption

Table 4 shows the rating of challenges experienced by respondents IPM adoption. Majority of the respondents rated age of farm (244.5) as the highest severe factor affecting IPM adoption in the State. [13] reported that age of farmers, access to capital and farming experience could affect farming business.

Other challenges such as inadequate credit facilities (228.8), inadequate labour and extension services were also severe constraints which could be as a result of rural urban drift of the youth in search for white collar job and lack of support for extension services by the government. Increase in government support for extension services would create opportunities for farmers' access to credit facilities for cocoa production. Encouraging farm mechanization may be an option to overcome the problem of inadequate labour.

Table 4. Percentage distribution of respondents according to challenges in IPM adoption

S/N	Variables	Very severe		Severe		Not severe		Weighted score
		Freq	%	Freq	%	Freq	%	
1	Age of farm	148	54.6	50	18.5	73	26.9	244.5
2	Off farm activities	93	34.3	63	23.2	115	42.4	191.7
3	Inaccessibility to market information	64	23.6	81	29.9	126	46.5	177.1
4	Inadequate labour	93	34.3	56	20.7	122	45.0	189.3
5	Inadequate credit facilities	146	53.9	57	21.0	68	25.1	228.8
6	Inadequate contact with extension agents	115	42.4	56	20.7	100	36.9	205.5
7	Non membership of cooperative	133	49.1	49	18.1	89	32.8	216.3

Source: Field survey, 2015.

Hypothesis 1: The result reveals that negative relationship exist between constraints and adoption behaviour and was significant (r=-0.236, p=0.000) (Table 5). This shows that the higher the challenges the lesser adoption behaviour of the respondents. Despite these constraints the farmers' field schools are today reputed as places where the farmers can gain greater mastery of integrated control methods which could ameliorate the constraints being faced by farmers. According to [9] farmers with higher education have more tendency for adoption of IPM technology which is widely considered as a complex technology involving various methods including arriving at Economic Threshold level (ETL).

Table 5. Correlation of challenges and adoption behaviour

	Cross Rivers State		
Variable	**r**	**P**	Decision
Challenges	-0.236**	0.000	Significant

Source: Field survey, 2015.

CONCLUSIONS

In conclusion, most of the farmers were in their prime age and ready to learn and apply the skill of IPM techniques in their farms. Most of the small scale farmers were males with long years of farming.

Age of farm and inadequate credit facilities were rated as the most severe challenges while the average yield of the farmers was low.

Government should encourage youths involvement in cocoa production to enhance sustainability.

The farmers size of farm is small they need to be supported with soft loan to enhance increase in their hectare of cocoa farms. Yield improvement programme such as rehabilitation programme in agronomic practices should be initiated in order to increase yield of farmers. Women should be encouraged to grow cocoa and they should be given access to farm land for tree crops.

There is need to examine the factors that pose challenges to adopt IPM practices in order to design and implement proper policy measures to promote the adoption of IPM. This will lead to a paradigm shift from the primitive natural control practices previously used by the farmers.

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EFFECTS OF POLLUTION AND CLIMATE CHANGE IN TIMIȘOARA MUNICIPALITY AND ITS PERIURBAN AREA

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Abstract

The preliminary determination of the article is to investigate the effects of pollution and climate change. In this regard, the authors want to highlight that this real and critical issue must take seriously because each of us contributes to pollution and climate change, which is very real, and which will be aggravated by not taking action. Global warming currently involves two major problems for humanity: on the one hand, the need to dramatically diminish greenhouse gas emissions to stabilize the concentration of these gases in the atmosphere to prevent anthropogenic influence on the climate system and enable ecosystems, contrastingly the need to accommodate to the consequence of climate change, given that these effects are already visible and inevitable due to the activity of the climate system, regardless of the outcome of emission reduction actions. The main problem with pollution is air quality, which has fallen considerably, especially in urban areas. The" World Health Organization" approximates, more than seven million people die each year from air pollution. The authors also conducted a case study on the local effects of climate change - Timişoara and its peri-urban area. Therefore, we concluded that if Timişoara is successful in reducing greenhouse gas emissions, this will create a test market for Romania's ecological technologies and help the environmental industries to locate in Timişoara.

Key words**:** *pollution, climate change, effects, Timisoara, Romania*

INTRODUCTION

Environmental pollution is one of the most disputed contemporaneity issues and the first-rate one for society's management [5].

Pollution is the process of contaminating the environment with materials that mess with human health, gratification, or the natural operation of ecosystems (living organisms and the environment in which they live). Although sometimes environmental pollution is a result of natural causes, most pollutants come from human activities [5, 10].

In the past, when low population density use, almost exclusively, natural products did not differentiate much human life from the simple way of life and did not produce so much residue.

With significant scientific advances, the quantity furthermore, their nature has changed fundamentally. In recent decades, the process of degradation of environmental factors on our planet has evolved more and more worryingly, with the number of pollutants reaching figures beyond imagination [5].

Removing pollution is a problem of correcting the errors that cause it because pollution is the main factor of climate change.

The term **climate** generally defines the average profile of weather conditions in a given area determined over several years. Climatic conditions depend on changes in the ecosphere, with the Earth's energy balance (radiation) playing an important role. In the last 150 years, anthropogenic activity has played a unique role in changing the Earth's climate, participating directly in this change through greenhouse gas emissions [1].

Climate change is not unusual, as the planet undergoes cycles of geological transformation over long periods, requiring adaptations and modifications in nature and its processes.

However, in recent decades, with the intensification of human industrial activity, which has led to a rapid increase in pollution, these climate changes are accelerating and threatening to upset the balance that ensures our existence on Earth [12].

Climate change is a warning threat to the environment facing humanity today.

By climate change, we mean phenomena that go beyond the ordinary pattern and become dangerous for our lives as humans and other living things on the planet [13, 10].

The amount of carbon dioxide in the atmosphere has increased by over 40% compared to the pre-industrial era. The amount of methane has doubled due to human activities, contributing to the greenhouse effect's intensification.

Observations indicate increases in global average water and ocean temperatures, widespread melting of snow and ice, and average global sea-level rise [7].

In a high-emission scenario (an increase in global temperature of 3.2°C - 5.4°C between 2081-2100), coastal areas could suffer economic losses of around EUR 39 billion per year by 2050 and up to EUR 960 billion per year by the end of the century [19].

According to statistics, at the national level, average temperatures will increase in the next 30 years by 1.5 - 2.5°C, and by the end of the century, by 2.5 - 5°C [18].

An increase of up to 6°C is forecast for the south of the country. Practically, at the end of the century, the city of Bucharest would reach the current average temperature of the city of Thessaloniki, located 400 kilometers further south [11].

Timișoara is the municipality of residence of Timiș County, Banat, Romania. In western Romania, close to borders with Hungary and Serbia, on the river's banks, Bega. It is an important industrial, commercial, medical, financial, and university center for Romania. Timișoara is an important industrial, commercial, medical, economic, and university center for Romania. The locality's name comes from that of the Timiș River, combined with the Hungarian noun vár, "fortress," meaning the Timiș Fortress. Located on the Bega River, the city is considered the capital of the historic Banat region [18].

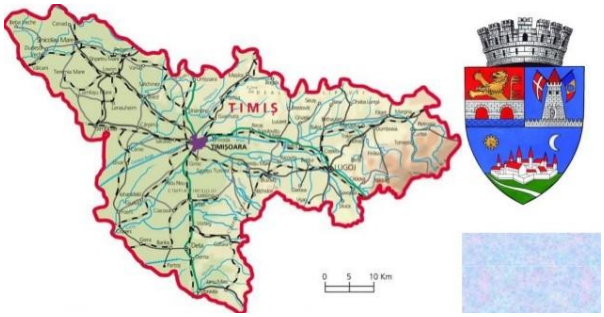

Fig. 1. Timiș County, Timișoara municipality
Source: www.infoimobiliar.ro, Accessed on 12.07.2020 [17].

In 2001, the introduction of the "peri-urban territory" term in the specialized legislation. In Law 350 on spatial planning and urbanism, defined in Annex no. 2 as "the surface around municipalities and cities, delimited by specialized studies, within which alliance relations are born in the economic field, of infrastructure, trips for work, insurance with green spaces and leisure, insurance with agri-food products" [4].

The study of the effects of pollution and climate change is critical, because only in this way can we adapt to these changes and reduce the pollution that contributes to these climate changes.

MATERIALS AND METHODS

The reason for choosing this topic comes from the unique features of this problem in everyday life and our lives' primary importance.

The paper's primary purpose is to emphasize the importance of climate change and the severity of environmental pollution in the city of Timișoara, as well as in the suburbs. In this sense, to follow the purpose of the work, the authors followed several steps:

-First of all, the authors follow the data collection stage,

-Then, the data is subjected to fair analysis and interpretation

-And last but not least, the set of data interpretation.

The main conclusions were expressed in the paper to strengthen the object proposed for research.

RESULTS AND DISCUSSIONS

Pollution is the contamination of the environment with substances generically called pollutants, which harm the environment, human health, or natural goods. The followings are significant environmental pollutants:
-Industria
-Agriculture
-Transporturile
-Human settlements
The **industry** is the primary source of environmental pollution. Industrial pollution of the environment occurs mainly through the breakdown of two essential elements of the natural environment: air and water.
The electricity-producing industry is responsible for the air pollution through the gases emitted from the thermal power plants and other industries: ferrous and non-ferrous metallurgy, chemical and the construction materials production industry.
Agricultural pollution occurs due to the introduction into the soil of substances necessary to increase agricultural production.
Agricultural pollution is mainly due to the overuse of chemical fertilizers, pesticides, industrialization, and excessive agriculture chemization.
Soil, the main factor and production in agriculture, has seen a decline in productivity due to its overexploitation with pesticides and chemical fertilizers. It is observed by the decrease of biocenosis activity, of humus content, of the change in availability of macroelements [9, 14].
Transport is another significant pollutant of the environment.
Land transport produces the most effects in this regard, through its influence on human settlements, cropland, and atmospheric air. Human settlements fall into the category of environmental pollutants.
Urbanization, determined by industrialization, has made cities the engines of the development of a region. The population is continually growing due to new jobs and many facilities, compared to rural areas [9].
Sources of pollution in Timisoara and the suburbs:
-industrial means, located on industrial platforms;
-inhabited areas, densely populated;
-circulation of vehicles;
-construction sites;
-electrothermal power plants;
- unauthorized combustion, in the open air, of some - household waste;
-worn tires, plastics;
- defective sanitation of the public space;
- improper disposal of industrial waste and household waste [15, 19].
Health effects of pollutants
A study by the IHME (Institute for Health Metrics and Evaluation) shows that the number of premature deaths attributed to air pollution has reached 5.5 million per year. More people die from polluted air than from malnutrition, obesity, alcoholism, drugs, or sexually transmitted diseases. Furthermore, World Health Organization estimates are even more pessimistic: methane, ozone, and "black carbon" kill more than 7 million people a year - which is why air pollution ranks 4th on the list of factors at maximum risk premature death [8].
The primary pollutants resulting from human activity and how they affect our health:
Carbon dioxide (CO2)
In principle, carbon dioxide does not directly affect human health unless excessively large amounts in the air we breathe.
Carbon monoxide (CO)
Toxic gas appears when the combustion process is incomplete. It dramatically reduces the blood's ability to carry oxygen, especially to the heart and brain. It provokes heart disease, myocardial ischemia, and chest pain [4, 6].
Sulfur dioxide (SO2)
It affects the respiratory system and lungs. Aggravates asthma and chronic bronchitis but also causes eye irritation. It leads to heart disease and even ischemic strokes. Sulfur

dioxide is responsible for acid rain and water pollution.

Volatile organic compounds (VOC)

Aromatic hydrocarbons cause various irritations and affect the respiratory system. They are also responsible for decreased neuromotor functions (late response to visual stimuli, poor memory [6].

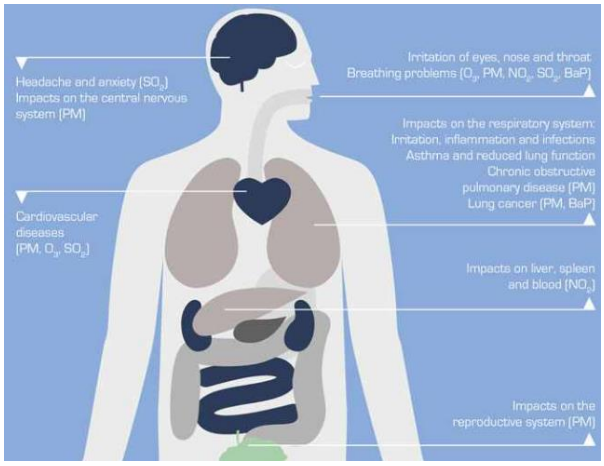

Fig. 2. The effects of pollutants on the body
Source: Ecological information and business platform [16].

Nitrogen oxides (NOX)

It promotes the appearance and development of asthma, as well as chronic obstructive pulmonary disease. It affects the normal development of the lung system in children.

Ammonia (NHX)

It causes respiratory, skin, and eye irritations and promotes the appearance of fine particles.

Fine particles (PM2.5)

With a diameter of 2.5 microns (30 times less than the thickness of a hair!), these particles are formed both by burning fossil fuels and by chemical reactions in the atmosphere between compounds such as NOX, SO2, and volatile organic compounds.

Extremely small, these particles reach the lungs and penetrate the tissues, entering the blood vessels.

Although skeptics of climate change continue to fundamentally criticize the results of the international scientific process of climate change, a significant consensus on climate change has grown in recent years among scientists and politicians [4, 6].

Projections of monthly average air temperature changes at the 94 weather stations for the period 2001-2030 made using statistical downscaling models applied to the three global climate models show the same air temperature rise signal, with some signal strength differences.

The average of all three models' projections is the optimal value (the most probable) [6].

Air temperature

For the period 2001-2030, compared to 1961-1990, a higher average monthly air temperature increase projected in November-December and the warm period of the year (May-September), of about one °C, slightly higher values (up to 1.4°C - 1.5°C,) being in the mountains, the south, and west of the country. In the cold, wintry season of the year, the heating does not exceed one °C (Figure 3). [3].

At the whole country's level, the average annual warming is between 0.7°C and 1.1°C , the highest values being in the mountainous area [1].

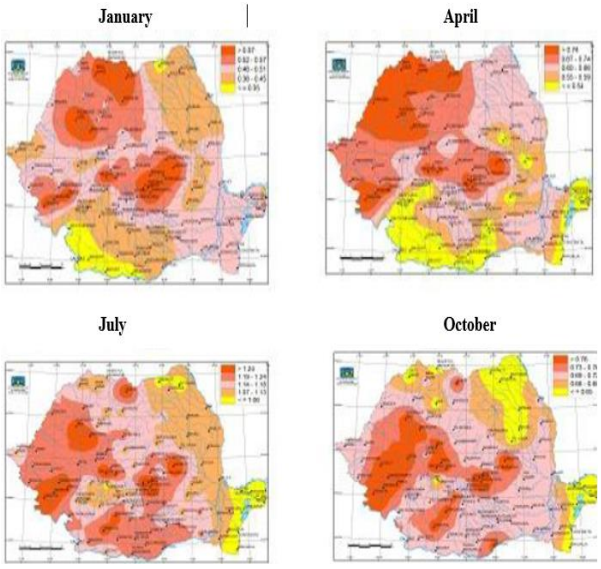

Fig. 3. Changes in the average monthly air temperature at 94 stations in Romania, for the period 2001-2030
Source: Climate change scenarios in Romania for the period 2001 – 2030 [2].

The climate in Timisoara

Like all of Romania, Timisoara is part of the moderate continental temperate climate, characteristic of the Pannonian Depression's southeastern region, with some sub-Mediterranean influences. Its general features distinguish by the diversity and irregularity of atmospheric processes [3].

Case Study

Local effects of climate change - Timisoara, and its peri-urban area

The studies carried out in this respect highlighted the following problems that appeared in the researched area:

-The appearance and expansion of some Urban Heat Islands
-Damage to facades, roofs, structural elements, resistance structures of buildings
-Increasing the number of air conditioners
-Increased energy consumption
-Decrease in gas pressure
-Acute aggravation of chronic diseases
-The appearance of vectors for infectious diseases
-Deformation/cracking of streets and sidewalks (especially at sewers)
-Forested and broken trees;
-Cable collapse/breakage;
-Interruption of power supply
-Partial or total drying of trees
-Change in energy cost (price increase) [13]
-Dust pollution
-Decrease in agricultural production
-Deaths for long periods, which can favor the appearance of uncontrolled fires
-Massive floods
-Changing the quality and quantity of water
-Impact associated with local fauna and flora
-Impact on the health of the population (for rainy periods, the appearance of mosquitoes carrying various infectious diseases, more and more frequent asthma diseases, and lung diseases due to sudden temperature changes) [3].

CONCLUSIONS

If we pollute the air we breathe, we voluntarily destroy our health. Nevertheless, no matter how logical the pollution = problems equation may seem, modern society continues to pollute through inertia through intensive human activity. The main "occupation" is the burning of fossil fuels: oil, coal, and natural gas. But also, intensive exploitation of wood mass - in the conditions in which the forests represent the primary source of oxygen production on the planet [7].

Timisoara cannot prevent global climate change but can set a good example:

If Timisoara is successful in reducing greenhouse gas emissions, this will create a test market for green technologies in Romania and will help green industries to locate in Timisoara. Reducing CO2 in Timisoara will also help reduce fine dust, NOx, CO, and soot particles. Improving and expanding public transport of electric mobility and expanding green spaces will reduce Timisoara's noise level. The elimination of the carbon content from Timișoara will produce positive effects for the health of the citizens of the municipality [4].

Some of the available discount options are everyday opportunities, which can generate multiple social and environmental benefits.

Most global warming reduction solutions are related to:

- the most cost-effective use of energy resources and energy of any kind, in general, for example, in construction, industry, household appliances
- increasing the use of renewable energy (solar, wind, biomass) and combined heat and power generation facilities
- improving public transport, infrastructure and promoting non-motorized means of transport
- reduction of carbon dioxide emissions generated by new cars
- reduction of industrial emissions
- improving the technologies used
- reduction of emissions from agriculture
- green procurement
-reducing deforestation, promoting sustainable forest management
- planting green spaces
- planting new forests
- reduction of emissions from landfills
- waste recycling
- reduction of water consumption for domestic and industrial use

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FINANCIAL RISKS OF AGRO-INDUSTRIAL COMPLEX ENTERPRISES IN THE CONDITIONS OF A PANDEMIC AND IMPLEMENTATION OF ANTI-CRISIS MEASURES FOR THEIR LEVELING

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Abstract

The purpose of the article is to substantiate the main risks for agro-industrial enterprises in a pandemic and to form solutions for their optimization. The article analyzes the users of the agricultural sector according to the distribution of organizational and legal forms in relation to the use of financial and credit resources during the pandemic and before its onset. The experience of developed countries is used to analyze the financial performance of the credit system in Ukraine. The influence of public authorities and subjects of the banking system of Ukraine in the formation of anti-crisis measures to support agricultural enterprises is considered. The algorithm of the state credit program "Affordable loans 5-7-9%" has been developed and its shortcomings have been improved. A system of anti-crisis measures has been developed to eliminate possible risk situations for the agro-industrial complex of Ukraine during the global pandemic caused by the COVID-19 virus.

Key words**:** *agro-industrial complex, anti-crisis management, credit system, business environment, COVID-19, risk management, state support for cheaper loans*

INTRODUCTION

As for today, the pandemic caused by the COVID-19 virus has led to crises around the world. The decline in economic indicators in Ukraine has caused a global economic crisis, which is felt in all sectors of the economy without exception. Significant negative impact is observed in the enterprises of the agro-industrial complex of Ukraine, which gradually lose their solvency and become insolvent in general. As agricultural enterprises are particularly important for food security, the risks to their activities must therefore be kept to a minimum. There is also a need for a clear program to bring agricultural enterprises out of the crisis during the pandemic and to improve risk management in the agricultural sector.

MATERIALS AND METHODS

The theoretical and methodological basis of the study is the dialectical method of cognition of objective reality. The classical provisions of economic theory and conceptual principles are also considered, which are clearly expressed in the works of domestic and foreign scientists on the theory of crisis phenomena and the effectiveness of crisis management. The study uses the following basic general scientific methods: analysis and synthesis (to assess the parameters and patterns of crisis management), induction and deduction (in the process of learning and forecasting the development of crisis management in agricultural enterprises), terminological approach to justify the term "crisis", "bankruptcy", "system", "management", "crisis management", abstract-logical (for theoretical generalizations of the results of scientific research and the formation of conclusions and proposals). Anti-crisis management of the enterprise is a system of pre-crisis (preventive) measures aimed at diagnosing the threat of bankruptcy and the development and imple-

mentation of actions to eliminate the negative consequences of the financial crisis [10].The practical study of risks in the agro-industrial complex is based on a survey of respondents (representatives of the agricultural sector in terms of enterprises in the L'viv region, divided into organizational and legal forms).

RESULTS AND DISCUSSIONS

Today, the country's agriculture is a significant part of the domestic economy. From the experience of observation, we can say with confidence that the agro-industrial complex of Ukraine survived the crisis and adapted to the market environment.

In conditions of macroeconomic instability and global uncertainty - the agricultural sector is the most defined among other sectors of the economy. The main task of public administration in the crisis is to prevent the economic downturn and provide assistance to agricultural producers by reducing the cost of credit. According to the Ministry of economic development, trade and agriculture of Ukraine, the state budget for 2020 fixes an amount of UAH 4.2 billion to support the agro-industrial sector, of which UAH 1.2 billion is expected to be allocated to the loan reduction program. In particular, the program will include:

- compensation of interest on loans for agricultural enterprises with an annual turnover of up to UAH 20 million. This area will have no restrictions on the intended use of loans. The state will compensate up to 1.5 of the NBU discount rate, the final cost of the loan for the farmer will not exceed 5%;
- compensation of interest on loans raised for the development of animal husbandry, including "niche" areas - sheep, goats, beekeeping, animal husbandry and others. It is assumed that the amount of loans should not exceed UAH 10-15 million;
- compensation of interest on loans raised for the purchase of agricultural land. The direction will apply to farmers of various forms of management. The amount of interest compensation will not exceed UAH 5 million per year [7].

It should be noted that today there are 42 authorized banks in Ukraine, through which the state support program for agricultural producers is implemented.

However, the support of banks by the regulator of cases of possible outflows and resource volatility also remains relevant today [1].

In Ukraine, the portfolio of banks is 40-50% of the agricultural sector. A similar figure in other developed countries is no more than 10%, which indicates that Ukraine remains a third world country that exports raw materials, rather than engaged in deep processing [3].

As of 2020, there are 35-40 thousand business units engaged in agriculture in Ukraine, while in Poland this figure is 800 thousand, which indicates insufficient funding from the state and lack of access to cheap credit resources of European banks.

The impact of the spread of the pandemic has affected the deterioration of the discipline of repayment of loans by agricultural producers within 5%.

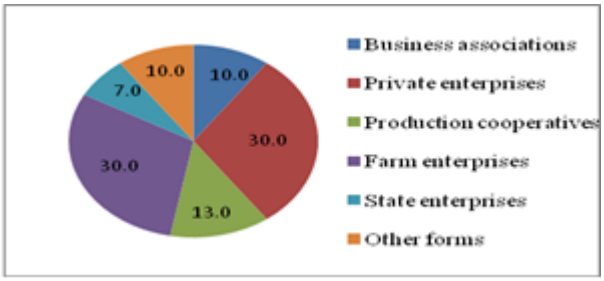

Fig. 1. Analysis of agricultural enterprises of L'viv region in terms of organizational and legal forms that use credit resources provided by state programs before the quarantine,%

Source: calculated by the authors in accordance with a survey of respondents (financial departments), which represent all organizational and legal forms of agricultural enterprises in the L'viv region.

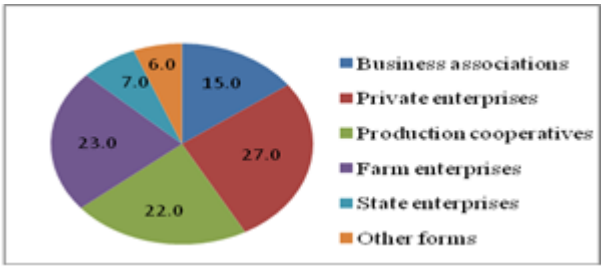

Fig. 2. Analysis of agricultural enterprises of L'viv region in terms of organizational and legal forms that use credit resources provided by state programs during quarantine,%

Source: calculated by the authors in accordance with a

survey of respondents (financial departments), which represent all organizational and legal forms of agricultural enterprises in the L'viv region.

Thus, analyzing the data in Figure 1 and 2, we can say that changes in demand for credit resources during quarantine have increased significantly in production cooperatives, primarily due to the development of livestock and agricultural processing.

It should be noted that currently agriculture is one of the most profitable sectors of the economy and profitable. The share of non-profit enterprises is insignificant. A more detailed analysis is given in Table 1.

Table 1. Dynamics of financial results before taxation of agricultural enterprises by their size and type of economic activity for the period 2017-2018 (thousand UAH)

Indicators		Large enterprises	Medium enterprises	Small enterprises	Micro enterprises	Total for agriculture
2017 year						
Financial result, total		–*	915,944.9	163,896.8	35,193.3	1,155,653.7
Profitable enterprises	Financial result, thousand UAH	–*	1,000,433.9	708,648.3	193,164.0	1,784,894.2
	In % to total number of enterprises	–*	88.7	81.9	81.4	82.1
Enterprises that received a loss	Financial result, thousand UAH	–*	84,489.0	544,751.5	157,970.7	629,240.5
	In % to total number of enterprises	–*	11.3	18.1	18.6	17.9
2018 year						
Financial result, total		–*	518,898.7	231,814.8	-285,856.6	1,232,520.5
Profitable enterprises	Financial result, thousand UAH	–*	667,576.7	788,058.0	223,747.0	1,937,441.7
	In % to total number of enterprises	–*	86.0	84.9	84.7	85.0
Enterprises that received a loss	Financial result, thousand UAH	–*	148,678.0	556,243.2	509,603.6	704,921.2
	In % to total number of enterprises	–*	14.0	15.1	15.3	15.0
Deviation, 2018 to 2017 y.						
Financial result, total	thousand UAH	–	-397,046	67,918	-321,050	76,866.8
	%	–	56.7	141.4	-812.2	106.7
Profitable enterprises	thousand UAH	–	-332,857	79,409.7	30,583	152,547.5
	%	–	66.7	111.2	115.8	108.5
Enterprises that received a loss	thousand UAH	–	64,189.0	11,491.7	351,632.9	75,680.7
	%	–	176.0	102.1	322.6	112.0

Source: developed by the authors according to the Main Department of Statistics in L'viv region [4, 5].

In general, it should be noted that during the study period in the agricultural enterprises of L'viv region was profitable business. Losses were suffered in general by medium and micro enterprises. This dynamics of indicators showed us in 2019 about insufficient funding from the state and lack of access to cheap credit resources of European banks to medium-sized enterprises and start-up micro-enterprises of L'viv region.

Saving resources, strengthening control over their spending are very important to overcome losses and achieve profitability of any enterprise.

According to A.R. Zhuravs'ka "it is very important that in the system of anti-crisis

management, profits increase, mainly due to intangible assets than due to fixed assets"[12].
E.M. Rudenko believes that to assess the relationship between the financial result and the cost of production, it is advisable to use the index method, which allows you to determine the relationship between the cost of basic products and financial results of agricultural enterprises [6].
Since the current situation in the world in connection with the pandemic requires a closer connection between public authorities, financial institutions and directly agricultural producers, in this case, we believe that to improve the financial performance of agricultural enterprises of L'viv region it is necessary to thoroughly assess all the risks of the above entities and propose effective anti-crisis measures (Table 2).

Table 2. Classification of risks according to the subjectivity of their formation and ways to optimize them through the use of anti-crisis measures

	Risks, problems	Anti-crisis measures
State	Increase spending on the agricultural sector by reducing funding for other important areas of the economy.	Development of a program to support micro and small businesses, reimbursement of all loan rates to zero.
Banks	- deterioration of the discipline of loan repayment up to 5%; - reduction of demand for credit leasing; - slowdown in the investment sphere; - the presence of discomfort of online communication with farmers; - extension of credit holidays; - reduction of long-term loans for the development of the processing industry of agricultural products.	- refinancing of existing debt on loans to micro and small enterprises in banks of Ukraine by providing a new loan and changing the terms of the loan agreement in order to provide it with state support, in the form of interest compensation.
Agricultural enterprises	- world price situation; - closing of markets; - problems of import of products; - problems in the international delivery of agricultural machinery and spare parts; - difficulties associated with the loan application by novice farmers due to the inconvenience of teleworking and a more scrupulous attitude to financial analysis by banks.	- opening of markets - state support in the purchase of domestic agricultural machinery; - promoting mutual assistance between farmers through cooperation; - development of the investment sphere; - creation by the farmer (agricultural enterprise) of additional value and vertically integrated business; - deferral of rent payments, land tax for micro, small and medium businesses;

Source: developed by the authors.

The main task of the state today is to prevent the economic downturn and the crisis in Ukraine by providing financial support to agricultural enterprises through cheaper bank loans and reimbursement of all credit rates to zero. The state credit program "Affordable loans 5-7-9%" was introduced to facilitate access of micro and small businesses to bank lending. Control over the implementation of the program is entrusted to the Fund for Entrepreneurship Development (FED) [8].
The Ministry of Economic Development, Trade and Agriculture supports the program "Affordable loans 5-7-9%" in terms of educational programs for entrepreneurs who want to become participants in the program [2].
Credit guarantees are provided on loans to micro and small enterprises that do not have sufficient assets to transfer it as collateral for the loan or are characterized by increased credit risks, such as start-ups.
Thanks to credit guarantees, the state through the Fund for Entrepreneurship Development covers part of the credit risk of SMEs, creating conditions for attracting bank loans.
Government support in the form of Credit Guarantees is provided exclusively in combination with support in the form of Interest Compensation for SME loans that

meet the requirements of the program. The main components of the program "Affordable loans 5-7-9%" are shown in Figure 3.

It should be noted that studying the more detailed operation of the program "Affordable loans 5-7-9%", we found certain shortcomings that reduce the possibility of using it. In particular, the program can not be used by a private individual who was registered less than a year ago, the need for collateral in the form of real estate or a vehicle, the presence of experience in the case. If at the initial stage of a new business the entrepreneur plans to work alone to gain experience or repay the loan faster, the loan rate will not be 5% per annum, but 7%.

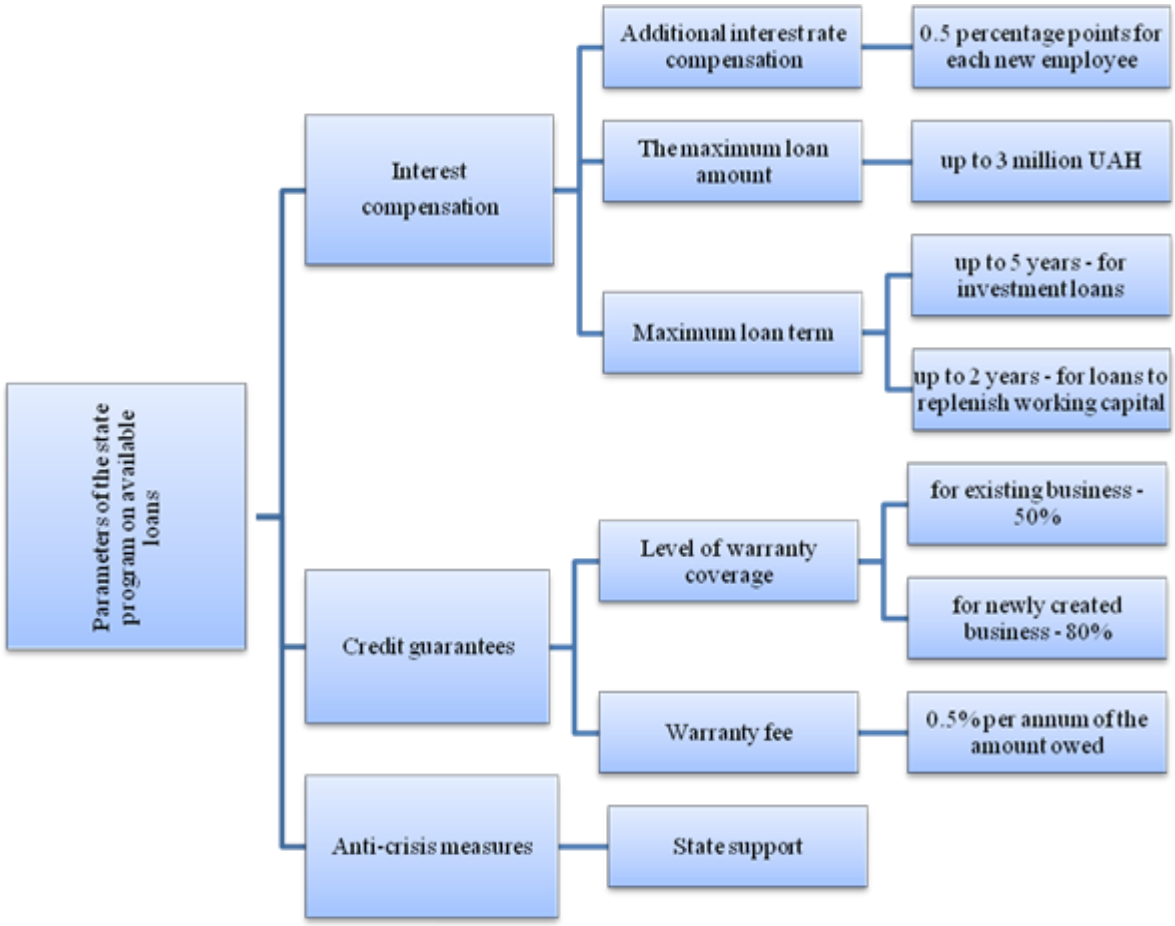

Fig. 3. Algorithm of the program "Affordable loans 5-7-9%"
Source: developed by the authors based on the source [9].

Thus, the program "Affordable loans 5-7-9%" will be possible to create businesses, attract more people to the business environment, increase the number of micro and small enterprises operating in the real sector of the economy only by eliminating the above shortcomings.

However, the program can stimulate the development of profitable small and medium-sized businesses. In particular, it provides such businesses with cheap working capital and funds for the acquisition or renewal of fixed assets [2]. According to P. Voitovych, in order to improve the methods of anti-crisis management, it is necessary to pay attention to the division of agricultural market entities into groups, based on subsystems of numerical orders, due to global trends in agriculture and the existing peculiar and specific conditions of this market in Ukraine [11]. In our opinion, every agricultural producer should strive for vertical integration in business and create added value. Because, it will at least help them to diversify their risks and survive difficult times. Adherence to such positions will make the sustainability of agricultural enterprises more diversified.

CONCLUSIONS

The impact of the COVID-19 coronavirus outbreak has significantly worsened economic conditions for all sectors of the economy and deepened economic uncertainty. In order to stabilize the economic situation in the agricultural sector of the economy, it is necessary, first of all, to implement anti-crisis programs, which are designed to bring agricultural business out of the economic crisis and provide financial support for development and capacity building.

We consider it necessary to improve the state program of support of agrarian business "Affordable loans 5-7-9%" and to apply it effectively. Agricultural producers should be encouraged to buy and use domestic agricultural machinery by developing government programs to reduce interest rates on loans or leasing, as experience shows that the export of machinery or spare parts during quarantine restrictions is also problematic.

Significant assistance from the state, in our opinion, would be the postponement of rent payments, land tax for micro, small and medium-sized agricultural businesses.

All measures should be aimed at improving the business environment and overcoming the crisis.

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