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ASSESSMENT OF DESIRED COMPETENCIES OF AGRICULTURAL EXTENSION AGENTS IN SUSTAINABLE AGRICULTURE DEVELOPMENT ACTIVITIES IN SOUTHWEST NIGERIA

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Abstract

Agricultural Extension Agents (AEAs) in Nigeria are saddled with the responsibility of helping farmers improve their knowledge and skill in agriculture thereby improving their livelihood opportunities. Based on this the study looked into the effectiveness of the agents in ensuring sustainable agricultural development. Specifically the study described the socio-economic characteristics of the AEAs, determined their levels of knowledge and skills in sustainable agricultural development activities and identified their training needs. Three states: Lagos, Oyo and Ondo states were randomly selected from the six in southwest Nigeria and all the AEAs in the Agricultural Development Projects in the selected states were sampled. Data were collected using a validated questionnaire. Data analysis was done using appropriate descriptive and inferential statistics. Results of the study revealed that males (68.1%) dominated extension service in southwest Nigeria. The mean age of the AEA was 39 years and the mean year of experience of the AEA was 10 years. AEAs highest mean score on knowledge in sustainable agricultural development activities was recorded in livestock manure management (x = 3.37) and the highest mean score in skill was recorded in farmers organization establishment (x = 2.98). Some of the training needs identified included participatory needs analysis and livestock manure management. The study concluded that many of the identified training needs are outside the pre-service training of the AEAs.

Key words**:** *agriculture, sustainable development, extension agents, human capital, training needs analysis*

INTRODUCTION

The concept of sustainability is illustrated by three interconnected mutually inclusive themes or spheres of the environment, society and economics [17]. The balance of these three spheres informed the definition of sustainable development as the development that allows the present generation to satisfy their needs without jeopardizing the ability of coming generations to meet their own needs. [5] defined sustainable agriculture development as one that results into abundant food production without depleting natural resources or resulting in environmental pollution. It is agriculture that uses natural principles to develop sustainable crop and animal production systems.

Furthermore, [17] submitted that sustainable agriculture development is that which is in line with the values of the society and one whose success cannot be separated from vibrant rural areas, good lives for farm families and food security for all.

Ensuring sustainable agriculture development calls for practice and technology which are technically appropriate, economically viable, environmentally friendly and socially acceptable [10]. Indeed, no agriculture could be said to be sustainable if it is not capable of ensuring a significant family income and a wholesome livelihood [1].

Sustainable agriculture development therefore, seeks to ensure that resources are used efficiently, renewable resources are replaced, and essential non-renewable resources are conserved. There is balance of inputs and outputs by minimizing resource costs and relying more on inputs derived from

the farm. This therefore depends not just on the motivations, skills, and knowledge of individual farmers, but on actions taken by organizations [6].

The goal of agricultural extension is to satisfy knowledge, skills and needs of all types of farmers in order to help them in running their farms efficiently and to become good citizens to improve their quality of life. Thus, the role of extension is very important to support sustainable agriculture which is moving from production to a wider set of sustainability. A key to sustainable agriculture development is the existence of sufficiently well trained personnel in all of the disciplines needed in the planning, development and management processes [23]. This means that the extension worker like a teacher needs to prepare and rehearse beforehand and teach well like a good teacher. The success of extension depends heavily upon selection of qualified and motivated personnel. But the basic problem of agricultural extension management is the lack of skillful field personnel needed to satisfy the requirements of sustainable agriculture. [4]. Training and continuous capacity development of extension agents will better position them to drive the needed institutional and community reorganization needed to ensure sustainable agriculture development and help the farmers with the adoption of the tenets of sustainable agriculture development.

Extension agents are adults most of whom are starters, mid-level career people and people almost at the end of their career and are sourced from different specializations in agriculture and even some of them from non-agriculture related specialization [3]. To keep updating the competencies: knowledge, skills and abilities of these people in recent development issues across the globe like sustainable agriculture development, training as a tool already established in improving human capital is encouraged.

Training that is not geared towards the exact needs of the trainees is bound to fail. This is because the possibility of addressing what is needed to improve performance is almost zero and it cannot be said to command adequate clientele participation since adults are self-directed in learning and only learn for immediate application and not for future application as children.

Theoretical framework for human capital development and training needs analysis

[26] defined human capital as an important ingredient in improving a firm assets and workers to improve production as well as maintain competitive advantage. Human capital implies processes that have to do with capacity development activities in and outside work environment that is targeted at improving what employees know and can do as well as improves his/her values to ensure satisfaction and performance and also by extension improves the performance of the firm [19]. According to [24] human capital is significant for improving the skill, and knowledge and competencies of the employees. [22] defined human capital as “the knowledge, skills, competencies, attributes embodied in individuals that facilitate the creation of personal, social and economic well-being”. Human capital concentrates on the economic behaviour of individuals especially in the way their embodiment of knowledge and skills empowers them to improve their productivity and their income and by so doing increase the efficiency and the wealth of the societies they live in [25]. Considering these definitions of human capital, it could be deduced that the focus of human capital is the knowledge or information, expertise and skills an employee possesses through the investment of education and training. Human capital to extension agents specifically will include knowledge and requisite skills and positive attitude needed in managing extension service systems as well as those required in reaching various clienteles in the field of agriculture and rural development for optimum production and improved livability. This implies that the productivity and effectiveness of each extension agent is a function of the accumulated human capital over the years foundationally during the pre-service training in colleges and universities and continuously through the various in-service and on the job training programmes. This is as a result of changing paradigm of development work and

improvement and update in technologies over the years. This explains the reasons why extension organization cannot afford to fold their arms as far as human capital development is concerned because extension agents' performance will not improve by itself, performance, once deteriorated becomes increasingly difficult to improve and performance will only stay improved if there is continuing support from the performance improvement system [27]. [7] dichotomized between the two types of human capital: the general-purpose human capital and the firm-specific human capital. According to the author, the general-purpose human capital consists of knowledge acquired through education and training in valuable areas to a wide spectrum of firms such as general skills in writing, communication and team work. Firm-specific human capital takes care of expertise gotten through education and training in areas specific to certain industry. Whatever the angle human capital is considered, education and training are its most vital investment although it is not built within the walls of formal educational institutions and frameworks alone. In the light of recent happenings across the globe in agriculture and rural development, agricultural extension agents desire new set of skills or competencies to be more efficient in ensuring agricultural and rural development considering various complications like climate change, environmental degradation, gender issues, hidden hunger and so forth. These competencies are the abilities, skills and knowledge – the behavioural dimensions that will differentiate between effective and ineffective performance of task [20] and [14].

Human capital focuses on two main areas which are the individual and the organization. [12] established four important components of human capital. These are (i) enhancement of individual skills (ii) the development of organizational capacities (iii) adaptability and flexibility and (iv) individual employability. These four components critically considered reveal that the focus of human capital is both organizational and individual development and value addition. Looking from the angle of individual improvement and development, [11] opined that human capital is important to give the individual a competitive edge while from the organization side, the firm gains advantage over others by possessing crucial resources that cannot be duplicated by their competitors. This implies that as individual competitive advantage increases, the competitive advantage of the firms they work also improves. This means that there is a direct relationship *ceteris paribus* between the development of the competitive advantage of the employees and the overall competitive advantage of their firms within a specific industry. As the discourse on human capital continues, firms develop motivations to improve its management towards reducing risks and increasing productive potentials. This supposes employees skill development in other to become competitive in their organizations [19].

Over time, the theory of human capital has evolved rapidly. Greater emphasis has now been placed on training related areas. This has a deeper relationship to the individual worker in that it sharpens their productivity. Therefore, training is crucial to human capital investment. Training itself as an intervention programme is not floating. Since adults are concerned and they do not learn as children do [18], training must have a direct relevance with what they do and it must promise immediate improvement if it will command their attention. If training programme will therefore be relevant to the need of the employees and the organization, it must be based on adequate training needs analysis that had revealed the various performance gaps [28].

In the light of this study, it implies that to improve the human capital of the agricultural extension agents in southwest Nigeria with a view to raising their individual performance and the entire productivity of extension service within the Agricultural Development Programme, training could be considered an important mechanism. In fact, workforce low competitiveness has been attributed to training [19]. Furthermore, this proposed training cannot achieve the desired result without appropriate training needs analysis using adequate models. Therefore, to improve the

competencies (the human capital) of the agricultural extension agent in sustainable agriculture, training programme based on adequate training needs analysis is desired. The study therefore, aimed to answer the following questions. What is the level of knowledge of agricultural extension agents in southwest geopolitical zone of Nigeria? How competent are the agricultural extension agents in ensuring sustainable agriculture development in southwest geopolitical zone of Nigeria? What specific areas of sustainable agriculture development do they require training on?

Objectives of the study

The specific objectives of the study were to:

1. describe the socio-economic characteristics of the agricultural extension agents in southwest geopolitical zone of Nigeria;
2. determine the knowledge and competence levels of agricultural extension agents in southwest, Nigeria in sustainable agriculture development; and
3. identify the training needs of agricultural extension agents in sustainable agriculture development.

MATERIALS AND METHODS

Southwest geopolitical zone of Nigeria is made up of 6 States which are Lagos, Ogun, Oyo, Osun, Ogun and Ekiti States. Lagos, Oyo and Ondo states were randomly selected for the study. All the extension agents with the Agricultural Development Programe (ADP) in the three states were reached using structured questionnaire duly validated and pre-tested. The information collected ranged from socio-demographic characteristics, level of knowledge and competence in sustainable agricultural development. The sustainable agriculture development model used for the study consisted of eighteen items generated by the researcher from desk study. Many of the socio-demographic variables were measured by their actual numbers while level of knowledge and competence were measured on a 5 point Likert type scale of 1 to 5 and categorized according to [3] and [2] as 1 - 1.49 (No knowledge/Not able), 1.5 – 2.49 (Little knowledge/Little ability), 2.5 – 3.49 (Moderate knowledge/Somewhat able), 3.5 – 4.49 (High knowledge/Able) and 4.5 -5 (Very high knowledge/Very able). In all 382 copies of the questionnaire were returned after four weeks. Data collected were summarized using descriptive statistics. Borich model of needs analysis was used to identify the training needs of the extension agents [8].

Borich model of needs assessment involves four steps which are listing competencies; surveying in-service employees (*clientele group*); ranking competencies, and comparing high priority competencies with training programme content. Applying this model to prioritize the needs of a group of employees, a discrepancy score will be calculated for each employee for each issue raised by subtracting the competency score from the knowledge score. A weighted score will then be calculated by multiplying the discrepancy score by the mean knowledge rating for each issue raised. A mean weighted discrepancy score (MWDS) will be calculated by taking the sum of the weighted discrepancy scores and dividing by the number of complete participant responses for the issue. The individual and groupings of professional competencies will then be ranked from lowest to highest using the computed mean weighted discrepancy score [13][9]. For this study, a Borich calculator [21] was used to avoid errors due to manual computation of large data set.

RESULTS AND DISCUSSIONS

Selected socio-economic characteristics of agricultural extension agents in the study area

Results in Table 1 shows that males (68.1%) dominated agricultural extension agents (AEA) in southwest geopolitical zone of Nigeria. This result corroborated the findings of [16] who reported that male dominated extension service delivery in Osun State. Also, Table 1 shows that the mean age of AEA in the zone is 39 years. Large proportions (83.0%) of the AEAs were between the ages 45 years and below. Table 1 also shows that majority (83.8%) of the AEAs were married. Result in Table 1 also indicates that majority

(73.0%) of the AEA had Bachelor of Science or Higher National Diploma degrees with 16.2 per cent having Master of Science. The study presents an interesting result as almost all the AEAs (96.6%) read agricultural related courses such as agronomy, agricultural extension, agricultural economics, and animal science with only 3.4 per cent that read non-agricultural related courses.

Table 1. Selected socio-economic characteristics of the agricultural extension agents

Variables	Frequency	Percentage
Gender of agents		
Male	260	68.1
Female	122	31.9
Age of agents in years		
≤ 25 years	5	1.3
26-35 years	111	29.1
36-45 years	201	52.6
46-55 years	64	16.8
56 years +	1	0.3
Marital status of agents		
Single	58	15.2
Married	320	83.8
Widowed	2	0.5
Divorced	2	0.5
Specialization of agents		
Crop science	121	31.7
Animal science	51	13.4
Soil science	26	6.8
Agricultural Economics	62	16.2
Agricultural Extension	91	23.8
Home Economics	11	2.9
Agricultural Engineering	3	0.8
Non-agricultural related specialization	17	4.4
Level of education of agents		
Secondary school education	12	3.1
Ordinary National Diploma	18	4.7
National Certificate of Education	9	2.4
Bachelor of Science/Higher National Diploma	279	73.0
Master of Science	62	16.2
Doctor of Philosophy	2	0.5
Professional cadre of agents		
Village Extension Agent	269	70.4
Block Extension Agent	56	14.7
Zonal Extension Agent	13	3.4
Subject Matter Specialist	29	7.6
Block Women in Agriculture	15	3.9

Source: Field Survey, 2016

Table 1 reveals that majority (70.4%) of the AEA in Southwest geopolitical zone of Nigeria are Village Extension Agent while others were Block Extension Agents, Subject Matter Specialist, Block Women in Agriculture and Zonal Extension Officer. Table 2 shows that more than half (55.2%) of AEA in the zone had been in service for about 10years while 37.2 per cent had been in service for 11-20 years. The mean year of service of AEA in the zone is 10 years. However, it was interesting to indicate that the mean year of service of AEA in Lagos state is 12 years. On average income, about 46.6 per cent of AEA in the zone made between ₦40, 001 - ₦80, 000 monthly.

The mean of monthly income of AEA in the zone was ₦60, 274 while for the 3 states was Oyo (₦67, 552), Lagos (₦76, 509) and Ondo (₦69, 117) respectively. Average number of farm families covered by AEA in the zone was 485. Average for the states was Oyo (440), Lagos (958) and Ondo (381) respectively. Considering the World Bank standard of one agent to 800 farmers, this finding portrays AEA/farmer ratio as adequate.

However, this findings deviates sharply from that of [15] who reported AEA/farmer ratio of 1:800 and 1:1612 for Oyo and Lagos state in 2012 and 1:1480 for Ondo state in 2011.

Result in Table 2 reveals that many (68.6%) of AEAs in Southwest geopolitical zone of Nigeria had Subject Matter Specialists as their source of information on agricultural issues with 41.8 per cent having radio, academic journal and agricultural books as their sources of information on agricultural issues respectively.

This finding reveals that AEAs utilize various sources for accessing information on agriculture. This will help them to be informed on current happenings and changes in agriculture across the globe.

Perceived level of knowledge on sustainable agriculture development activities

Result in Table 3 shows the perceived level of knowledge of agricultural extension agents in sustainable agricultural development activities. Results in Table 3 shows that the AEAs have moderate knowledge in thirteen of the 18 items listed on sustainable agricultural development activities.

The mean scores are below 3.00 in 7 of the listed items used to conceptualize sustainable agriculture development activities.

Table 2. Selected socio-economic characteristics of respondents

VARIABLES	FREQUENCY	PERCENTAGE	CENTRAL TENDENCY
Information sources on agricultural extension:			
Internet			
Colleagues	79	20.7	
Bulletin/Newsletter	44	11.5	
Radio	49	12.8	
Television	51	13.4	
Text messages	30	7.9	
Subject Matter Specialist	25	6.5	
Journals	262	68.6	
Books	41	10.7	
	36	9.4	
Number of farm families covered:			**Means:**
≤ 250	148	38.7	Oyo = 470 + 54
251 - 500	23	6.0	Lagos = 658 + 88
501 - 750	17	4.5	Ondo = 441 + 73
751 - 1000	142	37.2	SW = 485 + 75
1001 - 1250	31	8.1	
1251+	21	5.5	
Length of service:			***Means:***
< 10 years	211	55.5	Oyo = 18.5+ 2.40
11 – 20 years	142	37.2	Lagos = 12.08+ 3.37
21 – 30 years	27	7.1	Ondo = 11.27 + 2.31
31 years +	2	40.5	SW = 10.34 + 2.09
Average monthly income:			
≤ ₦40, 000	115	30.1	***Means*:**
₦40, 001 – ₦80, 000	178	46.6	Oyo = ₦67, 552±14, 218
₦80, 001 +	89	23.3	Lagos = ₦76, 509±15,682
			Ondo = ₦69, 117±21, 503
			SW = ₦60, 274±23, 747

Source: Field Survey, 2016.

Table 3. Perceived level of Knowledge of extension agents in issues in sustainable agricultural development

Issues in sustainable agricultural development	OYO ADP	LAGOS ADP	ONDO ADP	SOUTHWEST ADP
Participatory technology development	2.43	2.46	2.41	2.43
Integrated crop management	2.54	2.77	2.62	2.64
Agricultural waste management	2.62	2.78	2.68	2.69
Gender analysis	2.33	2.30	2.22	2.28
Livestock manure management	3.21	3.67	3.23	3.37
Integrated pest management	3.19	3.18	3.27	3.21
Low external input utilization	2.88	2.89	3.27	3.01
Water conservation	2.86	3.05	3.23	3.05
Participatory monitoring and evaluation	2.94	3.53	3.27	3.25
Soil erosion	3.15	3.27	2.51	2.45
Organic farming	2.42	2.43	3.22	3.26
Integrated weed management	2.91	3.42	3.14	3.16
Composting	3.16	3.14	3.22	3.17
Farmers organization establishment	2.95	3.30	3.17	3.14
No tillage	2.83	3.18	3.15	3.05
Participatory needs analysis	2.44	2.53	2.51	2.49
Agroforestry	3.03	2.93	3.16	3.04
Children involvement in programme planning & implementation	2.38	2.21	2.29	2.29

Source: Field Survey, 2016

The highest mean score was recorded in the *livestock manure management (x = 3.37)* followed by the mean score of the item *participatory monitoring and evaluation (x = 3.25)*. The least mean score was recorded in the item *children involvement in programme planning and implementation (x =2.29)*. This reveals that in respect of sustainable agriculture development activities, AEAs in the region are deficient in their knowledge on almost half of the items listed. Analysis of Variance (ANOVA) result in Table 4 reveals that a significant difference exists in the knowledge of the AEAs on sustainable agriculture development activities across the states.

Furthermore, Post Hoc test in Table 5 shows that there is no significant

difference in the knowledge of AEAs on sustainable agricultural development activities

between Lagos and Ondo states but a significant difference exists between the knowledge AEAs in sustainable agricultural development activities in Oyo state and Lagos states.

Table 4. Result of Analysis of Variance Test

		Sum of Squares	Df	Mean Square	F	Sig.
SADAKtotal	Between Groups	2190.361	2	1095.180	3.041	.049
	Within Groups	136491.139	379	360.135		
	Total	138681.500	381			
SADAStotal	Between Groups	6555.317	2	3277.659	6.608	.002
	Within Groups	187977.680	379	495.983		
	Total	194532.997	381			

SADAKtotal = sustainable agricultural development activities knowledge total score
SADAStotal = sustainable agricultural development activities skill total score
Significant at 0.05 level
Source: Field Survey, 2016

Table 5. Result of Post Hoc Test

Dependent Variable		(I) State ADP	(J) State ADP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
SADAK total	LSD	OYO ADP	LAGOS ADP	-5.76954*	2.34197	.014	-10.3744	-1.1647
			ONDO ADP	-2.85287	2.35834	.227	-7.4899	1.7842
		LAGOS ADP	OYO ADP	5.76954*	2.34197	.014	1.1647	10.3744
			ONDO ADP	2.91667	2.46560	.238	-1.9313	7.7646
		ONDO ADP	OYO ADP	2.85287	2.35834	.227	-1.7842	7.4899
			LAGOS ADP	-2.91667	2.46560	.238	-7.7646	1.9313
SADAS Total	LSD	OYO ADP	LAGOS ADP	4.06580	2.74841	.140	-1.3382	9.4699
			ONDO ADP	-6.36817*	2.76763	.022	-11.8100	-.9263
		LAGOS ADP	OYO ADP	-4.06580	2.74841	.140	-9.4699	1.3382
			ONDO ADP	-10.43397*	2.89350	.000	-16.1233	-4.7446
		ONDO ADP	OYO ADP	6.36817*	2.76763	.022	.9263	11.8100
			LAGOS ADP	10.43397*	2.89350	.000	4.7446	16.1233

SADAKtotal = sustainable agricultural development activities knowledge total score
SADAStotal = sustainable agricultural development activities skill total score
Significant at 0.05 level
Source: Field Survey, 2016.

Perceived level of competence (skill) on sustainable agricultural development activities

Similar to knowledge score, Table 6 shows that the AEAs' competence was also moderate. From the results in Table 6, all the mean scores were below 3.00 which x-rayed the position of extension agents in southwestern Nigeria in ensuring the desired sustainable agriculture development. The highest mean score was recorded in *farmers' organization establishment (x = 2.98)* and lowest in *children involvement in agricultural programme planning and implementation (x = 2.39)*. Generally, the findings of the study revealed that extension agents in southwestern Nigeria displayed inadequate skills in all the items listed in the study. This is an indication to what the extension agents in southwestern Nigeria are capable of doing in ensuring sustainable agriculture development. Result in Table 4 shows a significant difference in the skill level of the AEAs in sustainable agricultural development activities across the three states. Furthermore, the result of Post Hoc test in Table 5 reveals that no significant difference exists between the skill level of AEAs in sustainable agricultural development activities in Oyo and Lagos states but a significant difference exists between the skill

level of AEAs in sustainable agricultural development in Ondo and the other two states.

Table 6. Perceived level of Competence of extension agents in issues in sustainable agricultural development

Issues in sustainable agricultural development	OYO ADP	LAGOS ADP	ONDO ADP	SOUTHWEST ADP
Participatory technology development	2.53	2.45	2.64	2.54
Integrated crop management	2.93	2.50	3.11	2.85
Agricultural waste management	2.77	2.53	2.81	2.70
Gender analysis	2.54	2.29	2.75	2.53
Livestock manure management	2.76	2.65	2.83	2.75
Integrated pest management	2.98	2.53	3.23	2.91
Low external input utilization	2.63	2.59	3.14	2.91
Water conservation	2.88	2.33	3.11	2.77
Participatory monitoring and evaluation	2.88	2.83	3.19	2.97
Soil erosion	2.77	2.63	3.14	2.85
Organic farming	2.74	2.82	2.98	2.85
Integrated weed management	2.94	2.74	3.16	2.95
Composting	2.87	2.83	3.21	2.97
Farmers organization establishment	2.97	2.79	3.17	2.98
No tillage	2.84	2.69	3.16	2.90
Participatory needs analysis	2.43	2.37	2.53	2.44
Agroforestry	2.95	2.48	3.20	2.88
Children involvement in programme planning & implementation	2.42	2.23	2.53	2.39

Source: Field Survey, 2016.

Mean weighted discrepancy scores (MWDS) of competencies in sustainable agriculture development

Results in Table 7 shows the Mean Weighted Discrepancy Score (MWDS) for the items listed on sustainable agriculture development activities which are the areas of training needs of the AEAs. Eight of the items had MWDS higher than 1. The items were *participatory needs analysis* (1.47), *gender analysis* (1.43), *livestock manure management* (1.39), *children involvement in planning and implementation of agricultural programme* (1.38) *agricultural waste management* (1.25), *participatory technology development* (1.12), *and integrated crop management* (1.11) and *soil erosion* (1.08). Many of these identified training needs were outside the curricula of both undergraduate and postgraduate programmes in many of the universities in Nigeria and as such agents were not exposed to knowledge and expertise in these areas during their pre-service training. The main thrust of sustainable agriculture development in line with the general thrust of sustainable development is producing abundant food without depleting the earth's resources or polluting the environment. Therefore, training AEAs on sustainable agriculture development activities like agricultural waste management and soil erosion management will help them play good part in ensuring the health of the rural environment in line with the focus of sustainable development. Furthermore, if agricultural production is to be sustainable, then local people must be involved in all the stages of planning, implementation, and evaluation of agricultural programme.

Table 7. Mean weighted discrepancy score of issues in sustainable agricultural development

Issues in sustainable agricultural development	MWDS
Participatory technology development	1.12
Integrated crop management	1.11
Agricultural waste management	1.25
Gender analysis	1.43
Livestock manure management	1.39
Integrated pests management	0.88
Low external input utilization	0.44
Water conservation	0.55
Participatory monitoring and evaluation	0.69
Soil erosion	1.08
Organic farming	0.82
Integrated weed management	0.65
Composting	0.64
Farmers organization establishment	0.48
No tillage	0.47
Participatory needs analysis	1.47
Agroforestry	0.56
Children involvement in programme planning and implementation	1.38

Source: Field Survey, 2016

This is ethical and will definitely empower the rural people. Children especially must be included in any way possible to paint a picture in their minds that will encourage them to be involved in growing crops and raising animals for food and raw materials production. Also,

gender issues must be tackled to provide level ground for both male and female to achieve their full potentials as regard farming especially in the rural areas. Therefore, training AEAs on managing these competencies is germane to the success of their work and by extension to sustainable agricultural development in general.

CONCLUSIONS

The findings of the study establish that many AEAs in southwest Nigeria lacked knowledge and competence in many sustainable agricultural development activities which were not part of their pre-service training. Furthermore, the findings of the study reveal that a significant difference exist between the knowledge of AEAs on sustainable agricultural development between Oyo and Lagos states and a significant difference exist between the skill of AEAs on sustainable agricultural development activities between Ondo and the other two states. Therefore, the following recommendations were made. There is need for constant training needs assessment of AEAs after recruitment to bring them up to date with current developmental issues across the globe. Regular on – the – job training should be carried out for the AEAs to keep them informed and updated on recent developmental and environmental issues like sustainable agricultural development activities. Anytime capacity development programme is being planned for AEAs in southwest Nigeria, the peculiarity of each state should be considered in programme design and implementation.

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ASSESSMENT OF RURAL YOUTH ADOPTION OF CASSAVA PRODUCTION TECHNOLOGIES IN SOUTHWESTERN NIGERIA

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Abstract

This study assessed rural youth's adoption of cassava production technologies in Southwestern, Nigeria and determined the extent of usage of the technologies among them. A multistage sampling procedure was used to select 135 respondents. A well structured interview schedule was used to elicit information from the respondents. The data collected were analyzed using descriptive and inferential statistics. The results showed that the average age of rural youths that were engaging in cassava production in the study area was 29 ± 2.6 years with average farm size of 2.5 ± 0.3 hectares. Also, household size ($r = 0.249$; $P \leq 0.01$) and extent of usage of the technologies ($r = 0.363$, $p \leq 0.01$) shows significant relationship with level of adoption of the technologies at 0.01 while age ($r = 0.097$; $P \leq 0.05$) and years of former education ($r = 0.181$; $P \leq 0.05$) were significant at 0.05. It was concluded that the extent of usage of the technologies in the communities affect the rate of adoption positively and this might enhance the positive perception of youths on cassava production thereby ensure food security in the study area.

Key words**:** *assessment, rural youths, Cassava production technologies, food security*

INTRODUCTION

In Nigeria, agricultural production is still carried out using physical strength, which declines with age. This has therefore been observed as one of the major constraints to agricultural production in Nigeria [10]. Though youths have desirable qualities that can promote agriculture, most of them have strong apathy toward it [2][4]. The development of the agricultural sector of the Nigerian economy therefore depends on the young people, more especially the rural youths. This is because a larger population of youths represents the link between the present and the future as well as a reservoir of labour [10].

There are challenges faced by rural youth in participating in agricultural production. Some of these challenges are: strong beliefs in traditions and customs that are often in conflict with development and change concern; low education level, lack of relevant information, limited job opportunity, limited financial support available for rural youth and low management capabilities of youth leaders in the rural areas [12].

Cassava (*manihot spp*) is one of the most popular root crops grown in West Africa especially in Nigeria. Cassava is a major staple food in Nigeria. In 2004, the estimated cassava output from Nigeria was approximately 34 million tones. This production performance had rated Nigeria as the largest cultivator of cassava in the world [9]. In 2002, cassava suddenly gained prominence in Nigeria following the pronouncement of the presidential initiatives on the crops. This initiative was aimed at using cassava production as engine of growth in Nigeria. In 2011, the federal government came up with a programme tagged Agricultural Transformation Agenda (ATA) which focus in enhancing the role of agriculture as an engine of inclusive growth leading to rural employment, wealth creation, and diversification of the economy.

The initiative focus on ten major agricultural products value chain which includes: cassava, rice, maize, soybeans, cotton, tomato, fishery,

oil palm, poultry and fruit. [16] reported that despite the ongoing cassava revolution in Nigeria and the high level of awareness of associated technologies, lower levels of cassava technologies usage are still predominates. Cassava has being a versatile staple food for the people in south western region of Nigeria for a long time in which the adults and youths participate actively in the production, but the use of the improved technologies have not been maximized to make cassava always available for the people and also to export. Social systems theory is adopted for this study. The study was laid on social system theory of corporate actors, which look into the way social life is organised and, sometimes, transformed ([6], [7] and [11]). It questions the everyday assumptions which sharpen individual lives and reflects in a systematic manner on such issues as the division of power, nature of identity, forms of agency and rationality; and human experiences as pre-modern, modern or post-modern subjects. It serves as a field of critical inquiry which is interdisciplinary in character, and addresses the various social and human sciences on adoption of Cassava production technologies in the study area. The foregoing arouse the quest to assess rural youths adoption of cassava production technologies by identify and determine the awareness of cassava production technologies available to the youths and determines the level of adoption of these technologies among these youth. The null hypothesis tested was that there is no significant relationship between the adoption of cassava production technologies and rural youth personal characteristics.

MATERIALS AND METHODS

The study was conducted in Southwest, Nigeria. A multistage sampling procedure was adopted for the study. In the first stage, two states were purposively selected in southwest, Nigeria which were Osun (It lies between longitude 6 º51'N and 8 º10'N on the North-South pole and latitudes 4 º 05'E and 5º02'E on the East - West pole with estimated population of 4,137,627 [8] estimation)and Oyo (It lies in the coordinate of 8º00'N 4º00'E with estimated population of 6,617,720 ([8] estimation) states due to high level of cassava production and access to cassava production technology in the areas. In the second stage, purposive sampling technique was used to select two local governments each from the states selected which are Ibarapa central (Igbo-Ora) and Ibarapa East (Eruwa) Local Government Areas (LGAs) in Oyo state; and Ife North (Ipetumodu) and Ede South (Oke Ireesi) LGAs in Osun State. In the third stage, proportionate sampling technique was used to randomly select five; four, six and four communities from the selected LGAs respectively representing 20 percent of the rural communities in them, in all 19 communities were selected. In the fourth stage, Snow ball sampling technique was used to select about 7 rural youths in each community selected to make a total of 135 respondents. Validated structured interview schedule was used to elicit information from the respondents

RESULTS AND DISCUSSIONS

Demographic characteristics of youths

Results in Table 1 shows that the average age of the respondents was 29.13±4.86 years, majority (67.4%) were male, majority (95.8%) were single, their average years of former education was 11.9±3.15 years and their average farm size was 2.5± 0.98 hectares with average income of about ₦191,444.44 ± 88,656.78 per month.

This finding reveals that they are still in their active age based on the]15] categorization of youth and Torimiro [13] which defined youth as a group of people that are found within the age group of 13 to 30 years of age.

Also, [14] asserted that farming occupation in rural areas is dominated by male gender as a mean of livelihood.

Their low income might be connected with their low involvement in Cassava production because the uses of the improved technologies have not been maximized to make cassava always available for the people and also to export.

Table 1. Showing the Socio-economic Characteristics of the respondents

Variables	Frequency	Percentage	Mean	Std. Dev
Age				
15 - 19	10	5.9		
20 - 24	37	7.4	**29.13**	**±4.86**
25 - 29	80	27. 4		
30 - 35	135	59.3		
Total		100.0		
Sex				
Male	91	67.4		
Female	44	32.6		
Marital Status				
Single	115	95.8		
Married	5	4.2		
Divorce	-	-		
Total	135	100		
Years of Formal education				
0	1	0.7		
1 - 6	20	14.8		
7 - 12	74	54.8		
13+	40	29.7	**11.9**	**±3.15**
Total	**135**	**100**		
Average stipend per month				
<216,000	93	68.9		
216,000 - 431,999	36	26.7	**₦19,144.44**	**± ₦ 8,656.78**
432,000 - 647,999	5	3.7		
864,000+	1	0.7		
Total	**135**	**100**		
Farm size (in hectares)				
1 - 2.99	83	61.5		
3 - 6	52	38.5	**2.5**	**± 0.98**
Total	**135**	**100**		

Source: Field Survey, 2015.

Awareness and adoption of cassava production technologies

Table 2 shows the awareness and adoption of the cassava production technologies that available to the rural youth in the study areas among which were improved varieties of cassava (such as TMS 30572, TMS 4 (2)1425, TMS 50395, TMS 63397), use of tractor, use of herbicide for weeding, plant population density of 10,000 plants/ha to mention a few.

Table 2. Awareness and adoption of cassava production technologies by rural youth

Technologies	Awareness	Adoption
Improved cassava varieties that are low in HCN level and resistance to diseases	89(65.9)	75(55.6)
Use of tractor	64(47.4)	55(40.7)
Use of herbicides	84(62.2)	58(43)
Plant population density of 10,000 plants/ha	65(48.1)	51(37.8)
Use of appropriate length of cutting per stand	66(48.9)	57(42.2)
Appropriate spacing of 1m by 1m	59(43.7)	54(40)
Early weeding at least twice in 30 days	74(54.8)	60(44.4)
Fertilizer dose (NPK 15:15:15)	76(56.3)	65(48.1)
Intercropping of cassava with maize/cowpea	82(60.7)	74(54.8)
Supplying of missing stand	71(52.6)	65(48.1)
Use of pesticides	77(57)	55(40.7)
Timely harvesting	98(72.6)	79(58.5)

Figures in parenthesis represent percentage.
Source: Field survey, 2015

Further analysis shows that 65.9 percent of the respondents were aware of the availability of improved cassava varieties while 55.6 percent adopted it and 62.2 percent of the respondents were aware of use of tractor for land preparation while 43 percent of them adopted it among others. This is in agreement with findings of [5] that more than average of the youth who are involved in agricultural production in the study areas were aware of the availability of improved varieties of agricultural planting materials but fairly number of them adopted it.

Extent of usage of the cassava production technologies available to the rural youth

The results in Table 3 show ranked means of usage of these technologies to see the order of their usage. The result shows that improved cassava varieties are the technologies used mostly (2.51±0.76) by the respondents, followed by intercropping (2.34±0.83) and supplying missing stands (2.27±0.77) among others.

Table 3. Extent of usage of the cassava production technologies available to the rural youth

Technologies	Extent of usage		
	Mean	Std Dev.	Rank
Improved cassava varieties that are low in HCN level and resistance to diseases	2.51	0.76	1st
Use of tractor	2.24	0.73	4th
Use of herbicides	2.22	0.84	5th
Plant population density of 10,000 plants/ha	1.96	0.83	10th
Use of appropriate length of cutting/ stand	2.00	0.78	9th
Appropriate spacing of 1m by 1m	1.94	0.92	11th
Early weeding at least twice in 30 days	2.01	0.91	8th
Fertilizer dose (NPK 15:15:15)	2.16	0.87	7th
Intercropping of cassava with maize/cowpea	2.34	0.83	2nd
Supplying of missing stand	2.27	0.77	3rd
Use of pesticides	1.90	0.74	12th
Timely harvesting	2.18	0.88	6th

Source: Field survey, 2015.

Hypothesis testing

In order to establish relationship between the demographic characteristics of the respondents and their level of adoption of Cassava production technologies, data were subjected to correlation ® and chi-square (X^2) analyses. Results in Table 3 shows that there was significant relationship with level of adoption of the technologies and household size ($r = 0.249$; $P \leq 0.01$), extent of usage of the technologies ($r = 0.363$; $P \leq 0.01$) at 0.01 while age ($r = 0.097$; $P \leq 0.05$) and years of former education ($r = 0.181$; $P \leq 0.05$) were significant at 0.05.

Table 3. Result of Pearson's correlation analysis showing relationship between socio-economic characteristics of the rural youth, extent of usage and adoption of cassava production technologies

Variables	Correlation coefficient (r)	P-value	Decision
Age in years	0.097*	0.706	S
Household size	0.249**	0.004	S
Years of residence	0.511	0.196	NS
Farm size	0.034	0.701	NS
Income in farming per year	0.034	0.127	NS
Years of formal education	0.181*	0.036	S
Extent of usage	0.363**	0.010	S

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
S= Significant
NS= Not significant
Source: Field survey, 2015.

Also, the results in Table 4 reveal that marital status (χ^2=1.802 P≤ 0.05) had positive and significant associated to the level of adoption of Cassava production technologies by the rural youth at 0.05 level of significant. This agrees with [3] and [1] who opined that youth are less conservative in their nature and are more receptive to change. These results imply that there were significant relationship between the adoption of cassava production technologies and some selected rural youth socio-economic characteristics, therefore, the null hypothesis is rejected.

Table 4. Result of Chi square analysis showing relationship between socio-economic characteristics of the rural youths and adoption of cassava production technologies

Variable	X^2–value	Df	P-value	Decision
Sex	0.167	1	0.821	NS
Marital status	1.802*	1	0.043	S

*significant at the 0.05 level (2-tailed)
S= Significant
NS= Not significant
Source: Field survey, 2015

CONCLUSIONS

The study concluded that farming activities is still male dominated, their income was low (₦19,000.00k) that about $60 per month, 71 percent had secondary education and in most cases the level of awareness of the cassava production technologies among the respondents was higher than adoption. The adoption and extent of usage of cassava production technologies (r = 0.363, p ≤ 0.01) by rural youths are significantly related at 0.01 significant level. Therefore, if more technologies are introduced to the youths and they are thought how best to use them, they might make maximum use of the technologies, change their strong apathy towards agriculture which may enhance the positive perception of youths on cassava production thereby ensure food security in the study area.

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DEVELOPMENT OF METHODS OF FINANCIAL SUPPORT FOR INVESTMENTS

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Abstract

The growth of the investment activity in the Russian agro-industrial complex (AIC) is substantiated by the specificity of the agro-industrial production, the functioning of which is related to overcoming the following systemic problems: underdevelopment of infrastructure facilities, shortage of qualified production and management personnel, and a low level of developing scientifically grounded economic forms. The article introduces methods for supporting the AIC investment activity, including the economic methods that were recognized as the most preferable ones. The following instruments that have a direct financial influence in the taxation, credit-and-monetary, budgetary and external economic areas have been defined within economic methods: provision of tax credits for the placed investments (so-called tax credit); provision of tax incentives and special tax regimes for investors at AIC enterprises; accelerated depreciation of fixed capital; targeted lending of AIC enterprises for investment purposes; subsidies and subventions from local budgets for AIC enterprises; forming and funding of AIC investment projects from regional budgets; provision of budgetary guarantees to AIC private investors; attracting foreign investment in the region AIC; provision of privileges (taxation, lending) to AIC enterprises that participate in the foreign economic activity, etc. The sequence of organizing investment processes in AIC is shown. The normative and legal support for the AIC investment activity in the form of a three-level system of normative acts is given.

***Key words*:** *investment, agro-industrial complex, supporting investment activity*

INTRODUCTION

Since the population of the Earth increases, the agrarian sector of the world economy needs constant inflows of investments. According to the Food and Agriculture Organization of the United Nations (FAO), as on 2050 an annual funding of $209 billion will be required to provide inhabitants from 93 developing countries (including Russia) with food at the minimum level [12].

In 2017 in the Russian AIC sector a new mechanism of preferential lending was introduced. It freed agricultural producers from issuing numerous documents for subsidies and long waiting for public funds. Now they have the right for the preferential bank lending with a maximum rate of 5%, and state subsidies are sent directly to banks [1].

According to Interfax, in 2017 the total approved lending amount was RUB 700 billion, including RUB 500 billion for investment lending, and RUB 200 billion — for short-term loans [8]. In 2016, the amount of investment loans was less than RUB 130 billion. Today, 100 authorized banks participate in the new lending program, but due to the competition, the interest rate often decreased down to 2-3%. Due to preferential loans in the amount of RUB 66 billion, it is

planned to build 90 dairy farms, which in the future will increase the milk production by 500 thousand tons. Preferential loans in the amount of RUB 118 billion will be spent for creating 50 greenhouse complexes, which will increase the collection of vegetables by 480 thousand tons. Another RUB 72 billion of credit funds will be spent to process AIC products, and RUB 115 billion – to purchase agricultural machinery. [8]

The volume of investment in fixed assets in AIC has increased by almost 4% to RUB 612 billion. At the same time, the share of investments supported by the state increased from 26% in 2016 up to 46% in 2017. In 2018, the volume of state support for AIC is planned to remain at the level of 2017 – RUB 242 billion, including RUB 85.5 billion to support investments [10].

It is necessary to note that in the context of the sanctions imposed upon Russia on the EU food market, Russia has got an opportunity to enter the market of high quality food (dairy, fish and grain products) in the countries of Southeast Asia: China, Japan and South Korea. In general, in the context of the 17% decrease in total export in Russia in 2016, the export of agricultural products increased by 5.2% and was equal to the export of weapons. However, the volumes of foreign investments in the Russian AIC are still insufficient. According to the data of the Central Bank of Russia, they made up USD 830 million as on July 2016 [2, 3, 6]. However, the targeted foreign investment orders from countries of Southeast Asia, the Middle East and China for large quantities of food that are similar to foreign purchases of Russian weapons, energy resources, equipment for nuclear power plants could considerably contribute to the innovative development of the AIC companies.

For example, according to IPT Group experts, Chinese investments abroad exceed USD 116 billion per year, which is the third largest amount in the world after the U.S. (USD 337 billion) and Hong Kong (USD 150 billion). It is expected that after 2020 the volume of Chinese foreign investment will have exceeded USD 500 billion. However, the state task of increasing the Chinese investments in the Russian economy up to USD 12 billion by 2020 happened to be rather difficult to achieve. In 2014, the Chinese direct investments in Russia amounted to only USD 7 billion. In 2015, there was a sharp reduction of the Chinese investments: in the first half of the year, the decline was one fifth of the total amount. According to Chinese investors, the main reasons that complicate investments in the Russian economy, including in the agro-industrial sector, include the following: instability in macroeconomics (57%); problems with the legislation (43%); corruption (14%); sanctions war and problems of Russia with the U.S. and the EU (14%); complicated procedures related to registering property rights and trademarks (14%); and reduction of consumer purchasing power in the Russian Federation (29%) [9].

Due to the above, the objectives of financial support for the AIC investment activity are the following: to create many financial conditions and opportunities for the sustainable development of the agricultural complex; to timely provide financial resources to the industry enterprises that produce competitive products that can be sold to return the made investments.

In case of the smooth-running investment process, the deficit of public funds in AIC should be compensated by private financing, and the state plays a special role in attracting private investors.

The purpose of the study is to analyze methods of efficient financial support for the AIC investment activity.

The study hypothesis: the authors assume that the efficient financial support for the AIC investment activity is achieved by developing and implementing regulatory and legal, organizational, and resourceful support for investment processes by using administrative, economic, and institutional methods of supporting the investment activity.

MATERIALS AND METHODS

To achieve the set goal and confirm the hypothesis, an expert survey with 50 respondents was carried out.

Samples are characterized by:

-Specialization of experts: managerial (general director of the company), 10%, financial (preparing financial statements, financial control, taxation, etc.), 90%,
-Type of company: processing and marketing 20%, agricultural production 78%, consulting 2%,
-Number of the company employees (persons): up to 500 – 34%, from 500 to 2,500 – 40%, more than 2,500 – 26%,
-Period of the company's strategy
-Form of the company ownership: 1-2 years – 22%, 3-5 years – 44%, 6-10 years – 34%.
The experts were asked a number of questions suggesting the possibility of choosing several statements related to:
-Identifying and studying trends on the agricultural products' market in general,
-Existing AIC problems and preferred strategies of AIC enterprises.
In the context of the goal set in the study, the following issues were considered:
-Groups of methods for supporting the investment activity in AIC,
-General characteristics of the methods indicated in the survey, and
-Certain methods and instruments for supporting the investment activity in AIC in relation to a particular group of methods.
Data were collected through an online survey and personal interviews. When analyzing the data, the following was made: identification and research of trends on the market in general and investment activity in AIC, in particular, and data analysis (analytical study of the survey results to integrate the obtained conclusions).

RESULTS AND DISCUSSIONS

Business representatives gave a positive expert assessment of the industry and their own companies: 78% of experts said about positive or more likely positive state of affairs, almost 90% of respondents assessed the situation in their company positively or rather positively.
AIC experts assessed the Russian AIC perspectives as follows: 40% of experts did not expect any considerable changes in the AIC development, while 14% of them believed that the situation might change for the worse.
According to the experts, 85% of AIC companies' profits for three years are generated by state subsidies that are still one of the main factors of investing in AIC.
At the same time, 44% of companies intend to increase the volume of external, nonsubsidized financing in the near future (by borrowed funds or by a capital increase). The most demanded sources of financing for AIC are still loans from a Russian bank (62% of respondents) and the use of domestic sources of financing (54% of respondents).
Based on expert answers, the 2017 Top 10 problems of the Russian AIC were compiled (Table 1).

Table 1. Top 10 Problems of the Russian AIC in 2017

No.	AIC problem	% of references
1	Lack of state support and financing	44%
2	Insufficiently qualified staff	36%
3	Imperfection of the industry regulation by the state	30%
4	High cost of energy resources	22%
5	Low payment capacity of the population	20%
6	Nonflexibility of the tax system in relation to AIC	18%
7	Weak introduction of high technologies	10%
8	Risk of changes in stock prices for agricultural products	10%
9	Lack of capacities and production potential	8%
10	Low attractiveness of the Russian AIC for foreign investments	8%

Source: Compiled by the authors

According to Top 10 AIC Problems in Russia, most of them are directly or indirectly related to insufficient financial support for investments in AIC.
Based on the experts' answers, the Top 10 Strategies of Russian AIC Enterprises in 2017 had also been compiled (Table 2).

Table 2. Top 10 Strategies of Russian AIC Enterprises in 2017

No.	Strategy	% of references
1	Costs reduction	84%
2	Increase in overall production	70%
3	Entering new markets	66%
4	Increase in production and technical potential (introduction of new capacities)	62%
5	Business development through natural growth	60%
6	Investing in the personnel's development	58%
7	Investing in advanced technologies	48%
8	Attraction of external sources of financing	30%
9	Entering markets of new products or services	4%
10	Changing purchasing strategy	4%

Source: Compiled by the authors

According to the Top 10 Strategies of Russian AIC Enterprises, most of them are also related to the need in financial support for investments. Due to the importance of financial support for investments in AIC enterprises, the experts were asked about the characteristics and importance of methods for supporting the investment activity. The results of the survey are shown in Table 3.

Table 3. Methods of Supporting AIC Investment Activity

Group of methods	General characteristics	% of references
Administrative	They are based on the authority and strength of the state that creates and regulates legal conditions for regional industry investors. They formalize the nature of interrelations between investors and entities for investments, which allows directly resolving the most acute investment contradictions on a purposeful and operational basis.	44%
Economic	They take into account various interests and motives of various subjects of regional investment markets and create terms and conditions that contribute to the formation of their economic interest.	88%
Institutional	They are involved in establishing a system of institutions that are necessary for the activity of the entities involved in regional investment processes to achieve their goals and objectives within the regional investment strategy.	36%

Source: Compiled by the authors

According to the survey results, the experts define economic methods as the most important ones when supporting the AIC investment activity. Therefore, the experts were asked about the most preferred economic instruments for supporting investment activity in AIC. The results of the survey are shown in Table. 4.

The growth of the investment activity in the Russian AIC, as stated earlier, has gradually increased over the recent years. Due to this, new areas of the regional AIC activity and new investment projects implemented by them need to develop optimal financing schemes based on external sources.

According to the experts, in the AIC investment activity its regulatory and legal support on the regional level is of great importance, because regional legislation, as the majority of experts believe, determines legal, economic and social opportunities for implementing investment activities, the procedure of providing investors with state support and equity guarantees within the region, the forms and methods of financing priority sector investment projects and programs, the procedure of providing preferential loans for investment and tax benefits.

Table 4. Economic Instruments for Investment Activities in the AIC

Instruments	General characteristics	% of references
Taxation	Providing tax abatements for the placed investments (so called tax credit)	72%
	Providing tax incentives and special tax regimes for investors in AIC enterprises (investment tax holidays for income tax and regional taxes for several years)	62%
	Accelerated depreciation of fixed capital	58%
Credit-and-monetary	Targeted lending to AIC enterprises for investment purposes	64%
Budgetary	State guarantees for repayment of the borrowed funds allocated for the investment tasks of AIC enterprises	66%
	Subsidies and subventions to AIC enterprises from local budgets	26%
	Formation and financing of investment projects at AIC enterprises by using fund from regional budgets	24%
	Selection and financing of investment projects of AIC enterprises on a competitive basis	44%
	Control over the effective use of budget funds aimed at financing investment projects of AIC enterprises	42%
	Providing private investors of AIC enterprises with budget guarantees	20%
External economic	Attraction of foreign investments in the AIC of the region	32%
	Providing privileges (tax, credit) for AIC enterprises that participate in the foreign economic activity	16%

Source: Compiled by the authors

According to the experts, in order to ensure the maximum efficiency of the agrarian investment policy, it is necessary to develop it together with the nationwide investment strategy based on the maximum consideration of the world experience. Due to this, the agricultural investing experience of foreign countries causes interest.

It is necessary to note that Germany, Great Britain, France and Italy are the developed European countries that pursue efficient

investment policies. In addition to the national policy, they actively develop investment incentives within the EU's general agricultural policy (Table 5).

Table 5. Instruments of Investment Incentives in the EU Common Agricultural Policy

Instruments to stimulate investments in AIC	Countries			
	Germany	Great Britain	France	Italy
Accelerated depreciation of fixed assets	+	+	+	+
Preferential loans for AIC	+	+	+	+
Subsidizing AIC	+	+	+	+
Tax privileges				+
Special system of agricultural lending	+			

Source: Compiled by the authors

The German investment policy is characterized by a high level of openness and liberalization. In terms of investments in material and technical assets, the German experience is very valuable. Thus, after uniting the country, the government took measures to create favorable conditions for capital inflows to the East Germany. During this period, the state provided additional opportunities to debit or increase depreciation charges on fixed assets if these funds were invested in acquiring or producing new fixed assets. The 12% compensation rates for acquiring agricultural machinery and renewing production were applied, and the compensation for the expenses for creating production capacities and restructuring production were up to 23% of such expenses. Foreign investors were treated as domestic ones by their status and rights.

Nowadays in Germany, it is an important factor of developing the agricultural investment policy to create a special system of financial and credit relations that would not only accumulate and provide production processes with the necessary resources but will also stimulate the material and technical renewal of the industry.

In Germany, there is a whole system of agricultural lending that consists of the Raiffeisen banks group, the Union of German People's Banks that unite about 1,470 associations of farmers and rural entrepreneurs of the territories, the Agricultural Rent Bank, the German and Settlement Land Bank, the Credit Institute, and a system of saving associations that are controlled by the state. German farmers are provided with preferential loans either according to the General Program of Agricultural Loans that offers a 4–7% rates reduction for the existing loans, or according to the Investment Incentive Program that provides loans at 1% per annum. In addition, in the country there are special programs like "Young Farmers", "Agriculture" and "Village Renovation" that offer preferential terms and conditions for agricultural lending [7].

Organic farming became an important direction in German investing. It is stimulated due to direct payments that make up 200 Euro/ha per year. Direct payments are a common instrument in the EU to stimulate the development of agriculture and provide farmers with fixed payments as calculated per 1 hectare of agricultural land. They are often temporary and aim at assisting farmers in the redevelopment of their production activity [4].

In the United Kingdom there is also a favorable investment climate. Here foreign investors are not required to obtain any permits to carry out their activity on the territory of the state. In the UK, there is no specialized agrarian bank, and the policy of the banking system in relation to agriculture does not differ from other branches of the economy. However, banks are involved in various government subsidies, and this often makes a loan preferential. Investments in the agrarian sector are carried out mainly by the method of permanent lending. According to it, the loan amount, interest rate and type of debt are reviewed between the creditor and the borrower on an annual basis and are determined by the economic state of the company [5].

To speed up the modernization of agriculture and to ensure the competitive production, France provides special preferential terms and conditions of lending. In particular, depending on the terms and conditions of agricultural production, the interest rate of preferential loans varies from 3.1 to 8.9%. Privileged borrowers (cooperatives on machinery use) use a preferential loan with an interest rate from 4.1 to 4.35%. In addition, the country has an efficient system of attracting its own

and foreign capital. The government provides investors with subsidies at a rate of 25% of the cost of all capital investments made in land and equipment that are bought during the first three years of the project implementation. A system of long-term preferential loans is also widely used. The mechanism of preferential loans for the agricultural sector functions according to the bonification principle that is implemented in the form of the state compensation of the difference between the preferential interest rate of the loan and the contractual interest rate [3].

The legislation of Italy is rather protectionist in relation to investors. The main means of stimulation are subsidies, tax and credit benefits. In particular, the companies established for agricultural activity in the south are exempted from the income tax and a local tax equivalent for 10 years. The profit from foreign investments that was reinvested in the south of the country is also exempted from a number of other local taxes. Investors who buy land in this region to construct industrial agricultural facilities are exempted from registration, mortgage and land taxes [11].

It is necessary to note that the amortization policy is greatly important when managing the investment process. It is of great priority in stimulating investments in such countries as France, Germany and the United Kingdom. In addition to the traditional uniform debiting of depreciation charges, the amortization legislation of these countries includes the use of accelerated depreciation rates. The purpose of this method is to stimulate intensive renovation of the production means and to overcome the moral wear and tear of technical means.

The use of accelerated depreciation rates is also applied in the USA, Japan, Italy and other countries. In Germany, it is permitted to write off 40% of the expenses related to acquiring new equipment during the first year of operation.

Thus, summarizing this information, it is possible to state that in the AIC of the developed countries, investment processes are primarily determined by the market situation, peculiarities of the agrarian area in relation to the size and sources of financing the investments that are made mainly by private capital (domestic and foreign), direct budgetary financing, indirect budgetary subsidies for private investments (through tax incentives and investment loans), and investments from public and charitable foundations. At the same time, various methods of state stimulation of investment processes are used — tax, depreciation, credit, etc. Tax holidays, tax investment deductions and investment tax credits are widely used to stimulate productive investments, taking into account the economic situation and the need in the development of various industries.

Based on these facts and the foreign experience, the authors believe that the following measures should be the efficient instruments for stimulating the AIC investment activity:

(i)According to the example of Great Britain, investments in R&D and construction of industrial facilities should either not be taxed (subject to their strategic importance) or be subject to a tax credit. Tax credits for the use of equipment should be differentiated according to its age: new equipment should not be taxed; equipment with a service life of 1 year should be subject to a 50% tax credit, that of 2 years – 25%, etc.

(ii)Based on the example of Italy, the funds of foreign investors reinvested in the agriculture of depressed regions should be completely exempted from taxation.

(iii)Based on the international experience with the market economy, in order to accelerate the innovative renovation of the material and technical state of agriculture, fixed assets should be subject to the norms of accelerated depreciation.

CONCLUSIONS

The financial support for the AIC investment activity is closely related to other types of support: administrative, economic, institutional, etc. That is why it is necessary to consider it taking into account interrelations of the investment processes in the industry. It allows to make the conclusion that efficient financial support for the AIC investment

activity is achieved by forming and implementing regulatory and legal, organizational, and resource support for investment processes by using administrative, economic, and institutional methods of supporting the investment activity.

Having considered the experience of foreign countries in the area of agricultural investment, it is necessary to note that approaches to attracting investments in the industry vary greatly and depend on the goals of the country. Thus, some countries determined the attraction of foreign capital to the agrarian sector as an unconditional priority and, based on this, they created conditions for foreign investors that sometimes were even better than those for domestic entrepreneurs. In addition, successful use of tax incentives, the policy of credit reimbursement, contribution to investing in scientific and technical progress, and depreciation policy can become efficient factors in financial insurance of investments in AIC.

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INFLUENCE OF HUMAN RESOURCES FUNCTIONS ON ORGANISATIONAL CULTURE AMONG EMPLOYEES OF FEDERAL UNIVERSITY OF AGRICULTURE, SOUTHWEST, NIGERIA

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Abstract

The study examined the influence of Human Resources functions on Organizational Culture in the Federal University of Agriculture, Abeokuta, Nigeria. Multistage sampling technique was used to select 146 respondents with the use of a well-structured questionnaire. Data collected were analysed using descriptive and inferential statistical tools. Results revealed the mean age of the respondents were 39.2 years, majority (58.9%) were males, 89.1% were married and mean income of the employees were ₦81,610 per month. Major human resources functions that influenced organizational culture identified were: recruitment and selection ($\bar{x}$=3.67), performance appraisal ($\bar{x}$=3.67), career planning ($\bar{x}$=3.58), training and development ($\bar{x}$=3.36) and compensation administration ($\bar{x}$=3.25). Also, employees abide with the organisation culture based on the way they preserved and maintained by the employees ($\bar{x}$=3.05) and code of conduct were adhered to in the studied organisation ($\bar{x}$=3.05). More so, significant association existed between marital status (χ^2=44.21, p≤0.05), educational status (χ^2=71.03, p≤0.05), age (r=0.079, p≤0.005), years of working experience (r=0.031, p≤0.005), human resources strategies (r=0.389, p≤0.005) and organizational culture. The study concluded that employees adhere to the code and conduct of the organisation. Modernized equipment for effective job delivery is highly recommended.

Key words**:** *human resources functions, constraints, organisational culture and faculty lecturers*

INTRODUCTION

Human resources comprises the people who make up the workforce (that is procurement and retention of talented employees) of a business sector, organization and economy [2]. Human resources is synonymously used with human capital, talent, manpower, labour, personnel or people who maintain morale within the organisation, creating motivational compensation plans and maintained performance appraisal programs. [3, 13] also said that human resources is more diversified with specialized department attached to it with relative of performing various function by ensuring important information about benefit, laws and employment issues is disseminated and also help them to develop their skills [1]. Human resources also create a way of finding, screening, recruiting and training job applicants, as well as administering employee-benefit programs. More so, human resource functions involves completing all the functions of a human resource department in an effective manner to achieve the overall goals, missions and future aspirations of an organization. [7] described human resource function as the interface between strategic management and human resource management to develop organizational performance. It is the strategy adopted by an organization which aims at integrating its organization's culture, its employees and system by coordinating a set of actions to get the required organizational goals.

Culture simply refers to the underlying values, beliefs, codes of practices that governs a particular group of people in an organisation [1; 4; 11 and 19].

According to [15] organizational culture is the pattern of values, norms, beliefs, attitudes and assumptions that may not have been articulated but shape the ways people in organizations behaves and carried out their normal duties in an organisation. It is concerned with what goes in organizations since it is guided with the rules, regulations,

standards, work procedure, uniqueness of the organization and management of resources [18]. Therefore, a supportive culture is considered as a motivational instrument which promotes organizational growth and employee's productivity [9]. Based on this, the study addressed the specifically influence of human resources functions on organisational culture at Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. The objectives were to: ascertain the personal characteristics of the employees, identifying various human resources functions, determine various organisational culture and identify the constraints faced by the employees in the study area.

MATERIALS AND METHODS

The study area

The study was carried out at the Federal University of Agriculture Abeokuta (FUNAAB), Ogun State, Nigeria. The Federal University of Agriculture Abeokuta is one of the three agricultural institutions established by the Federal Government of Nigeria, with the acronym UNAAB till 2011 when Federal was added to its name. FUNAAB was established on January 1, 1988 by the Federal Government. FUNAAB was one of the first two Universities of Agriculture created and the other is located in Makurdi. The University started off from the old campus of Abeokuta Grammar School, Isale-Igbehin near the city centre. In December 1997 it moved to its permanent site on a 10,000 hectare campus which is located next to the Ogun Osun River Basin Development Authority on the Abeokuta-Ibadan road in the North Eastern end of the city, 15 km from Abeokuta city centre.

The Federal University of Agriculture Abeokuta is under Odeda local government in Ogun State. The University has 179 academic programmes made up of 44 undergraduate programmes, 135 graduate programmes which include 22 Postgraduate diploma programmes, 57 Masters Degree programmes and 56 Doctorate degree programmes. FUNAAB presently has a total of 10 academic college

Data collection and analyses

The population of this study comprise of agricultural employees at Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. Multistage random sampling techniques was used to select the respondents form the study area. The research was carried out among 146 respondents. The data for the study were obtained using a structured questionnaire. The questionnaire was structured into sections to generate information about personal characteristics, constraints, Human resources functions, and it effect on organisational culture were measured using 5 points Likert rating scale of: Strongly agree =5, agree = 4, undecided= 3, disagree = 2 and strongly disagree =1. Descriptive and inferential statistics were used for data analysis. Descriptive statistics included frequencies, percentages, mean and standard deviation. Pearson Product Moment Correlation and Chi-square analysis was used to determine effect of human resources functions on organisational culture.

RESULTS AND DISCUSSIONS

Table 1 presents the mean age of the respondents was 39.2 years, with less than half (48.8%) of the employees within the ranges of less than or equal to 40 years. This means that the employees were still at their youthful and vibrant age for work. This result supports the findings of [10, 12 and 17] who reported that most of the Agricultural employees in Nigeria were in the age range of 20-40 years. Also, more than half (58.9%) of the respondents were male while 41.1% were female. This indicates that there are more male employees as compared to female employees in the studied institution. Almost (89.1%) of the respondents were married, while 10.9% were single. This is in congruence with findings of [6] who was of the opinion that a great importance is attached to the marriage institution in Nigeria. It is wordy to note that simple majority (50.0%) of the respondents had PhD while, 32.8% had MSc. This implies that most of the employees had doctorate degree in the studied organisation. The mean income of the employees was #81,610.00 per month while

the mean years of experience was 12 years and this results is supported by [5] who observed that long-term employees generally have higher productivity and efficiency on the job than newer employees, due to their length of experience with their respective firm.

Table 1. Distribution of respondents by their personal characteristics

Variables	Freq.	Percent	Means
Age(years)			
Less than or equal to 30	11	7.8	39.2 years
31-35	28	19.7	
36-40	31	21.3	
41-45	29	19.7	
46 and above	46	31.5	
Sex			
Male	86	58.9	
Female	66	41.1	
Marital status			
Married	130	89.1	
Single	16	10.9	
Educational status			
.PH/PhD	73	50.0	
Msc	48	32.8	
Bsc	25	17.2	
Monthly income(#)			
Less or equal to 100,000	21	14.3	
101,000-150,000	59	40.4	#81,610
Above 151,000	66	45.3	
Years of working experience(years)			
Less or equal to 5years	18	12.3	12 years
6-10	42	28.7	
11-15	56	38.4	
16 and above	30	20.6	

Source: Field Survey, 2017

Human resources functions was explored during the cause of the study. Based on this human resources functions identified were: employees applied for their job ($\bar{x}$=4.76) and their duties and responsibilities are well-defined ($\bar{x}$=4.25). Also, they are encouraged to participate in workshop and seminar ($\bar{x}$=4.23), the organization places the right person for the right job ($\bar{x}$=4.09), constructive feedback makes work better ($\bar{x}$=4.03), selection of candidates is strictly based on merit ($\bar{x}$=3.81). This agrees with [16] who explains that employees who are well educated can share their knowledge and skills while using their creativity to understand and improve the morale and relationship in an organization.

Table 2 also revealed that, training enhance employees knowledge and skills ($\bar{x}$=3.76), employees get motivated based on promotion ($\bar{x}$=3.75), responsibilities and duties assigned are within employees capacity ($\bar{x}$=3.55), employees career is well planned ($\bar{x}$=3.52), training contents are relevant to the changing needs ($\bar{x}$=3.43), respondent in good standing always receive maximum of salary grade ($\bar{x}$=3.41). This support the findings of [17] who asserts the structure of an organization, the organizational culture and human resource practices have an impact on the organization system at all levels.

Table 2. Distribution of respondents by human resources functions

Human resource functions	Means	SD
Employees applied for their job	4.76	0.43
Duties and responsibilities are well-defined	4.25	0.71
They are encouraged to participate in workshop and seminar	4.23	0.96
The organization places the right person for the right job	4.09	0.92
Constructive feedback makes work better	4.03	0.75
Selection of candidates is strictly based on merit	3.81	0.39
Training enhance employees knowledge and skills	3.76	1.06
Employees get motivated based on promotion	3.75	1.12
Responsibilities and duties assigned are within employees capacity	3.55	1.18
Employees career is well planned	3.52	0.88
Training contents are relevant to the changing needs	3.43	1.04
Respondent in good standing always receive maximum of salary grade	3.41	0.99
Alternative staffing methods	3.40	1.33
High turnover rate due to human resource planning	3.40	0.92
Additional inputs of employees get rewarded	3.28	1.24
Satisfactory policies implemented in the organization	3.27	0.96
Provision of comprehensive compensation and benefit program	3.25	0.97

Source: Field survey, 2017

In addition, alternative staffing methods ($\bar{x}$=3.40), high turnover rate due to human

resource planning ($\bar{x}$=3.40), additional inputs of employees get rewarded ($\bar{x}$=3.28), satisfactory policies implemented in the organization ($\bar{x}$=3.27), provision of comprehensive compensation and benefit program ($\bar{x}$=3.25), knowledge acquisition through training to include social skills and problem solving ($\bar{x}$=3.24). This agrees with [18, 20] who affirmed that compensation and benefits are the most basic elements that encourages employees' inputs as well as performance.

Different organisation with different culture based on this organizational culture exhibited by employees in the study area was explored during the course of the study. Major organisational culture identified in the study area were: traditions of the organization are preserved and maintained ($\bar{x}$=3.05), adherence to code and conduct ($\bar{x}$=3.05) and familiarization with the standard operating procedure ($\bar{x}$=3.00).

This agrees with [8] who was of the opinion that rules and regulation helps organization to restrains employees behaviour.

Table 3.Distribution of the respondents by various organizational culture

Cultural Statements
Traditions of the organization are preserved and maintained
Adherence to code and conduct
Familiarization with the standard operating procedure
Employees were cultured based on healthy competition among them at their workplace
Extract the best out of each team member
Limited concern about employees welfare by management
Frequent punishment of staff due to complicated laws, rules and regulations
Rules set out within the organization are practical
The organization decides the ways employees interact at their workplaces
Allowances, fringe benefit and career development made provided for only employees having symbol higher status and authority within the organization
The organization's culture brings all the employees on a common ground

Source: Field survey, 2017

More so, employees were cultured based on healthy competition among them at their workplace ($\bar{x}$=2.99), extract the best out of each team member ($\bar{x}$=2.97), limited concern about employees welfare by management ($\bar{x}$=2.93) and frequent punishment of staff due to complicated laws, rules and regulations ($\bar{x}$=2.92). This results is in line with the assertion of [21] who said that organizational culture is a form of cohesive effect on organization to generate a sense of loyalty among employees and turn recognizable organizational value to a social glue.

The results of Chi-square and Pearson Product Moment Correlation Table 4 shows significant association/relationship existed with marital status (χ^2=44.21, p≤0.05), educational status (χ^2=71.03, p≤0.05) and employment status of employee (χ^2=21.77, p≤0.05), age (r=0.079, p≤0.005) and years of working experience (r=0.031, p≤0.005), human resources functions (r=0.389, p≤0.005) and organisational culture. The implication of this results is that irrespective of the age an educational status of the studied employees, adherence to the culture of the study area was the ultimate [21]. This results is in line with [14] who argue that bad and poor culture of the organization will lower the level of job satisfaction and reduce employees' productivity in an organization.

Table 4. Test of relationship between independent variables and organizational culture

Variables	χ^2	Df	r	P	Decision
Marital status	44.21	2		0.03	S
Educational status	71.03	3		0.04	S
Employment status	21.17	1		0.04	S
Age			0.079	0.00	S
Years of working experience			0.031	0.004	S
Human Resources practices			0.389	0.001	S
Constraints			0.337	0.003	S

Source: Field survey, 2017.

CONCLUSIONS

The study concluded that management of the institution always place a strong emphasis on providing a proper and clearly specified job description and job profile prior to recruiting and selection of recruited applicants. It was also discovered that employees familiarise

themselves with the norms, values, etiquettes, rules and regulations that revolve around their work environment. The study further concluded that employees believed in the culture of the organization, it extracts the best out of them to perform better as a team, promote healthy competition among employees and allow them to stand on a common ground. It becomes paramount for any organisation to emphasis on the rules and regulations meant to govern the affairs of employees should be flexible so as to accommodate dynamism from employees. In addition, the organization can strategically get latest equipment and facilities, provision of adequate transportation and provision of incentives through internally generated funds.

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EFFECT OF WELFARE SCHEME ON EMPLOYEE'S JOB SATISFACTION IN SELECTED RESEARCH INSTITUTE OF SOUTHWEST, NIGERIA

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Abstract

The study determine the effect of welfare scheme on employee's job satisfaction in Cocoa and Forest Research Institute of Nigeria, Southwest, Nigeria. Three hundred and twenty five employees were selected through simple random sampling techniques with the use of interviewed guide. Data collected were analysed using different statistical tools. Results revealed that the mean age of the employees was 38years, more than half (56.4%) of the employees were male, 32.9% and 52.1% were married. The result also revealed major welfare services as flexibility of work schedule ($\overline{x}$= 2.54), access to holiday and tours ($\overline{x}$= 2.33), availability of soft loan ($\overline{x} = 2.17$), health services ($\overline{x}$ =2.11) and compensation for non-working period ($\overline{x} = 2.09$). the result also revealed that 76.3% of the employees had high level of satisfaction in the study area. Significant relationship existed between sex ($\overline{x} = 106.2$), religion ($\overline{x} = 104.9$, p<0.05), rank ($\overline{x} = 124.4$,p<0.05), welfare services($r = 0.47$,p<0.05) and employees` job satisfaction. Access to holiday and tour after work enhance employees` job satisfaction. This study recommend that adequate facilities and feeding allowance should be provided for the employees.

Key words**:** *welfare scheme, agricultural employees, job satisfaction and challenges*

INTRODUCTION

The main reason of hired an employee is to serve an organization better in achieving its targeted goal. This set of hired employee must be retrained and maintained by the organization through various means in order to ensure the sustainability of such organization. For employee to remain glued to a particular staff such workforce needs different facilities such as welfare and environmental factors that will improve their mode operation with time [1]. Welfare facilities are designed to take care of the well-being of the employee either by the management or by collaborative effort of different group within the system. Welfare is a corporate attitude or commitment of the organization in respect of workforce safety or being happy [6]. Welfare facilities contribute to better work and pull the interest of the employee-employer together. It is worthy to note that if workers interest are pulled together, this will ginger workers to work and create better environment for greater performance among the workforce. According to [7] employee who are well motivated through different welfare facilities will also contribute their quota which will reflect in the achievement of organizational goals. Employee's job satisfaction has been defined in so many different ways. Some believe that it is simply how content an individual is with his or her job [4, 15]. It is a multi-dimensional psychological responses to the job itself. According to [16] "Employees attain satisfaction when their needs are met. Other scholars have also noted that job satisfaction measures vary in the extent to which they measure feelings about the job or cognitions about the job (cognitive job satisfaction). [2] opined that employees' moods and emotions at work are also related to overall job satisfaction which can be positive or negative emotions. The study focus specifically on effect of welfare scheme on employees' job satisfaction in Cocoa and Forest Research Institute of Nigeria.

MATERIALS AND METHODS

This study was carried in two selected research institute in southwest Nigeria (Cocoa Research Institute of Nigerian CRIN and Forestry Research Institute of Nigeria FRIN). CRIN founded in 1964, and CRIN was originally a branch of the West Africa Cocoa Research Institute (WACRI), with headquarters at Tafo, Ghana. The Institute now has its headquarters at Idi-Ayunre, near Ibadan. The cocoa research institute in Oyo state was established by the Federal Government of Nigeria through the Nigeria research institute act of 1964. The Act established research institute for cocoa, palm oil, coffee, and cola. CRIN was established to promote and improve the productivity and of cocoa and its products in Nigeria and globally. Also, The Forestry Research Institute of Nigeria was established in 1973. It has its headquarter in Ibadan, Oyo State. The institution is mandated to conduct research has eight functioning departments. The vision is to ensure true scientific research activities and man power development, sustainable forest resources production, management utilization, biodiversity conservation, forest based raw materials provision, food production and security through agro forestry and wild life employment opportunities thereby alleviating poverty, and environmental conservation and management.

Data collection and analysis

The population of this study comprise of agricultural employees of Cocoa Research Institute of Nigerian (CRIN) Oyo State, Nigeria Multistage random sampling techniques were used to select the respondents form the study area. The research was carried out among 325 respondents, data for the study were obtained using a structured questionnaire. The questionnaire was structured into sections to generate information about the employees, welfare scheme and it effect on employee's job satisfaction were measured using 5 points Likert type rating scale. Data were analysed and presented in tables. Regression analysis was used to determine effect of welfare scheme on employees' job satisfaction.

RESULTS AND DISCUSSIONS

It is wordy to note that the mean age of the employees were 38 years and 46.3% of the employees fall within the range 36 – 40 years (Table 1).

Table 1. Distribution of respondents by their personal characteristics

Variables	Frequency	Percentage	Mean
Age (years)			
Less than 30	122	37.1	38 years
31-35	84	25.6	
36-40	68	20.7	
Greater than 40	56	17.0	
Sex			
Male	185	56.4	
Female	143	43.6	
Educational status			
B.Sc	108	32.9	
HND	80	24.4	
OND	40	12.1	
MSc	74	22.6	
PhD	28	8.5	
Marital Status			
Married	256	78.0	
Single	72	21.9	
Religion			
Christianity	200	61.0	
Islam	72	39.0	
Income(₦)			
Less than 100,000	127	38.7	₦107,692.00
101,000-1500,000	108	32.9	
>150,000	93	28.3	

Source: Field survey, 2016

This result implies that the employees were still at their youthful and vibrant age for work. This result supports the findings of [2, 10], who reported that most of the most Agricultural employees were within this age range of 30 – 40 years. Also, majority (56.4%) of the employees were male while, 43.6% were female. This implies that there are more male than female working at the institute. This results is corroborated by the assertion of [3, 15] who asserted that most research institute in Southwest Nigeria is constitute with male staff. More so, it is wordy to note that 32.9% of the employees had BSc as their educational qualification. Majority (78.0%) were married while, 21.9%

were single which an indicator that most employees were married is. Most (61.0%) of the employees were Christians while, 39.0% were Muslims.

The result in the Table 2 below shows that majority of the respondents affirmed that the welfare services provided by the management of their organisation were: Security services ($\overline{x} = 2.87$), accommodation ($\overline{x} = 2.79$), transportation and canteen services ($\overline{x}$ =2.78), maternity leave ($\overline{x} = 2.68$), training and education facilities ($\overline{x}$ =2.61) and retirement benefits ($\overline{x} = 2.59$). This implies that the organisation had made all these welfare package available to cushion any challenges that might happen suddenly. That is availability of accommodation and transportation system will make the employee to be more relax and discharge their duties efficiently and have strong attachment with the organisation. This results is in line the assertion of [5] who asserted that employee's welfare includes provision of relaxation centers, and works' canteen together with various saving schemes.

Table 2. Distribution of respondents by types of welfare scheme

Welfare scheme	Mean	SD
Provision of security services	2.87	1.90
Provision of accommodation	2.79	1.65
Provision of transportation and canteen services	2.78	1.55
Availability of maternity leaves	2.68	1.43
Availability of training and education facilities	2.61	1.39
Provision of retirement benefit	2.59	1.28
Compensation for non-working periods	2.43	1.26
Provision of insurance policies	2.33	1.18
Provision of health and welfare services	2.21	1.08
Provision of counselling services	2.01	0.98

Source: Field survey, 2016

Ability of the employee to remain in an organization depends on how satisfied they are with organization [2] Table 3 shows the result on the finding of employees' job satisfaction in the studied area. Based on this employees derived their satisfaction through: flexibility in work scheduling ($\overline{x} = 2.54$) and opportunities for promotion ($\overline{x} = 5.53$). this result is in line the report of [8, 13, 16] who said employees become committed when they get promotion and this gives them utmost satisfaction.

Also, other indicators were relationship with co-workers ($\overline{x} = 2.46$) , opportunities to utilize their skills and talents within and outside the organization ($\overline{x} = 2.43$).

This result is supported with the findings of [14]and [9]who were of the opinion that job become interesting if the workforce can be allow to fulfil their obligation with less supervision. Few of the studied employees were averagely satisfied with relationship with supervisors ($\overline{x} = 2.24$), opportunities to repeat task ($\overline{x} = 2.33$), and location of work at hand ($\overline{x} = 2.28$). this is also in line with [11] who was of the opinion that indicators mentioned above will improve the interest an employee and led to better satisfaction. It necessary to note that the level of employee's job satisfaction is high in the studied organisation.

Table 3. Distribution of level of employees' job satisfaction

Statements	Mean	SD
Flexibility in scheduling	2.54	0.50
Opportunities for Promotion	2.53	0.66
Amount of paid vacation time/sick leave offered	2.45	1.00
Relationships with your co-workers	2.46	0.70
Hours worked each week	2.43	0.68
Opportunity to utilize your skills and talents within and outside the organization	2.43	0.66
Support for additional training and education both locally and internationally	2.41	0.66
Benefits (Health insurance, life insurance, etc.)	2.36	0.67
Opportunity to redo a task that is not done properly	2.33	0.74
Location of work	2.28	0.76
Relationship(s) with your supervisor(s)	2.24	0.78
Degree of independence associated with your work roles	2.22	0.74
Time given to complete a task	2.20	0.59
Job Security	2.13	0.77
Recognition for work accomplished	2.12	0.80
Opportunity to learn new skills	2.11	0.74

Source: Field survey, 2016

Table 4. Level of job performance

Categorisation	Frequency	Percentages
Low level	18	23.7
High level	58	76.3

Source: Field survey, 2016

The results indicated that there is significant relationship between employees sex (χ^2= 106.211, p<0.05), religion (χ^2= 104.87, p<0.05), and rank (χ^2= 124.484, p<0.05). This results implies there was strong relationship between employee's religion and their welfare packages. Also, significant relationship existed between employees welfare scheme(r = 0.470 P<0.05) and job satisfaction. This results is in line with [12 and 15] who was of the opinion that better welfare scheme will enhance employees' attitude.

Table 5. Test of relationship between independent variables and job satisfaction

Variables	χ^2	df	R	P-value
Sex	106.211	1		0.00
Marital status	40.397	4		0.91
Religion	104.934	1		0.00
Rank	124.484	2		0.00
Position	61.510	1		0.22
Welfare scheme			0.470	0.04

Source: Field Survey, 2016

CONCLUSIONS

The welfare measures in the studied organization involves various aspect that helps the employee to argument their monthly package form the government. Based on this, the study concluded that employee are satisfied because the received batter welfare package on security, transportation, maternity leaves and training both at local and international. Also, employees had high level of job satisfaction in the studied organisation. It will become more important if the organisation or labour union can intensify more on welfare package in order to better the life of their members. Also, individual bodies can also be of help by proving more fund that will allow many members to benefit from the package at the same time.

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FORECASTING THE DEVELOPMENT OF AGRICULTURAL PRODUCTION IN THE CONTEXT OF FOOD SECURITY

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Abstract

The urgency of this study is substantiated by the problems related to forecasting the development of the national food market and the need to increase the capacity of the food security system. The problem becomes especially urgent due to the need to improve its sustainability and competitiveness. That is why in order to solve the problems of developing the national food security system, it is important to understand strategic benchmarks where the forecasts are considered to be especially important substantiated development benchmarks. The reality level of substantiating parameters of the food market development in the forecast models depends on the degree of accounting resources of the food commodity groups, and the opportunities for their forecasting are the basis for the reality of the forecast development scenarios. That is why the approach offered in the article assumes the solution to an urgent and timely problem. The goal of this article is to substantiate methodological approaches to commodity group forecasting of the food market development as the most objective in the system of strategic food security management, and based on this, to substantiate offers on developing the national food security system. Defining strategic long-term forecasts of the national food security system development and parameters of the food market based on them is an important area of scientific studies based on a comprehensive analysis of the agro-food market's activity, identifying the existing problems and developing offers on improving management instruments. The objects of the study are strategically important commodity groups of the production food subsystem of the national economy and food resources of the market.

Key words**:** *agriculture, import substitution, forecasting, food security, grain*

INTRODUCTION

The urgency of this study is substantiated by the problems in the strategy of the further development of the national food security system. Under the existing circumstances, the revealed imperfection is related to the insufficient scientific substantiation of the methodology to forecast the parameters of the production subsystem: the methods used to forecast the parameters of the national food security system development do not fully take into account the peculiarities and resource potential of the production subsystem by food groups. Therefore this problem becomes especially important in the context of the sanctions regime and the growing competition. The need in the objectivity and reality of the forecast models in the strategy of food security management under these conditions seems to be a factor that solves the problems on further increase in the resources of the food market [9].

The need to take into account the principles of predictability in the system of strategic management measures is indicated in Decree of the President of the Russian Federation No. 120 dated 30.01.2010 and the Doctrine of Food Security of the Russian Federation dated November 28, 2008, and are formalized in the State Program for the Development of Agriculture and Regulation of Agricultural Products, Raw Materials and Food Markets for 2008-2012. [5, 7].

Legislatively the consistency and predictability principle is applied in measures

on implementing Resolution of the Russian Government No. 717 dated 14.07.2012 "On the State Program for the Development of Agriculture and Regulation of Agricultural Products, Raw Materials and Food Markets for 2013-2020". Besides, this principle is applied in the National security strategy of the Russian Federation until 2020 approved by Decree of the President of the Russian Federation No. 537 dated May 12, 2009. In accordance with the orders of the President of the Russian Federation and the Government of the Russian Federation, measures were initiated to improve the forecasting mechanisms stated in the Concept of Long-Term Socio-Economic Development of the Russian Federation until 2020 (approved by Order of the Government of the Russian Federation No. 1662-r dated November 17, 2008) [4, 14].

Thus, the issues on improving approaches to forecasting in the system of measures on strategic management of the national food security system and food market development are an urgent and timely problem.

Today, long-term trends in prices for agricultural products have strategic consequences for food security. They are as important as the trends related to short-term price leaps for the trend. In their work Raushan Bokusheva, Hockmann Heinrich and Subal Kumbhakar [3] studied the latest generalizing market forecasts for different scenarios, and then analyzed data on how trade policy restrictions are usually changed to prevent national markets from short-term fluctuations in international prices around their long-term trends.

It is known that over the last 50 years the international agricultural trade has been developing rapidly. In particular, in the 1960s, analytical studies were focused on the crisis in the global agriculture caused by the policy of supporting domestic prices. There were attempts to measure the results caused by the national policy in developing countries and to form a model of their impact on the world agricultural markets. T. Josling, K. Anderson, A. Schmitz, and S. Tangerman [10] developed instruments to explain trends and fluctuations in world prices and consequences of the crisis on food markets. They also formulated tasks for the future, including analysis of trade based on consumer preferences for certain production methods and in terms of understanding the impact, i.e. mitigation of the consequences related to the climate change, and, accordingly, the formation of forecasts on the adaptation of food markets to it. According to the authors, this paper specifies quite relevant instruments to explain trends and fluctuations in world prices and consequences of the crisis on food markets.

It is possible to distinguish the article by N. Farhadi and S. Moosavi [6] as an example of studying the forecast of the interaction between investments in an agrocompany and competition in the industry. The authors selected a statistical aggregate that consists of all companies listed at the Teheran stock exchange from 1989 to 1993. 129 companies were selected as a sample for the study. The work used a multidimensional regression. The generalized estimation was carried out by the least squares method (EGLS). The data of the obtained model and the estimated developed hypothesis were verified. The results show a considerable and direct relationship between them. The use of the multidimensional regression model, as well as the generalized estimation approach by using the least squares method, is of great scientific interest.

In their work Cloé Garnache, Pierre Mérel, Richard Howitt and Juhwan Lee offered a new information method for calibrating the shadow values of constraints in positive mathematical models of agricultural supply programming [8]. The shadow values are chosen to minimize the deviation of the model from the observable costs related to the activity and data input, which improves the informational basis of the calibrated model. The supposed elasticity of demand for nitrogen minimally depends on the choice of shadow values. However, the predicted environmental results differ, because this choice has the impact on the distribution of nitrogen in regions and cultures. In the work, the mathematical model of agricultural supply programming is urgent.

In their work K. Anderson, S. Jha, and S. Nelgen summarize the latest forecasts of food

markets up to 2030 under various scenarios and then analyze data on how trade policy restrictions are usually changed to protect national markets from short-term fluctuations of international prices around their long-term trends. The authors argue that long-term trends in prices for agricultural products have political consequences for food security, which is as important as the trends related to short-term price leaps for the trend [2]. This work is of considerable scientific interest because it contains a methodology for determining long-term trends.

Such researchers as A.I. Altukhov, V.V. Drokin, and A.S. Zhuravlev consider today's fundamentally new social and economic situation in the agrarian area [1]. In their opinion, it does not fit into the framework of the current national agrarian policy as a long-term instrument for the economic regulation of the agro-food market and state support for the agrarian sector. It is possible to ensure food security based on import substitution in the context of globalization of national agro-food markets under macroeconomic conditions that contribute to the development of the competitive agricultural sector [11]. The main reason constraining the development of the industry is the nonequivalent interbranch exchange that is not favorable for agriculture. The article offers and tests the author's model (variant) of the methodical scheme for estimating the impact of price interindustry relations and state financial support (in the form of subsidies) of agricultural organization on their profitability formation [13].

MATERIALS AND METHODS

It is important to understand trends (forecasts) of the parameters of problem sectors of the agro-food market that are based on a comprehensive analysis of the activities of these markets, identifying the existing problem sectors and developing offers for improving management tools.

The study objects are the most important problems of strategic development of food groups and resources of the food market.

The materials of this study include the statistical data of the food product groups under study that are found in public sources and on official websites, as well as materials of the food groups submitted to the authors under official requests made within the state task.

The conducted research used such methods as analysis and comparison, induction and deduction methods, graphical analysis method, and the generalization method. Based on assessing methodological approaches, defining production opportunities and the capacity of the food market, the authors offer a system of measures to solve the above problems. It consists of the following stages:

– Stage 1: collecting and processing the initial information,

– Stage 2: developing methods to estimate the capacity of the agro-food market,

– Stage 3: developing the forecast of the food market development, and

–Stage 4: developing offers on the elimination of shortcomings.

At the first stage, it is necessary to carry out the following activities: to obtain official data on the food market by requesting Rosstat or marketing agencies, and adding the volume of the informal market (35-40%)to them; to collect and to analyze statistical data on the population size; and to calculate the volumes of security for each commodity group per person.

The second step of the first stage is to systematize data, to make up grouping and analytical tables, dynamic series of analyzed indicators, diagrams.

This stage of the information analysis is preparatory because it makes the quantitative and qualitative estimation of the food market capacity.

The third stage is to define production opportunities and potential capacity.

The potential capacity will be interpreted as the maximum possible sales volume. At the same time, the volume of sales is a set of potential consumers who buy food products based on physiological standards of consumption. However, at the same time, the potential capacity of the food market cannot be achieved, because consumers have certain

restrictions: the profitability of the population, financial constraints, consumption limitations, etc.

At the fourth stage, the results of the real and potential capacity of the market of the main groups of food products are compared. Using the comparative analysis, it is possible to identify the provision of the potential food product capacity, which allows defining the possibility of exporting this product to other regions, as well as importing deficit products under a considerable excess of the real capacity over the potential.

RESULTS AND DISCUSSIONS

Based on estimating methodological approaches, defining the potential capacity of the food market, the authors offer a system of measures to solve the above problems. It consists of the following stages.

The first stage results in obtaining analytical data that are a basis for defining the potential capacity of the food market.

At the second stage, it is necessary to determine the real capacity of the food market. It is defined as the sum of the volume of production, the volume of import by trade organizations, the volume of surplus in trade organizations and the volume of state reserves, minus the volume of export:

$$E = V_{pr} + V_{im} + V_{surp} + V_{sr} - V_{exp}$$

where: E is the real capacity of the food market,

V_{pris} the volume of food production,

V_{imis} the volume of food import,

V_{surpis} the volume of food surplus in trade organizations,

V_{sris} the volume of state reserves, and

V_{exp} is the volume of food export.

At the same time, these indicators are calculated as the total volume of sales of the product group under consideration.

The third stage is the determination of the potential capacity.

The required capacity will be interpreted as the maximum possible sales volume. At the same time, the volume of sales will be considered as a set of potential consumers who buy food products, based on physiological standards of consumption. However, at the same time, it is impossible to achieve the potential capacity of the food market because consumers have certain restrictions: the profitability of the population, financial constraints, consumption limitations, etc.

When calculating the potential capacity of the food market, annual consumption rates per person or medical consumption rates and the total size of the population are used:

$$C = S_c \times T_P \text{ or } C = S_{mc} \times T_P$$

where: C is the capacity of the food market,

S_c is the standard of food consumption by one person,

S_{mc} is the standard of medical consumption of food by one person, and

T_p is the total size of the population.

The authors think that in order to define the consumption standard more accurately, it is necessary to divide the population of the country into the following groups:

- by the intensity of consumption (with a high, medium, and low degree),
- by age (children, youth, employable population, pensioners), and
- by the territory of residence (urban, rural population).

At the fourth stage, the results of the real and potential capacity of the market of the main groups of food products are compared. Using the comparative analysis, it is possible to identify the provision of the potential food product capacity, which allows defining the possibility of exporting this product to other regions, as well as importing deficit products under a considerable excess of the real capacity over the potential.

It is reasonable to define the capacity of the market of agricultural enterprises on the basis of secondary data of state or regional statistics. The ratio of the turnover of an agricultural enterprise to the capacity of the market gives the market share of this enterprise. The market share of the enterprise can be characterized as an objective indicator that can generalize the result of the competition in the market [12]. A selective

comparison of the main positions of agricultural production and food industry indicates that in most cases the change of the trade balance in physical volumes is considerably compensated by the change in production, but the production growth exceeds the growth in the trade balance only for poultry meat and flour.

To create the terms and conditions for sustainable development and optimal functioning of the food security system, it is necessary to forecast the least efficient factors calculated on the basis of the dynamics of minimum (medical) standards and consumption levels of food groups at average rates (Table 1) and volumes of consumption, production and sales of food product groups in 2013-2016 at minimum and average rates for three groups (Table 2).

Table 1. Dynamics of Minimum (Medical) Standards and Food Consumption at Average Rates for Three Groups

Groups of products	Minimum standards by population groups, (kg per year per person)				Dynamics of food consumption at average rates for three groups (tons)			
	Employable population	Pensioners	Children	Average standard for three groups	Average consumption at average standards for three groups in 2013	Average consumption at average standards for three groups in 2014	Average consumption at average standards for three groups in 2015	Average consumption at average standards for three groups in 2016
Population, thous. people					**143,347**	**143,667**	**146,267**	**146,545**
Bakery and pasta in terms of flour, cereals, legumes, in total	126.5	98.2	77.6	100.8	14,449,377.6	14,481,633.6	14,743,713.6	14,771,736
Potatoes	100.4	80.6	88.1	95.5	13,689,638.5	13,720,198.5	13,968,498.5	13,995,047
Vegetables and melons	114.6	98.0	112.5	108.4	15,538,814.8	15,573,502.8	15,855,342.8	15,885,478
Fruits, berries and grapes	60	45.0	118.1	74.4	10,665,016.8	10,688,824.8	10,882,264.8	10,902,948
Meat and meat products, in total	58.6	54.0	44.0	52.2	7,482,713.4	7,499,417.4	7,635,137.4	7,649,649
Milk and dairy products in terms of milk, in total	290	257.8	360.7	302.8	43,405,471.6	43,502,367.6	44,289,647.6	44,373,826
Eggs	210	200	201	203	29,099,441	29,164,401	29,692,201	29,748,635
Fish and fish products	18.5	16.0	18.6	17.7	2,537,241.9	2,542,905.9	2,588,925.9	2,593,846
Sugar	23.8	21.2	25.8	22.3	3,196,638.1	3,203,774.1	3,261,754.1	3,267,953
Oil	11.0	10.0	5.0	8.7	1,247,118.9	1,249,902.9	1,272,522.9	1,274,941

Source: Compiled by the authors on the basis of the Federal State Statistics Service data (www.gks.ru)

Table 2. Consumption, Production and Sales of Food Products in 2013-2016 at Minimum and Average Standards for Three Groups

Groups of products	Dynamics of food consumption at average standards for three groups (thous. tons)				Production of food products groups in, thous. tons		
	2013	2014	2015	2016	2013	2014	2015
Bakery and pasta in terms of flour, cereals, legumes, in total	14,449.4	14,481.6	14,743.7	14,771.8	18,036	18,162	1,8213
Potatoes	13,689.6	13,720.2	13,968.5	13,995.0	30,199	31,500	33,600
Vegetables and melons	15,538.8	15,573.5	15,855.3	15,885.5	16,109	15,500	16100
Fruits, berries and grapes	10,665.0	10,688.8	10,882.3	10,902.9	2,941.5	2,995.6	2903.3
Meat and meat products, in total	7,482,713.4	7,499,417.4	7,635.1	7,649.6	8,544.2	9,070.3	9,565.2
Milk and dairy products in terms of milk, in total	43,405.5	43,502.4	44,289.6	44,373.8	30,700	30,790.9	30,796.9
Eggs, mln	29,099.4	29,164.4	29,692.2	29,748.6	41,286	41,860	42,571.7
Fish and fish products	2,537.2	2,542.9	2,588.9	2,593.8	3,789	3,725	3,829
Sugar	3,196.6	3,203.8	3,261.8	3,267.9	4,959	5,249	5,743
Oil	1,247.1	1,249.9	1,272.5	1,274.9	3,934	4,976	4,655

Source: Compiled by the authors on the basis of the Federal State Statistics Service data (www.gks.ru)

In order to forecast the indicators of the food production and consumption market taking into account the size of population, Excel and official statistical reporting data for the previous ten years (not more) were used in order to forecast trends for subsequent years.

In the authors' opinion, it is possible to resolve this problem by using the following model (1):

$$H_t = f(X_{t(11)}) + C(X_{t(11)})$$

where: H_{tis} the annual value of the indicator t,

$f(X_{t10})$ is the function of average t (11) for 11years, and
$C(X_{t10})$ is the characteristic of the model that shows the forecasted indicators for future years based on the previous ones; in this case, 11 years.
It is necessary to calculate the function $f(X_{t11})$ as an average.

According to the above analysis of Table 2, the following types of food groups have the greatest deviation from the required minimum: fruits and berries (31.7%), and milk and dairy products (70.7%).
On average the minimum consumption rate for the consumer group "fruits and berries" is 74.4 kg per person. Based on this, their necessary production is calculated (Table 3)

Table 3. Dynamics of Gross Collection, Actual Consumption of Fruits, Berries and Grapes Per Capita

Year	Population, thous. persons	Gross collection of fruits, berries and grapes, thous. kg	Consumption per capita, kg	Required production of fruits, berries and grapes, thous. kg (with a minimum rate of 74.4 kg per person)
Actual indicators				
2003	145,000	3,451,000	23.8	10,778,000
2004	144,200	3,935,000	27.2	10,728,000
2005	143,500	3,710,000	25.8	10,676,000
2006	142,800	2,174,000	15.2	10,624,000
2007	142,200	2,818,000	19.8	10,580,000
2008	142,800	2,669,000	18.6	10,624,000
2009	142,700	3,067,000	21.4	10,617,000
2010	142,800	2,473,000	17.3	10,624,000
2011	142,900	2,927,000	20.4	10,632,000
2012	143,000	2,931,000	20.5	10,639,000
2013	143,300	2,941,500	21	10,662,000
2014	146,090	2,995,600	21	10,869,096
2015	146,267	2,903,300	20	10,882,265
2016	146,545	3,300,000	22.5	10,902,948
2017	146,877	2,880,000	19.6	10,927,649
2018	**146,904**	**3,350,000**	**22.8**	**10,929,658**
2019	**147,500**	**11,000,000***	**74.6**	**10,974,000**
2020	**147,900**	**13,000,000***	**87.9**	**11,003,760**
2021	**148,200**	**13,300,000***	**89.7**	**11,026,080**
2022	**148,500**	**13,500,000***	**90.9**	**11,048,400**

Source: Compiled by the authors on the basis of the Federal State Statistics Service data (www.gks.ru)

At this stage of development, one of the most important problems of the country's food security is the liquidation of disproportions in the structure of food production, the optimization of its quality and the creation of terms and conditions for the competitiveness of the national food security system. It resulted in the following:
–Processes related to the formation and development of a bimodal type of the economic structure of the national food security system characterized by large-scale production (agroholdings), liquidation of the small and medium-sized business sector in agriculture, its underdevelopment in processing, and agro service of the national agroindustrial complex,
–The imperfection of the program-targeted management of the development and functioning of the national food security system, and
–Impact of the globalization of food markets due to entering the WTO and liabilities to further use the potential of the national food security system.
In practice, management of the national food security system development can be explained by its imperfection, taking into account the consistency and predictability principle.
The situation on the food market is characterized by the achieved food security parameters for the main groups of commodity supply, and the inability to achieve them in separate but significant areas (milk, beef meat, vegetables and fruits).

CONCLUSIONS

Based on the study, it is possible to note that the creation of terms and conditions for sustainable development and functioning of

the food security system involves the development of programs that suppose:

•Optimization of the parameters of the economic structure and its formation in regional food security systems by the product type in accordance with the available resource potential and the mechanism for attracting development resources (budget funds, credit sources, citizens' funds),

•Improvement of the mechanism of the program-targeted regulation of the development and functioning of regional food security systems in accordance with the principles of the territorial and product approach instead of the existing territorial and sectoral approach.

A prerequisite for this is the creation of the terms and conditions for the sustainability of rural areas according to parameters of the rural population's employment in order to form a high-quality labor potential.

The problem can be resolved by improving the mechanism of managing the development of the national food security system and activating the innovative approach to organizing the improvement of the mechanism for regulating the food market development.

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RURAL COMMUNITIES, AN IMPORTANT FACTOR FOR THE SOCIAL AND ECONOMICAL DEVELOPMENT OF THE VILLAGE IN CĂLĂRAȘI COUNTY

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Abstract

The rural areas possess a substantial potential of growing and t have a vital social role in the social and economic life of every country. The social and economic life in the rural areas is carried out via rural communities. The paperwork is presenting the results of a study which was performed in rural communities of Călărași County regarding the public perception of the inhabitants on the development of the rural communities. The criteria of the analysis were the following: the locality, the age, the level of education, the gender and the professional status. The study emphasized the fact that the model of the community's development may be considered as a local specific model, which is the result of some complicated processes that required a long- term evolution.

Key words**:** *rural development, citizens' involvement, rural community, active participation*

INTRODUCTION

Rural communities are communities on a voluntary basis, which help the institutions with the sustainable continuity of the social and economic life [11].
From the administrative point of view, the Romanian territory is organized, at NUTS5 level in 320 localities (of which 103 municipalities – the most important cities) [8] which forms the urban areas and 2,861 villages, which represent the rural area (at 31 of December 2011) [9].
On their turn, the villages are most of them formed from more villages (12,957 villages).
The towns and the villages are clustered in counties (NUTS3 level) which hold administrative functions.
The 42 counties are clustered in 8 regions of development (NUTS2), which do not have administrative functions. [3]
The rural areas of Romania cover 87.1% of its territory and 47.2% from its population, 8.98 million of inhabitants 2011 [5].
The County's surface is 5,088 square kilometres, representing 2.1% of the Romanian territory, Călăraşi County occupying rank 28 considering the size among the country's counties.
The population of Călăraşi County is formed of 308,655 inhabitants (1.64% of the country's population) [6].
From the point of view of the distribution on the areas of residence 61.55% are living in the rural areas 38.45% of the county's population lives in the urban areas [1].
The level of the population's urbanization being under the average of the country, which is 46.1% [6].

MATERIALS AND METHODS

Starting from the assumption that the citizens' participation represents an important marker in the rural development [10], it was carried out during the year 2017, a survey, on a questionnaire basis in the rural communities from Călărași County in order to capture the public perception on the influence of the rural communities (citizens/organizations) regarding the rural development.
The research was carried out through the inquiry method on the questionnaire basis, which represents an instrument of research consisting of a series of questions and of

answers based on quality (the following were used: very much, a lot, little, not at all) in order to collect the information.
The analysis of the data from the questionnaire was carried out with the help of the conformity test $\chi 2$ ("hi-square") which can be applied to any statistic distribution.
$\chi 2$ test allowed the clustering and the calculation of the qualitative answers' significance on the criteria of the respondents' characterization (village of residence, age, level of education, sex, professional status). The significance was calculated for the probabilities of transgression. <0.05%, insignificant; 0.05, significant (*); 0.01, distinctive significant (**); 0.001, very significant (***)).

The research was carried out in three main villages (Belciugatele, Dragalina and Dragoș Vodă), with 100 respondents and villages with a number of 80 respondents, which were analysed as ~other villages~.
The selection of the respondents was carried out by choosing the fifth house. The author was accompanied by educational staff which knew the inhabitants of the villages.

RESULTS AND DISCUSSIONS

The investigated rural communities present a different level of social and economic development.
They are different as size and stretch and they are positioned in different areas of Călărași County.

Table 1. The structure of the population from the studied villages according to gender, in the year 2016, in Călărași County.

Village	TOTAL POPULATION		MALE		FEMALE	
	No	%	No	%	No	%
Belciugatele	2,247	100,0	1,139	50,7	1,108	49.3
Dragalina	8,597	100.0	4,382	51.0	4,215	49.0
Dragoș Vodă	2,946	100.0	1,458	49.5	1,488	50.5

Data source: INS, 2013 Regional Direction of Statistics- Călărași – Stable population at 1 January 2011[6]

The studied villages have a population of 13,790 people (Table 1), which represents 22.38%, of the total population from Călărași County. (Dragalina with 8.597 inhabitants, Dragoș Vodă with 2.946 inhabitants and Belciugatele with 2.247 inhabitants).
The occupied surface of the three villages is 5,088 ha, which represents 7.55% of the county's surface (Table 2).
The population's density is very different, from 38 citizens/square km in Dragoș Vodă village, to 46.2 citizens/square km in Belciugatele village to 74.4% in Dragalina village.

Table 2. The surfaces and population share and the population's density of the investigated villages, comparing with Călărași County

Village	Total surface		Population		Density	
	km^2	%	Inhabitants	%	Inh./km2	%
Belciugatele	80.14	1.58	2,247	1.58	28.0	46.22
Dragalina	180.71	3.55	8,597	3.55	47.6	78.42
Dragoș Vodă	127.76	2.51	2,946	2.51	23.1	38.01
Total County	5,088	100	308,655	100.00	60.7	100.00

Data source: INS, 2013 Regional Direction of Statistics- Călărași – Stable population at 1 January 2011[6]

In Călărași County the density was of 60.7 citizens/square km (rank 32 on counties)[7], and at the country level of 84.4 citizens/square km (rank 84 in the world)[12].

Analysing the correlation between the rural development and the existence of some strong rural communities, at the village level it is noted that there is a very significant

distinction (***) of the appreciation degree.
(Table 3)

Table 3. The analysis of the correlation between the village development and the existence of some organized communities according to the studied villages from Călăraşi County, in the year 2017

Village	MU	Do you believe that the existence of some strong organized communities can influence the development of your village?				Total	
		Very much	A lot	Little	Not at all	no	%
Belciugatele	No	7	10	32	51	100	26.25
DragoşVodă	No	26	39	30	6	101	26.51
Dragalina	No	86	14	0	0	100	26.25
Other villages	No	38	25	14	3	80	21.00
Total	No	157	88	76	60	381	100
	%	41.21	23.10	19.95	15.75	100	x
Indicators	Test $\chi 2$	Threshold of significance					
	≤	0.2	0.1	0.05	0.01	0.001	
CHIINV (Chi theoretic)	≥	12.24	14.68	16.92	21.67	27.88	
CHIINV (Chi calculated)	247.99					****	
Pearson Coefficient	0.628						

Data source: Călin –Năstase Mariana, 2017, Questionnaire- rural communities, Călăraşi County [2]

The inhabitants of Dragalina and Dragoş Vodă are the ones which appreciate very much the positive influence of the strong organized communities in the development of the village of which they belong to.

The respondents of the questionnaire have declared that they are consulted by the local public authorities, there is decision transparency and an important number have participated in an active manner to the implementation of the local projects, meanwhile the level of acknowledgement of the influence and the impact of the communities in the rural development is low represented in Belciugatele village.

Table 4. Analysis of the correlation between the village development and the existence of some organized communities according to the respondents' age from Călăraşi County in the year 2017

Age	MU	Do you believe that the existence of some strong organized communities can influence the development of your village?				Total	
		Very much	A lot	Little	Not at all	no	%
Under 30 years	no	22	19	13	12	66	17.32
Between 31-40 years	no	62	25	15	6	108	28.35
Between 41-50 years	no	41	26	21	15	103	27.03
Between 51-60 years	no	18	12	12	10	52	13.65
Over 61 years	no	14	6	15	17	52	13.65
Total	no	157	88	76	60	381	100
	%	41.21	23.10	19.95	15.75	100	x
Indicators	Test $\chi 2$	Threshold of significance					
	≤	0.2	0.1	0.05	0.01	0.001	
CHIINV (Chi theoretic)	≥	20.47	23.54	26.30	32.00	39.25	
CHIINV (Chi calculated)	43.48					***	
Pearson Coefficient	0.320						

Data source: Călin –Năstase Mariana, 2017, Questionnaire- rural communities, Călăraşi County [2]

In this regard, the correlation is appreciated with very much and a lot by 17% of the Belciugatele village's inhabitants, 65% of Dragoş Vodă inhabitants, 90% of Dragalina inhabitants, and 63% of the inhabitants from the other villages.

From the statistical analysis of the answers on the respondents' criteria of age, according the correlation between strong communities and

the development of the village, resulted that the pattern of appreciation is different, such as the differences of the answers are appreciated as very significant (***)(Table 4).

Therefore, the segments of age between 31-40 years old and segments of age between 41-50 years old, they most appreciate and acknowledge the impact of the organized communities on the local development, the first segment (very much and a lot 87 Inhabitants, 81 %) and the second segment (very much and a lot 67 Inhabitants, 65%).

The least appreciates the segment over 60 years (very much and a lot 20 Inhabitants, 38%).

Regarding the statistic distribution of the answers, according to the level of education, concerning the correlation between strong communities and the development of the village, also have resulted different appreciations, respectively the answers appreciated as very significant from the statistic point of view. (***)(Table 5).

Table 5. The analysis of the correlation regarding the development of the village and the existence of the communities organized according to the level of education of the respondents, from Călărași County, in the year 2017

Last graduated school	MU	Do you believe that the existence of some strong organized communities can influence the development of your village?				Total	
		Very much	A lot	Little	Not at all	no	%
1-4 Years of studies	no	3	2	7	1	13	3.41
5-8 Years of studies	no	20	27	19	17	83	21.78
High-school	no	83	44	39	36	202	53.02
University	no	51	15	11	6	83	21.78
Total	no	157	88	76	60	381	100
	%	41.21	23.10	19.95	15.75	100	x
Indicators	Test $\chi 2$	Threshold of significance					
	≤	0.2	0.1	0.05	0.01	0.001	
CHIINV (Chi theoretic)	≥	12.24	14.68	16.92	21.67	27.88	
CHIINV (Chi calculated)	35.63					***	
Coefficient Pearson	0.292						

Data source: Călin –Năstase Mariana, 2017, Questionnaire- rural communities, Călărași County [2]

Thus it can be noted that the appreciations very much and a lot, they grow with the level of education: 38% at1-4 years of studies (5 Inhabitants), 56% 5-8 years of studies (47 Inhabitants), 63% high-school studies (127 Inhabitants) and 79% university degree (66 Inhabitants).

These appreciations confirm the affirmation that "the development doesn't start from goods, but from education, organization and the discipline of humans [4].

Table 6. Analysis of the correlation between the development of the village and the existence of some organized communities according to the respondents' gender, in Călărași County, in 2017

Gender	MU	Do you believe that the existence of some strong organized communities can influence the development of your village?				Total	
		Very much	A lot	Little	Not at all	No	%
Male	no	88	50	45	46	229	60.10
Female	no	69	38	31	14	152	39.90
Total	no	157	88	76	60	381	100
	%	41.21	23.10	19.95	15.75	100	x
Indicators	Test $\chi 2$	Threshold significance					
	≤	0.2	0.1	0.05	0.01	0.001	
CHIINV (Chi theoretic)	≥	4.64	6.25	7.81	11.34	16.27	
CHIINV (Chi calculated)	8.36			*			
Coefficient Pearson	0.147						

Data source: Călin –Năstase Mariana, 2017, Questionnaire- rural communities, Călărași County [2]

Regarding the distribution on gender, the ones that most appreciate the importance of organized communities and their impact on the rural development are men (60.1%), being

known the fact that in the rural mentality, the rural family model is centred on power and masculine representation, the woman being the one who raises children and doing household (39.9%).
This difference is statistically appreciated as significant (*) (Table 6).

Analysing the statistic distribution of the answers, according to the professional status of the respondents it is noted that there are differences very significant (***) between the modality of the answer (Table 7).

Table 7. The analysis of the correlation between the village development and the existence of some organized communities according to the professional status of the respondents, from Călăraşi County, in the year 2017

Professional Status	MU	Do you believe that the existence of some strong organized communities can influence the development of your village?				Total	
		Very much	A lot	Little	Not at all	No	%
Farmer	no	17	16	13	7	53	13.91
Employee	no	104	44	36	28	212	55.64
Registered unemployed	no	4	5	5	0	14	3.67
Unregistered unemployed	no	5	4	2	2	13	3.41
Without status	no	21	15	12	6	54	14.17
Retired Inhabitants	no	6	4	8	17	35	9.19
Total	no	157	88	76	60	381	100
	%	41.21	23.10	19.95	15.75	100	x
Indicators	Test χ^2	Threshold significance					
	≤	0.2	0.1	0.05	0.01	0.001	
CHIINV (Chi teoretic)	≥	20.47	23.54	26.30	32.00	39.25	
CHIINV (Chi calculat)	48.66					****	
Coefficient Pearson	0,337						

Data source: Călin –Năstase Mariana, 2017, Questionnaire- rural communities, Călăraşi County [2]

CONCLUSIONS

From the analysis of the correlation between strong communities and the village development after the comparison criteria: village, age, level of education, gender, and professional status of the respondents, it results that there are differences among all these criteria that are appreciated statistically as very significant (***), with the exception of the cluster according to the gender, which is significant (*).
In villages, the answers like: very much and a lot, regarding the correlation between strong communities and the village development, register a ratio which ranges between 17% and 90 %.
Between ages the answers like: very much and a lot are contained between 20% and 67%, and according to the gender between 39.9% for the female and 60.1% for the male.
According to the level of education the differences are from 38.4 %, at 1-4 years of studies to 79.5%, to university degree, and according to the professional status from 28.5% to retired inhabitants and unregistered unemployed, to 69.8 % at employees.
According to the given answers it can be considered that the model of the community's development may be considered as a local specific model, which is the result of some complicated processes that required a long-term evolution.

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UDDER MEASUREMENTS AT "ALBA DE BANAT" AND "CARPATINA" GOATS BREEDS

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Abstract

Considering that the form and size of the goat's udder can influence its productive capacity, a series of measurements of certain dimensions of the udder at Romanian breeds Alba de Banat and Carpatina were performed, as follows: large perimeter of the udder, small perimeter of the udder, prior depth of the udder, back deepness of udder, length of udder, length and thickness of nipples. The primary data obtained was statistically processed using statistical functions available in Microsoft Excel and the main statistical parameters were determined: arithmetic mean, standard error of mean and variability coefficient. The udder measurements indicated that, in both breeds, the udder suffers transformations along lactations; thus, with regard to the large perimeter, as well as the small perimeter of the udder, the largest dimension is reached at the 3rd lactation, after which it begins to decrease. These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the quantity of the milk. The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish. The length of the udder is higher at Carpatina by 20.3% than Alba de Banat, suggesting a longer form, but nipples at Alba de Banat are longer (by 9%) and thicker (by 22.7%) compared to Carpatina, so it is better suited to the mechanical milking.

Key words**:** *goats, milk, udder, dimensions, measurements*

INTRODUCTION

The opportunity of these researches is that in the specialty literature on the Romanian goat breeds there are quite a few references regarding the sizes of the udder. The form and development degree of the udder can influence its productive capacity. The sizes of the udder increase in the same time with milk production, to the top of the lactation curve, after that begin to decrease. The results of other researches in this direction have shown that these dimensions are influenced by breed and are positively correlated with the milk production, also depending on the lactation curve [2].

The udder and its characteristics are influenced by several factors such as genotype, growing and management systems applied. The breed is an important factor that determines the production of milk, and in this sense there are different levels of amelioration [9]. Research conducted in Nigeria on local breeds demonstrated that the age of the goat, the lactation phase and the weight of the goats are important factors that have great influence on the udder size [1]. Lactation number influence on milk production, where the evolution is ascending with a maximum at the 3rd lactation, after which, beginning with the 4th lactation, the production starts to decrease, is also confirmed by the research of other authors [4].

MATERIALS AND METHODS

Research has been carried out in the goats' farm belonging to S.C. AGROFAM HOLDING S.R.L., located in Călăraşi County, on the biological material represented by the lactating goats of Alba de Banat and Carpatina breeds.

There were performed 7 types of udder measurements, on different lactations, for 120 goats, of which 60 goats of Alba de Banat breed and 60 goats of Carpatina breed, using the ribbon, as follows [3]:

- The udder's large perimeter - determined as circumference of udder in zone of its grip on abdomen;

- The udder's small perimeter - determined as a circumference of udder in the zone of the nipples grip on udder;
- The anterior depth of udder - size between the zones of udder grip on abdomen, in the anterior part of udder, to the area where nipples are attached to udder;
- The posterior depth of udder - dimension between the zone of udder grip on abdomen, in the back part of udder, by the point of nipples attachment to the udder;
- The udder's length - dimension between anterior part of udder's grip on abdomen, by posterior part of udder's grip on abdomen;
- The nipples length - determined from their gripping area on abdomen, to their top;
- Nipple thickness - measured as their circumference.

We should mention that the timing of the measurements was 3 hours before the second milking of the day.

The primary data obtained was statistically processed using the statistical functions available in Microsoft Excel program and the main statistical parameters were determined: arithmetic mean, standard error of mean and coefficient of variability, following the relations:

Arithmetic mean [5]: $\overline{X} = \frac{\sum_{i=1}^{n} Xi}{n}$

Standard error of mean: $s_{\bar{x}} = \pm \frac{s}{\sqrt{n}}$

Coefficient of variability: $V\ \% = \frac{s}{\overline{X}} \times 100$

The test of differences statistical significance between averages was carried out with the help of ANOVA Single Factor, within the Excel program.

The measurements provided clues about the form and sizes of the udder as well as mechanical milking suitability, being an originality aspect of the research in the domain of goat rising in our country.

RESULTS AND DISCUSSIONS

Analyzing the data in Table 1, illustrated in Figure 1, it is noted that with regard to the large perimeter of the udder and the small perimeter of the udder, the largest dimension is reached at the 3rd lactation [8].

Practically, the evolution of these two dimensions indicates that the udder undergoes transformations along lactations, so that after the third lactation begins to diminish.

The prior depth of udder increases permanently by the fourth lactation (by 33.3%), and regarding the back depth of udder, it has a continuous dimensional evolution until the third lactation, after which it begins to decrease.

The length of the udder reaches the maximum size at the 4th lactation (30.20 cm), 57.3% higher than the first lactation.

Table 1. Udder's sizes at Alba de Banat, on lactations (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$			
	First lactation	Second lactation	Third lactation	Fourth lactation
Large perimeter of the udder	41.60± 1.86	43.40± 1.03	49.20± 3.06	47.60± 0.68
Small perimeter of the udder	37.40± 1.08	41.60± 2.42	47.20± 0.86	44.40± 0.40
Prior depth of the udder	6.00± 0.32	6.20± 0.37	7.20± 0.58	8.00± 0.45
Back depth of the udder	12.00± 1.14	15.80± 1.46	18.20± 1.36	17.80± 0.58
Length of the udder	19.20± 0.97	27.60± 1.86	29.60± 1.54	30.20± 1.07
Length of the nipples	8.00± 0.32	8.00± 0.63	10.20± 0.74	7.60± 0.25
Nipples thickness	14.80± 0.58	17.40± 1.03	18.80± 0.66	11.60± 1.03

Source: Own calculation.

These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the amount of milk that for this breed, reached a maximum of 2.3 kg / day during the studied period.

The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish.
Thus, the nipple length of the 3rd lactation (L3) is 27.5% higher than the first lactation (L1), and their thickness is 27% higher at L3 than L1.

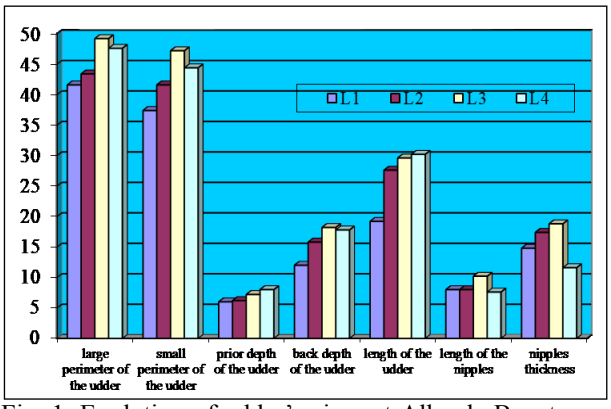

Fig. 1. Evolution of udder's sizes at Alba de Banat, on lactations
Source: Author's calculation.

The test of differences statistical significance between lactations regarding udder's dimensions at Alba de Banat using ANOVA Single Factor shows there are significant differences (P <0.05) between lactations for the large udder perimeter, the udder's prior depth, and the nipples length.
Distinctly significant differences (P <0.01) there are between lactations regarding small perimeter of udder and udder's back depth.
Very significant differences between lactations (P <0.001) there are at Alba de Banat in terms of length of udder and thickness of nipples.

Table 2. The mean of udder's sizes at Alba de Banat (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$	V%
Large perimeter of the udder	45.45 ± 1.12	11.00
Small perimeter of the udder	42.65 ± 1,05	11.03
Prior depth of the udder	6.85 ± 0.27	17.89
Back depth of the udder	15.95 ± 0.78	21.95
Length of the udder	26.65 ± 1.20	20.13
Length of the nipples	8.45 ± 0.34	17.79
Nipples thickness	15.65 ± 0.74	21.17

Source: Own calculation.

The mean, standard error of the mean and coefficient of variability of these sizes parameters of udder at Alba de Banat are shown in Table 2.
The average dimensions of the udder at Alba de Banat breed suggest a globular form of it, with a good abdominal grip, with well-developed nipples, suitable for both manual and especially mechanical milking.

Fig. 2. Goats of Carpatina breed
Source: Photo by author

At Carpatina breed, the same types of measurements were performed, on different lactations, and the results are found in Table 3 and Figure 3.
In this breed, there is also an evolution of the udder's sizes, from the beginning of the productive life to the end of it, or until the maximum lactation (L3).

Table 3. The udder's sizes at Carpatina, on lactations (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$			
	L1	L 2	L 3	L 4
Large perimeter of the udder	35.40 ± 0.51	36.20 ± 2.52	44.80 ± 1.28	38.40 ± 0.93
Small perimeter of the udder	30.60 ± 0.51	40.40 ± 1.12	44.40 ± 1.21	40.40 ± 1.12
Prior depth of the udder	5.60 ± 0.40	9.60 ± 0.40	15.20 ± 1.24	11.40 ± 0.75
Back depth of the udder	12.00 +0.55	16.40 ± 0.40	18.80 ± 0.58	21.40 ± 1.40
Length of the udder	21.60 ± 1.44	29.20 ± 0.74	38.40 ± 0.75	39.00 ± 0.55
Length of the nipples	5.80 ± 0.49	8.40 ± 0.25	9.20 ± 0.37	7.60 ± 0.81
Nipples thickness	9.80 ± 0.37	12.60 ± 0.51	14.40 ± 1.03	14.20 ± 1.43

Source: Own calculation.

The perimeters of udder, the prior depth of udder, as well as parameters of nipples reach the maximum size at L3, then decrease, and posterior depth of udder and its length increase along the lactations.

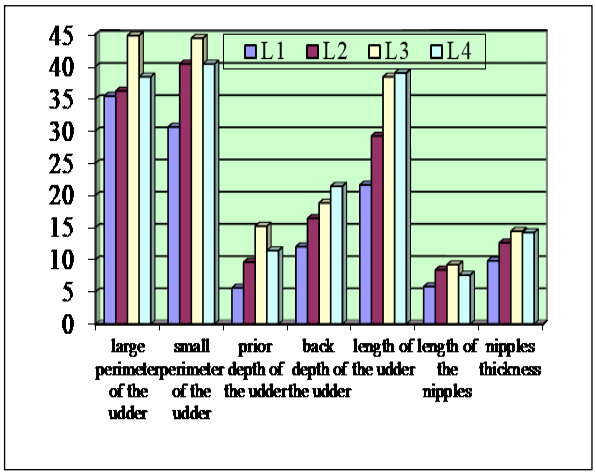

Fig. 3. The evolution of the udder dimensions at Carpatina breed, on lactations
Source: Own calculation.

It can be seen that at L3, the large udder perimeter increases by 26.6% compared to L1, and the small perimeter of the udder increases by 45.1% between L1 and L3. Also, the prior depth of udder is greatly increased, by 171% in the same period, and the back depth of udder increases by 78.3% at the end part of lactations compared to L1.
The length of the udder has also a spectacular evolution, which is 80.6% higher at L4 than L1, surpassing Alba de Banat breed, where the increase is 57.3%.
Also, the length and thickness of the nipples evolves until the 3rd lactation, when the maximum of the productions is reached.
The test of statistical significance of differences between lactations in terms of udder's sizes at Carpatina using ANOVA Single Factor shows that there are insignificant NS differences (P> 0.05) regarding the small perimeter of udder, the prior and posterior depths of udder and the length of udder.
There are also significant differences among lactations (P <0.05) in terms of nipple thickness and distinct significant differences (P <0.01) regarding the large perimeter of the udder and the length of the nipples.

Fig. 4. Goats of Carpatina breed
Source: Photo by author

In Table 4 there are presented the average dimensions of the udder at Carpatina, which show, among other things, that the small perimeter of the udder is actually slightly larger than the large perimeter and the length of the udder is higher than that of Alba de Banat with 5.4 cm.
Also, the depths of the udder are higher at Carpatina than Alba de Banat, all of these indicating a different form from Alba de Banat, where the udder is globular, at Carpatina being in the form of pear, flaccid and not so well gripped by abdomen like the other breed.

Table 4. The mean of the udder's sizes at Carpatina breed (cm) (n = 60)

Specification	$\bar{X} \pm s_{\bar{x}}$	V%
Large perimeter of the udder	38.65±1.07	12.40
Small perimeter of the udder	38.95±1.26	14.46
Prior depth of the udder	10.45±0.87	37.19
Back depth of the udder	17.15±0.88	22.96
Length of the udder	32.05±1.70	23.73
Length of the nipples	7.75±0.38	21.70
Nipples thickness	12.75±0.60	21.12

Source: Own calculation.

Following Figure 5, the udder's average sizes in the two breeds are compared. At Alba de Banat, the large perimeter of the udder is

17.6% higher than Carpatina, and the small perimeter of the udder is 9.5% higher.

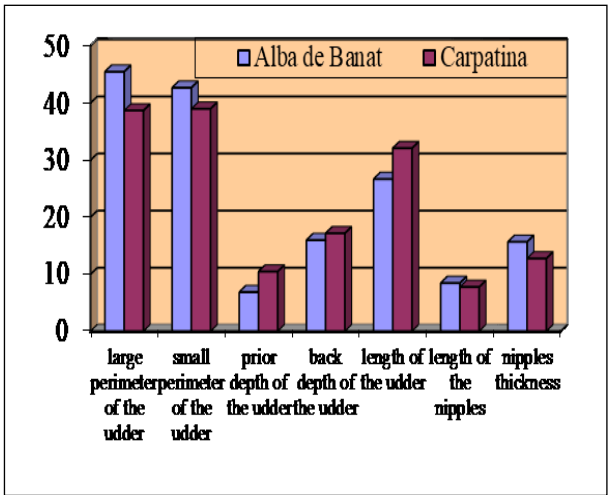

Fig. 5. The average sizes of udder at Alba de Banat and Carpatina
Source: Author's calculation.

The prior depth of the udder at Carpatina is 52.6% larger than Alba de Banat, and the back depth is higher by 7.5%.

Also, the length of the udder is higher at Carpatina than Alba de Banat by 20.3%, suggesting a longer shape, while the nipples at Alba de Banat are longer by 9% and thicker by 22.7 %, compared to Carpatina, thus, they are more suited to mechanical milking.

Statistical significance of differences among the two breed averages indicates that there are insignificant NS differences (P> 0.05) regarding the udder's large perimeter, the back depth of udder and length of nipples.

There are also significant differences (P <0.05) with respect to the small perimeter of the udder and the length of the udder, distinct significant differences (P <0.01) on the thickness of the nipples and very significant differences (P <0.001) regarding the anterior depth of the udder.

CONCLUSIONS

It is necessary to monitor all the categories of factors that determine milk production, in order to positively influence both the top of the lactation curve, the variations and the rate of decline [6].

Udder measurements indicated that, in both breeds, the udder suffers transformations along lactations; thus, with regard to the large perimeter, as well as the small perimeter of the udder, the largest dimension is reached at lactation 3, after that it starts to decrease.

At Alba de Banat, the prior depth of the udder and the udder's length grow continuously until the 4th lactation.

These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the milk quantity produced.

The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish.

The average dimensions of the udder at Alba de Banat breed suggest a globular shape with a good abdominal attachment, with well-developed nipples, suitable for both manual and especially mechanical milking.

Average udder dimensions at Carpatina show that the small perimeter of the udder is slightly larger than the large perimeter, and the length of the udder is larger than Alba de Banat with 5.4 cm.

Also, the depths of the udder are larger at Carpatina than Alba de Banat, all of these indicating a different form from Alba de Banat, where the udder is globular, at Carpatina being in the form of pear, flame and not so well caught by the abdomen as the other breed.

The necessity to implement a strategy for the improvement of goats for dairy production is due to the increased interest of Romanian breeders for this species, as well as the opportunity for export of goat milk products to the European markets [9].

By launching an improvement program based on performance and growth technologies, the efficiency of exploitation of goats will increase [10].

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TECHNICAL EFFICIENCY OF SHEEP FARMING IN TURKEY: A CASE STUDY OF ISPARTA PROVINCE

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Abstract

The purpose of the study was to analyze the technical efficiency of sheep farming using Data Envelopment Analysis (DEA) in Isparta province in Turkey. The data used were collected from 80 farmers using the stratified sampling method by means of a questionnaire. The technical efficiency of the sheep farming varied between 0.63 and 1.00. The mean efficiency of farms was calculated to be 0.41 and 0.48 for constant and variable returns to scale assumptions, respectively. The greatest slacks were defined as veterinary-drug costs and labour use. The most significant factors affecting efficiency of sheep farming were education, family and hired labour, AU, milk yield per sheep, age at separation (years) and number of lambs per sheep born (%).

Key words**:** *sheep farms, technical efficiency, data envelopment analysis*

INTRODUCTION

Livestock activities are important for balancing of the workforce and better usage of main and by-products obtained with plant production. In addition, livestock activities provide optimal resource utilization and have a positive impact on farm income [13]. Animal husbandry has an important function in rural and economic development as well as in balanced and healthy nutrition [4]. Sheep breeding takes an important place among animal production activities in the world. Forage and pastures that are not used for other purposes can be evaluated through sheep production activity. The sheep transform the natural vegetation in such areas to food such as meat and milk to feed people. Sheep benefit more poor forage than other farm animals. Sheep also produce wool and leather products such as those used in making clothing items for people's lives [14].
One of the major problems of the sheep farms in Turkey is that they are usually small family farms. This situation affects the supply of inputs and the use of technology negatively. However, there are also advantages such as small-scale enterprises can deal with the production process more closely. Nowadays Determination and comparison of the farm performance become more important. The most appropriate method for this comparison is to determine the efficiency score [28].
The efficiency is defined as the degree of reaching the targets and the relationship between the desired goal and the actual goal. It is important to distinguish between the results and the outputs while focusing on the efficiency. Measuring and evaluating results is more difficult than evaluating the input or output [19]. The efficiency allows determining where the company is situated in the current competitive market and shows how well the output can be obtained from the available inputs [36].
There have been many studies on animal production related to Data Envelopment Analysis. Toro-Mujica et al., (2011) [34] were analysed production processes and economic viability of farms in a traditional dairy sheep farming community of Spain (Castilla-La Mancha), and modelled their production and quantifying their technical efficiency. Theocharopoulos et al., (2007) [32] used data envelopment analysis to determine the effectiveness of sheep breeding enterprises in

Greece. Theodoridis et al., (2012) [33] used the data envelope analysis to determine the technical efficiency of Sakız sheep farming in Greece. Many studies related to the efficiency levels of dairy farms in Turkey has also done [20, 23, 3, 24, 6, 7, 17, 25, 5, 29, 26, 28]. Özden and Armağan (2014) [27] used data envelopment analysis to determine the efficiency of beef cattle farms. Şanal and Işık (2014) [30] used data envelopment analysis to determine the efficiency of bovine farms in Erzurum province. Gul et al. (2016) [18] used data envelope analysis to determine the technical efficiency of goat farms in Isparta.

Thanks to Turkey's geographical structure and the wide pastures are thought to have significant potential for sheep breeding. Recently, in Turkey and in the Isparta the presence of sheep appears to be significantly increased. Sheep number in Turkey is approximately 23.1 million head in 2010 and reached 33.7 million in 2017, with an increase of 46%. Isparta Province shows a 129% increase in the same period and reached 229 thousand sheep.

In this study, it is aimed to determine the technical efficiency of sheep farms in Isparta province. Data envelopment analysis, which is a non-parametric method, has been used for the technical efficiency. Tobit Regression Analysis investigated the relationship between the technical efficiency coefficients obtained from the DEA and the selected socio-economic variables in order to determine the factors causing the inefficiency. It is hoped that this study will provide useful data to sheep producers, policy makers and researchers working on this issue.

MATERIALS AND METHODS

The main material of the study is obtained by using the questionnaire from the sheep farms in Isparta. It has also benefited from similar work carried out by various individuals and organizations. Survey data cover the production period of 2017.

According to the information obtained from Isparta Province Sheep & Goat Breeders Association, the districts of Centre, Yalvaç, and Şarkikaraağaç, are dominant in sheep breeding, so these districts were selected. All the sheep farms in these districts are constituted the research population. According to TUİK data, the selected districts constitute approximately 67% of total sheep in Isparta province. For this reason, it can be said that the research region has the qualifications to represent the sheep farming in Isparta Province.

The number of samples representing the population was calculated as 80 by using the Neyman method [35]. The distribution of selected enterprises by groups is given in Table 1.

Table 1. Distribution of sheep farms according to the animal numbers

Animal number	Farm number	Percentage (%)
≤100	23	28.75
101-200	22	27.50
201+	35	43.75
Total	80	100.00

Source: Own calculation

Efficiency analysis

Efficiency is a concept that refers to the proper use of resources without waste. Technical efficiency is defined using the input component in the most appropriate way and the most successful output level [31].

In order to identify technically active unit among the examined farms, technical efficiency was calculated using Data Envelopment Analysis (DEA) method. DEA is a technique based on linear programming principles and designed to measure the relative effectiveness of farm or economic organizations for transforming input into the output referred to as "Decision-making Units" in the literature [12]. The Data Envelopment Analysis (DEA) does not impose any functional form and can handle easily multiple input and multiple output cases. Moreover, in DEA applications inputs and outputs can have very different units of measurement without requiring any a priori trade-offs or any input and output prices. These highly desirable features provide this analysis become popular among researchers [16].

Coelli et al., (1998) [11] explained efficiency in two main ways. These are input-oriented

and output-oriented criteria. The input-oriented model of the Banker Charnes Cooper (BCC) for decision-making units that produce M output using K inputs with different inputs is given below: [11, 12].

$$\text{Min } \theta, \lambda\ \theta$$
$$\text{limitations}$$

$$-y\ i + Y\lambda \geq 0$$
$$\theta\ xi - X\lambda \geq 0$$
$$N1\ '\lambda = 1$$
$$\lambda \geq 0$$

Where θ is a scalar value, N1' is the constraint for the convexity condition, and λ is an N x 1-dimensional vector. Y is the output matrix; X represents the input matrix. The efficiency scores of the farms are indicated by θ, which takes a value between zero and one. This linear programming model needs to be solved for each farm separately. θ value will be the efficiency score for the farm i. This linear programming problem must be solved separately for each farm in the research sample. According to Farrell's (1957) [15] definition, the θ value indicates that it is technically efficient. Coelli et al., (1998) [11] and Coelli (1996; 1997) [9, 10] developed a computer program that implements a robust multi-stage model among multi-stage methodology and other options.

In this study, four input and one output models have emerged. In the analysis, gross production value (GPV) per bovine unit output was used. Milk and dairy products, wool, fertilizer and productive value increases were taken into account in the calculation of GPV. The inputs used in the analysis are; labour force (hour / AU), concentrate feed (kg / AU), roughage (kg / AU) and veterinary-drug costs (TL / AU). The labour input consists of the sum of foreign and family labour hours per cattle unit.

RESULTS AND DISCUSSIONS

General information on interviewed sheep farms is given in Table 2. The average age of sheep breeders was 47.54 years, and their education duration was 5.80 years and their experience was 23.05 years in sheep farming. In a similar study by Gül et al. (2016) [18], the average age of the breeders was determined as 50.51 years, their education level as 5.18 years and their experience in goat breeding as 25.33 years.

The average sheep stock in the farms was found 183.49 heads (17.58 AU). The milk yield per sheep was calculated at 0.44 liters/day and the average lactation period was indicated 96.38 days. The grazing duration of the cows were found to be 242 days per year. In a study conducted in Konya province, it was determined that the average grazing time of sheep was 240 days [1].

The average planting area per farm is 5.02 hectares. The average planting area of the forage crops was 4.64 hectare, it was determined that 35.68% consisted of barley, 27.60% wheat, and 13.93% vetch. Feed plants constitute 92.32% of the total processed area. It was determined that 27.50% of the producers surveyed used credits for sheep farming. 40 per cent of the breeders use credits from cooperatives and 93.75 per cent from Breeding Sheep-Goat Breeders Association.

Table 2. General features of sheep breeding farms

Features	Mean
Breeders age (year)	47.54
Breeders education level (year)	5.80
Breeders experience (year)	23.05
Sheep (head)	183.49
Sheep (AU)	17.58
Milk yield (lt/sheep/ day)	0.44
Lactation duration (day)	96.38
Grazing duration (day)	242
Planted area (ha)	5.02
Forage crops area (ha)	4.64
Credit usage rate (%)	27.50
Cooperative membership (%)	40.00
Breeding Sheep-Goat Breeders Association membership (%)	93.75

Source: Own calculation

Statistical data on the variables used in the Data Envelopment Analysis is given in Table 3. The highest variability observed in the chart is observed in 51.39% roughage intake followed by 42.61% workforce, 41.85% veterinary-drug expenditures and 24.47% concentrated feed intake. Gül et al. (2016) [18] determined that inputs showing the

highest variability in goat breeding farms in Isparta province are labour (hr / AU), concentrate feed (kg / AU) and roughage (kg / AU).

Table 3. Descriptive statistics of DEA variables

Variables	Min	Max	Mean	Std. Ev.	Variation coefficient (%)
Output					
GPV/AU	5177.23	10670.73	7178.30	1160.96	16.17
Input					
Labour(hour/AU)	150.39	912.04	326.65	139.19	42.61
Concentrated feed(kg/AU)	361.27	1936.38	1078.81	264.03	24.47
Roughage(kg/AU)	260.15	4865.13	1170.14	601.34	51.39
Veterinary and drug expenses/AU	113.12	613.50	302.03	126.41	41.85

Source: Own calculation

The purpose of the input-oriented data envelopment analysis is; the amount of input used can be reduced proportionally without producing a change for output produced. The results of the analysis for the input are given in Table 4. As seen in the table, it was found that out of 80 sheep farms, except for 5 farms (6.25%), the scale was below constant return to scale and 13 farms (16.25%) were below the variable return to the scale. The technical efficiency scores of the sheep farms range from 0.48 to 1.00. The average efficiency score of researched farms was calculated as 0.69 under the assumption of fixed return on the scale and 0.79 under the assumption of the variable return to scale. In this case, it may be the case that sheep farms reduce their inputs by 21% without changing the output amount. Among the 13 efficient sheep farms, 2 of them are found in-group 1, one is in the group 2 and 10 farms are in the group 3. The average activity of sheep farms in Greece by Theocharopoulos et al. (2007) [32] was 0.54 under the assumption of the constant return to scale and 0.66 under the variable return assumption. In this case, it was stated that it might be the case that the enterprises should reduce the inputs by 24% while keeping the output amount.

In a study conducted by Gül et al. (2016) [18], the average activity of goat breeding farms was calculated as 0.44 under the assumption of the constant return to scale and 0.66 under the variable return to scale assumption. It has been found that sheep farms need to reduce their inputs by 34% without reducing the amount of output.

Table 4. Input- oriented efficiency score results

Efficiency score	CRS	VRS	SE
1.00	5	13	5
0.91-0.99	6	6	29
0.81-0.90	9	22	22
0.71-0.80	16	15	19
0.61-0.70	17	15	5
0.51-0.60	16	7	0
0.41-0.50	11	2	0
Min	0.41	0.48	0.63
Max	1.00	1.00	1.00
Mean	0.69	0.79	0.87

Source: Own calculation

Input losses and excessive input usage

The input losses due to the inefficiency of sheep farms were calculated by subtracting the targeted input usage amounts from the use of existing inputs of the farms, which did not provide efficiency in the production, in order to realize an effective production activity. In other words, the surplus labour, concentrate feed, roughage and veterinary-drug expenditures of the ineffective farms in each group are determined according to the reference farms. It has been found that 25 of the 80 sheep farms use 7.64% surplus labour, 15 sheep farms use 3.68% surplus concentrated feed, 8 of the sheep farms use 2.19% surplus roughage and 26 of the sheep farms spend 8.78% surplus for the veterinary and drugs (Table 5). In a study conducted by Gül et al. (2016) [18] in Isparta province, it was found that that 44 of the 92 goat farms use 23.59% surplus labour, 60 goat farms use 28.85% surplus concentrated feed, 26 of the goat farms use 15.58% surplus roughage and 30 of the goat farms spend 21.26% surplus for the veterinary and drugs.

Determination of causes of technical inefficiency

The relationship between efficiency scores and selected socio-economic variables was investigated by Tobit regression in order to determine the factors causing ineffectiveness. In the analysis of Tobit, the variables such as education level, total labour hour, number of sheep as AU, milk yield (lt / sheep / day), age at which sheep were separated from the right side (years) and number of lambs per breeding sheep the effects on the technical efficiency levels of the enterprises have been examined. The coefficients obtained with the Tobit regression are given in Table 6 together with the standard error and p values.

The educational status of the breeders is represented by a dummy variable. Number 1 represented those with a level of education of 8 years and over and the others were represented by number 0. Findings show that as the education level increases, the effectiveness of farm increases and it is statistically significant ($p < 0.05$). However, some researchers have stated that there is a negative relationship between educational level and effectiveness [21, 2, 8, 22, 29]. Gül et al. (2016) [18] found that there was a positive relationship between the level of education and efficiency in their study. However, this was not statistically significant ($p > 0.10$).

The labour was represented by the total annual time of the family and foreign labour. According to the results of the regression, the decrease of the coefficient shows that the efficiency decreases with increasing the labour utilization and this result is statistically significant ($p < 0.01$). (Gül et al., 2016) [18], there was a negative relationship between the labour and the efficiency and statistically significant ($p < 0.01$).

According to the obtained results, sheep number as animal unit affects the efficiency of the farms and this was found statistically significant ($p < 0.01$). Another result of the research is that the milk yield (lt / sheep/day) increases the efficiency of the farm and this result is statistically significant ($p < 0.10$). Gül et al. (2016) [18] found that there was a positive relationship between milk yield per goat and efficiency of the farm and their finding was statistically significant ($p < 0.01$).

Milking duration / separation from the milking of the sheep was included as a year to the model. The results showed that the efficiency decreased with increasing the age of separation from the milking, and this result was statistically significant ($p < 0.01$). Regression analysis results showed that the efficiency increased as the calving rate per sheep (%) increased, and this finding was statistically significant ($p < 0.01$).

Table 5. Input losses and excessive usage

Input	Number of farms	Average input losses	Average input usage	Excessive input usage (%)
Labour (hour/AU)	25	25.05	326.65	7.64
Concentrated feed (kg/ AU)	15	39.74	1,078.81	3.68
Roughage (kg/ AU)	8	25.60	1,170.14	2.19
Veterinary and drug expenses (TL/ AU)	26	26.52	302.03	8.78

Source: Own calculation

Table 6. Results of Tobit regression analysis

Variable	Coefficient	Std. Error	z-value	p-value
Constant	0.255379	0.170879	1.494500	0.1350
Education	0.058504	0.028101	2.081925	0.0373*
Labour	-6.758645	1.480359	-4.565543	0.0000***
AU	0.019677	0.002444	8.051922	0.0000***
Milk yield (lt/sheep/day)	0.279166	0.147005	1.899026	0.0576*
Milking duration / separation from the milking (year)	-0.050281	0.018177	-2.766175	0.0057***
The calving rate per sheep (%)	0.005679	0.001030	5.512388	0.0000***

Source: Own calculation

CONCLUSIONS

It was found that out of 80 sheep farms, except for 5 farms (6.25%), the scale was below constant return to scale and 13 farms (16.25%) were below the variable return to the scale. The technical efficiency scores of the sheep farms range from 0.48 to 1.00. The average efficiency score of researched farms was calculated as 0.69 under the assumption of fixed return on the scale and 0.79 under the assumption of the variable return to scale. In this case, it may be the case that sheep farms reduce their inputs by 21% without changing the output amount.

It has been found that approximately 31 % of the sheep farms use 7.64% surplus labour, 19% of the sheep farms use 3.68% surplus concentrated feed, 10% of the sheep farms use 2.19% surplus roughage and 33% of the sheep farms spend 8.78% surplus for the veterinary and drugs. Especially veterinary-drug expenditures and labour costs are drawing attention in the input losses. It is suggested for breeders to take collective services by combining with other farms instead of receiving individual veterinary services that in order to reduce the veterinary-drug costs. The need for an active producer organization is better understood when farms are in small-scale. It is recommended that more technological improvements are needed to optimize the use of the family labour or foreign labour.

According to Tobit regression analysis, the education level ($p < 0.05$), total labour hours ($p < 0.01$), number of sheep in terms of AU ($p < 0.01$), milk yield (lt / sheep / day) 0.10), milking duration / separation from the milking (year) ($p < 0.01$) and the calving rate per sheep (%) ($p < 0.01$) affect the efficiency of the farms and these were found statistically significant. It was found that the training levels of producers should have a positive effect on the farm efficiency. Therefore, it has concluded that training and extension services are important. Keeping high yielding breeds of sheep in farms appropriate to the regional conditions will also increase the efficiency levels.

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A MARKOV CHAIN ANALYSIS OF PADDY RICE MARKETING IN ADAMAWA STATE, NIGERIA

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Abstract

Many factors such as poor transportation, inadequate capital and credit facilities, problem of supply, the magnitudes and multiplicity of fees arising from market operations and change in climate amounts to price instability which is quite threatening, as participant in rice marketing stand the danger of crashing in their investment if price fall. The study was conducted to predict the future price of paddy rice and described the problems militating against rice marketing. Data were collected from 204 rice marketers using multi stage sampling approach. Markov chain Techniques and simple statistical measures such as tables, means, frequencies and percentages were employed as tools for data analysis. The Markov chain result predicted 2% of the retailers to sell at a price of ≤ ₦4500, 4% to sell at prices between ₦4501 to ₦6500 and 94% to sell at prices above ₦6500 per 100kg bag in distant future. While, in the wholesale category 20% would sell at ≤ ₦4500, 60% would sell at prices between ₦4501 to ₦6500 and 20% would sell a 100kg bag of paddy rice at prices above ₦6500. The study recommends the state and non-governmental organizations to establish a broad common base of information for all economic agents involved in rice marketing chain. This will help policy makers to monitor marketing issues which are paramount in evaluating the outcome of agricultural price policies. The state should reconstruct rural roads for easy transfer of agricultural inputs and good. Financial support and formation of unions would enable the marketers benefit from large scale operation. These will stabilize prices and guarantee adequate returns hence, improved standard of living.

Key words**:** *Markov chain, Paddy rice, marketing*

INTRODUCTION

Rice is an edible grain of the origin *Gramineae* and genus *Oryza*. It is rated as one of the main food for more than 50% of human race globally [3] and the third most cultivated crop worldwide. It is a main calorie generic food for many people [12]. Estimate shows that about 500 million metric tonnes is produced annually from land area of 150 million hectares [20]. The crop is a substantial grain to the extent that most people use it as part of their daily diet particularly in Asian countries and part Africa [11]. The global demand for rice has being on the increase and to meet up with the future challenges production has to increase from annual production of 586 million metric tonnes in 2001 to 756 metric tonnes in 2030 [16].

High rate of increase in urban population is one of the factors responsible for the escalation of demand for rice in black African countries. Urban population in African is projected to increase by 10%, demand for the commodity is expected to grow tremendously [2]. Research has shown that importation of the commodity into African countries has been on the increase. In 2006 alone, Africa imported 32% leaving 68% to the rest of the world [6]. Similarly, 9.68 million metric tonnes, worth more than $5 billion was brought into black African countries in year 2009. Rice has become a necessity now in Africa than in other parts of the globe because of high population growth and rice is

cherished more than it was before [22]. Rice has become one of the Nigeria's leading foods to the extent that its consumption has outpaced production, making Nigeria the world leading importer of rice. In 2010, the total demand for milled rice in Nigeria was estimated to be around 5,000 kg million of which 3,200 kg million kg was produced locally and the deficit was bridged by importation [15].

Studies related to agricultural products prices helps in the upkeep of food availability status. Adequate agricultural marketing set up and its position in ensuring food availability in Nigeria is vital in minimizing post-harvest losses; guarantee sufficient reward to farmers investment and invigorating a boost in agricultural production thereby adding to the level of food availability in Nigeria as a result of appropriate information on prices of agricultural products [18]. Thus, producers will decide on the number of hectares to cultivate bearing in mind the preceding market value. This shows that price dictates the demand and supply of food commodities. If the market value of farm produce increases, the more resolute the eagerness of farmers and agricultural production will expand [23]. Price of farm products in Nigeria is not exempted from seasonal price variation as a result of unpreventable gab between planting period and harvest. Price is lowest at harvest and escalates as season progresses and reaches its peak at planting time [21]. Price instability is a broad obstacle that is caused by many elements, these conjointly, put the marketers at high risk. Although increase market value of goods is heart balm to farmers, volatile price is quite a terrible thing, as farmers and participants in rice marketing stand the danger of crashing in their investment if price fall. The nature of agricultural commodity market is one of the reasons why prices keep fluctuating. Supply is far less than people's need thus, escalated prices. Negative effects of climatic change and problems caused by population increased translates into price volatility in agricultural product market. [13]. Therefore, this study was conducted to analyze paddy rice marketing in the area under study. The objectives studied were:

(i) predict the future price of paddy rice and (ii) identify major constraints militating against rice marketing.

MATERIALS AND METHODS

Study Area

The study area is situated in Northern part of Nigeria on latitude 7^0 to 11^0N and longitude 11^0 to 14^0E. Adamawa state boarders Taraba, Gombe and Borno states [1]. It has boundary with Cameroon republic to the east. The State occupies an area of 38,741 km^2 with about 3,860,023 people inhabiting it [17] using 2.5% growth rate).

Questionnaires were used as instrument for data collection which was distributed to the sampled respondents in the study area. The respondents were selected from each market randomly proportionate to its size. The data for study covered year 2014 and 2015.

Multi stage sampling method was used in choosing the respondents from all the four Agricultural zones of Adamawa State,

Zone 1: Madagali, Michika, Mubi North, Mubi South and Maiha Local Government Areas (LGAs)

Zone 2: Hong, Gombi, Song and Girei LGAs

Zone 3: Fufore, Ganye, Jada, Mayo-Belwa, Toungo, Yola North and Yola South LGAs

Zone 4: Demsa, Guyuk, Lamurde, Numan, and Shelleng LGAs.

Stage two involved purposive sampling technique was employed to select ten famous rice markets in the State. The respondents were categorized into wholesalers and retailers in stage three. The statistic of traders in each category were obtained from market association chairman (Sarkin Kasuwa) and they classified the rice marketers as those that sale in bags (wholesalers) and those that sale in different units of small measures (mudus) as retailers. The final stage was the random selection of 60 wholesalers and 144 retailers proportionate to the number (40%) of respondents in each market.

The Markov chain model was used to predict the distant future monetary value of rice and simple statistics was employed to describe the problems militating against rice marketing.

This study adopted the markov chain model as demonstrated by [5, 8].
The model is expressed as:

$$P = \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix}$$

where: p = transition matrix, P_{11}, P_{12}, P_{13}, P_{21}, P_{22}, P_{23}, P_{31}, P_{32} and P_{33} are prices of rice at different states.

RESULTS AND DISCUSSIONS

Transition Probability Matrix for Price of Rice in Adamawa State

The monetary value of rice in Adamawa State in distant future was forecasted with the aid of Markov chain technique, which uncovers the future monetary value of rice (paddy) per 100 kg. The transition matrix and probability vector was obtained for projected price of rice from two years price: 2014 (t_o**)** and 2015 (t_{o+1}**).** Price was classified into three categories $S_{(i)}$ obtained from the total price of marketers for year 2014 and 2015. The three price categories were designated in the price states $S_{(i)}$ the price states created on the basis of price per 100 kg bag as:
S_1 = Less than or equal to N4,500
S_2 = Between ₦ 4,501 and ₦ 6,500
S_3= Above ₦ 6,500
Table 1 presents t_0 (2014) and t_o+_1 (2015). The first category, ($S_1 = \leq$ ₦4,500), the second category (S_2=N4.501- ₦6,500) and the third category (S_3= >₦6,500).
Q_{11} were the number of marketers who sold less than or equal ₦4,500 in year 2014 and still sold at the same price in 2015.
Q_{12} were the number of marketers that sold less than or equal to ₦4,500 in 2014, but transited to sell at price between ₦ 4,501- ₦ 6,500 in 2015.
Q_{13} were the number of marketers that sold at a value below or commensurate to ₦ 4,500 in 2014 but, advanced to sell above ₦6,500 in 2015.
Q21 were the number of marketers that sold at a price between ₦ 4, 501- ₦ 6,500 in 2014, but fall back to sell at price of ≤ ₦ 4,500 in year 2015.
Q22 were marketers that sold at a price between ₦ 4,501- ₦ 6,500 in 2014 and still maintained the same price in year 2015.
Q23 were marketers that sold between ₦4, 501- ₦ 6,500 in 2014, but proceeded to sell at price above N6,500 in 2015.
Q31 are number of those that sold above ₦ 6,500 in year 2015 but sold at a price of ≤ ₦ 4,500 in 2015.
Q32 were those that sold above ₦ 6,500 in 2014 but fall back to sell at price between ₦ 4,501- ₦ 6,500 in 2015.
Q33 were the number of marketers that sold at price above ₦6,500 in 2014 and maintained the same status quo in 2015.

Projected Price of Rice in Adamawa State

The result obtained from initial probability for year t_0 and t_{0+1} (2014 and 2015) in Table 1 revealed that in the long, 2% of the population of retail rice marketers in Adamawa State would sell their product at ≤ ₦4,500 per 100 kg bag, 4% at range of ₦4,501- ₦ 6,500 per 100 kg and a larger proportion (94%) of the retailers would sell at prices above ₦ 6,500 per 100 kg bag of paddy rice. The results from initial probability for year t_0 and t_{o+1} (2014 and 2015) also unveiled that in distant future 20% of wholesale traders to sell a 100 kg bag of paddy rice at a price range of ≤ ₦4,500, 60% of the would sell at a price range of ₦ 4,501- ₦6,500 and 20% would sell a 100 kg bag of paddy at prices above ₦6,500. The outcome of the long run prices analysis indicates that greater proportion (94%) of retailers would sell 100 kg bag of paddy at prices above ₦6,500 while greater part (60%) of wholesalers would sell at a price range of between ₦ 4,501- ₦6,500 meaning that most retail rice marketers in Adamawa State source their paddy rice from wholesalers at price range of ₦4,501 – ₦ 6,500 and sell at prices above ₦ 6,500. The implication of this result is that: rice traders and producers are likely to obtain favorable price for their products in distant future.
Also there is that likelihood that rice business would be a more profitable venture. So also, in distant future consumers taste is expected to change in favor of rice and rice products. This result is in agreement with [2] which revealed

the consumption of rice to rise considerably in African countries particularly Nigeria.

Table 1. Flow chart for rice price 2014 and 2015 marketing years

Year 2015(t_{0+1})		**Retailer**				**Wholesaler**			
Year 2014(t_0)		S_1	S_2	S_3	Total	S_1	S_2	S_3	Total
	S_1	32	49	63	144	14	20	26	60
	S_2	27	52	65	144	10	22	28	60
	S_3	21	54	69	144	7	24	29	60
	Total	80	155	197	432	31	66	83	180

Source: Field survey, 2015

S_1= ≤ ₦ 4,500, S_2 =₦4,501-₦6,500, S_3= > ₦6,500

Result for retailer: S_1=0.02, S_2=0.04, S_3=0.94

This can be interpreted as 2%, 4% and 94% respectively.

Conformation: 0.02+0.04+0.94=1

Result for wholesaler: S_1 =0.20, S_2= 0.60, S_3=0.20

This can be interpreted as 20%, 60% and 20% respectively.

Conformation: 0.20+0.60+0.20=1

Problems of Rice Marketing

Results in Table 2 indicate problems militating against rice marketing efficiency. These constraints hinder effective marketing system. The main problem confronting marketers in Adamawa state is inadequate transportation system. Transportation problems have much dispersion: in some cases there were insufficient vehicles to carry goods from the farm to rural market and from the rural market to towns. In some other, there were no roads or where they exist they are not motorable throughout the year or they are in deplorable conditions and this in turn affect the evacuation of farm produce from rural areas to urban markets thereby making market transportation cost to account for a very significant part of the overall costs. It can be deduced from the result that poor transportation is the behind poor in marketing performance. This is in accord with [7] that most transportation facilities in Nigeria are dilapidated. He pointed out that in almost all rural farm settlements, motorable roads are lacking and where they available, they are either not motorable or are laced with potholes which makes it difficult to get to farm site to evacuate the farm produce. The state of the roads further increases post-harvest losses through damages of farm produce. Similarly [14] mentioned high cost of transportation as one of the major factors rice value in Kano State, Nigeria.

Inadequate capital and credit facilities available to the marketers were grossly inadequate to cater for their marketing needs. This means that lack of or inadequate capital and credit facilities limit the capacity of marketers to take advantage of economies of scale to embark on large scale purchase, transportation, processing and sales of rice which cut down cost and increase income. This result compliments the finding of [19] who attested that low capital is one of the factors militating against rice marketing. Also the result is in consonance with [14, 9] that inadequate credit facilities is a major challenge to agricultural marketing in Nigeria.

Poor market communication system was identified as a major evil hindering effective marketing. Adamawa state rice traders were desirous to be informed about the credit facilities and product prices. Absence of facts about market situation to sellers and buyers could greatly reduce market efficiency. Another implication of this result is that without information on product prices, farmers are likely to be cheated and some middlemen will capitalize on this short coming by offering less attractive prices, a disincentive towards boosting rice production and marketing. The result is in agreement with [10] who stated that poor market information renders marketing system inefficient.

Source of supply serious problem affecting rice traders. Evidence from the study showed that rice is produced on small farms scattered throughout the study area. It is not an easy task to organize and assemble paddy for efficient marketing. Moreover, there may be varieties of rice which could pose problems

for easy pricing. Also the magnitudes and multiplicity of fees arising from market operations affect rice marketers. Fees are charged from whole range of functionaries (warehousing agents, loading agents etc.). In addition, commission agents are charged commission fees on transaction between farmers and buyers. This confirms the work of [4] that high taxes/fees are charged severally along the marketing chain which significantly increases the cost of marketing and causes problem to marketing.

Table 2. Constraint of Rice Marketing

Problems	Frequency	Percentage
Poor transportation system	179	87.70
High cost of transportation	98	48.04
Inadequate capital	83	40.68
Inadequate credit facilities	74	36.27
Poor market communication system	66	32.35
Inadequate storage facilities	48	23.53
Instability of prices	46	22.56
Source of supply	42	20.59
High taxes/levies	31	15.20
Lack of standardization/grading	21	10.29
Poor processing facilities	13	6.37
Total	701*	

Source: Field Survey, 2015 *Multiple responses

CONCLUSIONS

The research predicted that in the long run majority of the wholesalers would purchase rice at the farm gate and dispose to the retailers; then retailers would sell directly to the consumers. Farmers and marketers would also receive relatively good price for their produce and rice trading.

In order to stabilize prices, guarantee adequate returns and improve the standard of living of the market participants the following recommendations:

(i)Government and non-governmental organizations to establish a broad common information base for all economic agents involved in rich marketing chain. This will help policy makers monitor marketing issues which is paramount in evaluating the outcome of agricultural price policies.

(ii)Government and other agencies should construct the rural roads in the State for easy transfer of farm inputs and agricultural goods.

(iii)Financial support and formation of unions would enable marketers benefit from large scale operation.

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FACTORS INFLUENCING PEOPLE'S PARTICIPATION IN THE EXPLOITATION OF WATER RESOURCES IN AGRICULTURE SECTOR OF IRAN

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Abstract

The purpose of this study was to investigate the factors influencing people's participation in the exploitation of water resources for agriculture. The population consists of experts with a B.A. and higher degree employed in various sectors of Agriculture Organization, Water Organization and Research Center of Urmia city. The sample was randomly selected, and the sample size was determined through Kerjice and Morgan table to be 196. This is an applied field study. The survey tool is a structured questionnaire with close-ended question and its validity and reliability is confirmed by experienced professors, and Cronbach's alpha coefficient which indicates the validity of the questionnaire is calculated to be 0.834. The results show that there is a significant relationship among the administrative, social, cultural, educational, economic, ecological, technical, structural and political factors and the importance of people's participation in the exploitation of water resources for agriculture. The results of multiple regression showed that the independent variables explained 66 percent of the dependent variable variance. According to finding in this research these recommendation comments: Improvement and shortening of water transfer networks in order to speed up the transfer of water and reduction of water loss. Government financial support in the agricultural-industrial sector in order to use new technologies. Preventing economic, social, environmental and political losses due to Urmia Lake drying. Maintaining the diversity of plants and crops through water management and environmental management and environmental ethics. The role of mass media such as radio and television, the use of other channels of communication in highlighting the importance of optimal water consumption. Government support for farmers to renew or launch pipeline for farms and gardens to prevent water losses, as well as supporting new irrigation methods and repairing old transmission lines. Increasing cooperation between people and society and even the state regarding participation in the optimal use of water resources.

Key words**:** *exploitation, participation, water resources, agriculture sector, Urmia, Iran*

INTRODUCTION

Water is the most important factor in the countries' agricultural production and national capital. Limited water resources as a result of improper irrigation practices led to dedicating more specialized manpower to increase the efficiency of water consumption. Modern irrigation techniques are divided into two categories: drip irrigation and sprinkler irrigation which increase irrigation efficiency [11]. Factors affecting farmers' participation in the management of water supply networks include: demographic variables such as age, education level, experience in agriculture and stockbreeding activities; economic variables such as income, the area of agricultural land, the water rights, water pricing in agriculture, irrigated agriculture profitability; social variables such as membership in social organizations, membership length in Water User Associations (WUAs), solidarity and collective power, and participation in collective educational activities, etc. These factors were considered in the design and development of a questionnaire in order to access the following specific objectives [24].

Experts consider public participation in the development process of great importance such that they often equate participation to the development or introduce participation as the purpose of development. Apparently the concept of participation is clear, but actually different interpretations have been made. Sometimes participation is considered of political, cultural, social and economic perspective; and sometimes participation in the implementation is considered and

participation in decision making, evaluation, monitoring and follow-up is not even mentioned. In third world countries, because of centralized political structure and in some cases non-democratic governments, usually participation in the implementation is meant if the issue of participation is ever raised. Just like the period of lord and vassal when the master made key decisions and peasants in groups were active in the implementation [20].

According to most experts, low irrigation efficiency in developing countries is due to lack of real participation of beneficiaries in decision making, implementation, management and maintenance of irrigation networks. The policy of beneficiaries participation in the implementation of irrigation networks has been of particular interest since the late 80s, mainly due to the inability of government agencies responsible for organizing the water sector and the lack of funds for maintenance and operation of these networks; the policy of motivating and encouraging beneficiaries to participate in the construction of these networks have been adopted in more than 20 countries such as Mexico, the United States, Colombia, the Philippines, India, Pakistan, Turkey, China, Sri Lanka, Nepal and New Zealand [6].

The world is facing a challenge in relation to water. The growing increase in water consumption in Iran led to considerable investments at national and regional level. River basins especially in arid and semi-dry areas such as Iran and adjacent territories have always been the settlements for civilization of human societies [12]. Population growth and pressure on water resources and soil in recent times, in addition to the development of water supply technologies and cultivation methods, has led to give more importance to this limited resource in Iran than ever. Therefore, soil and water resource management and conservation measures are necessary [5].

It is not only a particular community or group that depends on water; however, water in the rural community due to its heavy reliance of agricultural practices on water has an important role in rural development [7]. The agricultural sector, consuming 92% of the 1.93 billion cubic meters of water obtained, is the largest consumer of water; so agricultural development strongly depends on water resources management [19].

Unfortunately, due to inappropriate and excessive exploitation of agricultural water resources Iran is facing serious constraints in supplying water for agriculture; and realizing the goals of water management in agriculture sector is faced with different challenges [4].

So it seems that we should consider limited water resources as a dynamic issue related to the sustainability of water resources. Therefore, the sustainability of these limited resources for future generations must also be considered to optimize their consumption. This issue in agriculture sector as the most important consumer of water resources is of ever more importance [1].

The purpose of integrated management of water resources is to create a system that cross-linking water management with environmental, social and economic development benefits from their reflection and feedback and finally, with the participation of different sectors the decisions for development and allocation of water resource are made. The important points that should be considered in studies of water resources management are recognition of components and their uncertainties, identification and clarification of the relationships between the components, and the direct and indirect effects of the components, so that solving a problem and planning a component will not overshadow other parts of the system [8]. Direct effects are usually measurable. Integrated water resource management take advantage of a combination of different strategies and policies such as water storage, aquifer recharge, water transportation, water saving, management of pressure and leakage in water distribution networks, increasing the water supply considering hydrological, hydraulic and structural uncertainties [17].

The spring studies in 2005 reflected the fact that there was significant relationship between the promotion of social and economic indicators and optimized management of agricultural water by wheat producers. Mohammadi [13] analysed the context and

mechanisms of agricultural water management in Zarrin Dasht city, Fars province; and studied the drop in groundwater levels, groundwater salinization caused by overuse of the water, excessive evaporation of water in the channel route, the terrestrial channels with low efficiency of water transfer, saline irrigation water, land fragmentation, priorities of problems regarding irrigation sources, water supply and consumption on the farm by farmers [13].

Dehymavi and Ahvaziyan [3] also considered reduction of government tenure in the water and irrigation sector, reduction of the maintenance and operation cost of irrigation systems, improvement of network maintenance, reduction of the disputes caused by non-uniform distribution of water among farmers, the development of lands under cultivation, job creation and solving the problem of unemployment, increasing collective cooperation and cohesion among rural communities, solving the problem of low efficiency of water, and ultimately preventing excessive water consumption and high income with solving structural and fundamental problems as the positive outcomes of handing the irrigation management to WUAs [3].

Omani and Chizari [14] studied the factors contributing to the sustainable management of agricultural water resources in the northern part of the Modarres watershed, Khozestan province and concluded that five factors determined 71% of the changes in the sustainable management of agricultural water resources: economic features, educational-promotional activities variables, social activities, awareness and support of government. This means that if these five factors be considered in planning agricultural activities, it could be argued that the level of technical knowledge of wheat farmers in the field of sustainable agriculture in Ahvaz city will highly be improved [14].

Hosseinzad and co workers [6] studied mechanisms of agricultural water management in Tabriz plain and concluded that the disproportion between the number of wells and the area of land under cultivation, salinization of groundwater resources due to excessive consumption, and groundwater levels reduction were identified as first to third priorities in agricultural water management problems of the region. The results also showed that about 61% of the total variance of agricultural water management is explained by three factors: deep and semi-deep groundwater and surface water. Therefore, reducing the amount of wells discharge and efficient use of surface water in order to increase the land area under irrigated cultivation will be effective in the management of regional water resources [6].

Shibani and Kazemi [20] in a study entitled "Factors affecting the public participation in the use of modern irrigation methods to reduce water consumption in line with the sustainable development of the environment" concluded that the reasons for the lack of acceptance of new irrigation technologies by farmers include: Recommendation of difficult and expensive technologies, failure to promote new technologies, the lack of adequate credit facilities, and so on. Inhibiting factors of new irrigation methods include: high costs, lack of education and insufficient awareness. Participation in previous phases and during procedures, as well as adequate awareness are the factors encouraging new methods of irrigation [20].

Oweis and Hachum [15] in a study, “improving water productivity in rain-fed agricultural land in West Asia and North Africa”, emphasized the role of agricultural water resources management to increase productivity and argued that economic, social and organizational structures must be considered in realization of water resources management [15].

Results of Yercan [23] shows of successful participatory management of water resources projects in other countries such as China and Sri Lanka in a study entitled "Evaluation of participatory management of irrigation projects in Sri Lanka: minor fixes, minor interests" and in Turkey also confirms these results [23].

Kijene [10] believed that there was a significant relationship among increasing agricultural water productivity, food security, increased and sustainable food supply, increased water use efficiency, water

consumption optimization and management structural reforms realization of which requires a fundamental change in the behaviour of farmers, especially cognitive domains [10].

Boelense and co-workers stated that empowerment of farmers through promotional and training measures is the major factor in the management of agricultural water resources [2].

Qiao and co-workers in a study entitled "Water associations in Mongolia: factors affecting farmers to join water management", showed that WUAs in Hubei province played an important role in reducing conflicts among upstream and downstream users; and on the other hand, they had improved the irrigation services as the lands irrigated in two weeks before the establishment of WUAs were irrigated in four days using the new irrigation system. However, this caused a 50 percent increase in irrigated land area [18].

MATERIALS AND METHODS

Regarding the purpose of the study, this study was an applied research. Also, considering the amount and degree of control of the variables, it was a non-experimental study. Besides, considering the data analysis, the study was descriptive, correlation study. In order to collect the data, in the fieldwork stage, a questionnaire was used as the main means of the data collection. To measure its validity, the necessary amendments were made after getting the professors and experts' opinions. Also, in order to measure the reliability of the questionnaire, thirty questionnaires were completed by the experts and Cronbach alpha coefficient (0.834) was calculated. The population consists of 400 experts with a B.A. and higher degree employed in various sectors of Agriculture Organization, Water Organization and Research Centre of Urmia city. The sample was randomly selected, and the sample size was determined through Morgan table to be 196. The collected data through the questionnaires was analysed by SPSS version 15. In the descriptive statistical section, distribution, percentage, and mean were used. In the inferential statistics, factorial analysis method was employed.

RESULTS AND DISCUSSIONS

The description of the age of the sample of the study showed that the mean of the age of the participants was 43, and the maximum age was 59 and the minimum age was 22. The majority of the participants were men (% 76.9) and the (% 23.1) were women.

Table 1. The personal characteristics

The distribution of respondents by gender				
Gender	Distribution	Percentage		
Male	150	76.9		
Female	45	23.1		
The distribution of the subjects' educational group				
Group	Distribution	Percentage		
B.Sc.	101	51.5		
M.Sc.	89	45.4		
Ph.D.	6	3.1		
The distribution of the age groups of the subjects				
Group	Distribution	Percentage	Mean	Variance
Less than 30 years	22	9.4		
31 to 40 years	40	19.8		
41 to 50 years	90	47.9	43.32	9.047
More than 51 years	43	22.9		
The distribution of the age experience				
Group	Distribution	Percentage	Mean	Variance
Less than 10 years	38	19.8		
10 to 20 years	42	21.87	18.66	5.81
More than 21 years	112	58.33		

Source: Research findings.

Regarding their job experience, the mean of the work experience of the participants was 18.66 years. Most of the participants, 112 subjects (% 58.33), had the job experience of more than 21 years. Considering their educational level, there were 101 B.Sc., 80 M.Sc., and 6 PhD. Other finding are shown in Table 1.

Table 2 shows the priority of variables regarding the problems of the lack of public participation in agricultural water resource utilization from the experts' view. According to this table, "the lack of cooperation between people and society" with a variation coefficient of 0.245 and "cultivation of high-water-needing crops in wide areas of lands to gain more economic interest" with the variation coefficient of 0.325 were the minimum and maximum value of variation coefficients, respectively.

Table 2. The priority of variables regarding the problems of the lack of public participation in agricultural water resource utilization from the experts' view

Variable	Average	SD	Variation coefficient	Rank
Lack of cooperation between people and society	3.76	0.922	0.245	1
False culture of the people regarding the use of water	3.78	0.984	0.260	2
Increased number of wells dug by farmers	4.06	1.093	0.269	3
Farmers believing in traditional irrigation and their lack of trust in modern irrigation methods	3.64	1.009	0.277	4
Lack of access to financial resources for applying modern irrigation methods	3.99	1.120	0.281	5
Disputes arising due to the non-uniform distribution of water among farmers	3.57	1.028	0.288	6
Lack of responsibility for protecting water resources	3.87	1.149	0.297	7
cultivation of high-water-needing crops in wide areas of lands to gain more economic interest	3.68	1.194	0.325	8

Likert scale: very low: 1; Low: 2; Average: 3; high: 4; very high: 5

Source: Research findings.

Correlation coefficient of variables

Pearson's correlation coefficient was used to examine the relationship between the aforementioned dependent variable (the importance of public participation in the exploitation of agricultural water resources) and independent variables (factors affecting people's participation in the exploitation of agricultural water resources) which include administrative, social, cultural, educational, economic, ecological, technical and structural, political factors and the problems of the lack of public participation. The results suggest that the administrative factor and the importance of public participation in agricultural water resource utilization have a significant positive correlation at the level of 1%. That is, the better administrative factor, the more important public participation in the exploitation of agricultural water resources will be.

There is a significant positive correlation between the social factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between education factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between economic factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between political factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between ecological factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between technical-infrastructural factor and the importance of public participation in agricultural water resource utilization at the level of 1%.

There is a significant positive correlation between the problems of the lack of public participation and the importance of public participation in agricultural water resource utilization at the level of 1%.The results of the correlation coefficient of dependent variable and the independent variables are shown in Table 3.

Table 3. Calculation of the correlation coefficient of dependent variable with independent variables

Variables	Correlation coefficient (rs)	Significance level
Administrative factor	0.582**	0.000
Social factors	0.668**	0.000
Education factor	0.647**	0.000
Economic factors	0.719**	0.000
Political factors	0.573**	0.000
ecological factor	0.665**	0.000
Technical and infrastructural factor	0.427**	0.000
Problems of the lack of public participation	0.391**	0.000

** P≤0.01

Source: Research findings.

Regression analysis of variables

This study in line with its purpose (predicting a dependent variable from independent variables) used multiple-regression model to predict the dependent variables from the independent variable. Pearson's correlation coefficient was used to examine the relationship between the aforementioned dependent variable (the importance of public participation in the exploitation of agricultural water resources) and independent variables (factors affecting people's participation in the exploitation of agricultural water resources) which include administrative, social, cultural, educational, economic, ecological, technical and structural, political factors and the problems of the lack of public participation.

A multiple regression analysis (ENTER) is used to predict the dependent variable (importance of public participation in the exploitation of agricultural water resources) variance in the event of a change in the independent variable (factors affecting public participation in the exploitation of agricultural water resources) which includes administrative, social, cultural, educational, economic, ecological, technical and structural, political factors and the problems of the lack of public participation. Multiple-correlation coefficient (R) which represents the intensity of the relationship between the dependent and independent variables, in this equation is equal to 0.812. According to the R2, these factors explained 66% of the dependent variable variance.

Beta values were used to determine the significance of the independent variables in the regression. Based on these values it could be stated that the economic and the educational factor have a more significant role in predicting the dependent variable, compared to other variables. The results of the analysis are shown in Tables 4 and 5.

The linear regression equation using the B coefficients is as following:

$$Y = 9.964 + 0.073\ X1 + 0.086\ X2 + 0.212\ X3 + 0.188\ X4$$

Table 4. The coefficients of the variables entered into the regression equation

Variables	B	SD	Beta	T	Sig. level
Constant	9.964	1.396	-	7.138	0.000
Administrative factor (x1)	0.073	0.030	0.114	2.433	0.001
Social factors (x2)	0.086	0.041	0.123	2.097	0.001
Educational factor (x3)	0.212	0.069	0.278	5.170	0.000
Economic factors (x4)	0.188	0.050	0.297	3.760	0.000
Political factors (x5)	0.096	0.054	0.145	1.778	0.077
Ecological factors (x6)	0.019	0.063	0.030	0.308	0.759
Technical- infrastructural factor (x7)	0.042	0.023	-0.115	1.826	0.071
Problems of the lack of public participation(x8)	0.086	0.065	0.123	1.365	0.089
R=0.812 R2 =0.66 F=35.921 Sig. 0.000					

Source: Research findings.

CONCLUSIONS

Due to the need of rural communities to environment, natural resources, particularly water, have very important role in agricultural sector and rural areas; the optimal utilization of these resources and their management is critical. Public participation in such cases provides the necessary opportunities for successful implementation of projects for proper exploitation of water resources. Given that water resources play a key role in the sustainable development of rural areas and definitely agricultural development without water security would not be possible, the study of effective factors in the fight against water crisis in agriculture seems necessary.

According to the prioritization of variables regarding public participation importance in agricultural water resource utilization, "improvement and shortening of water transfer networks in order to speed up the transfer of water and reduction of water loss" with a variation coefficient of 0.198 had the minimum value for variation coefficient. In other words, "improvement and shortening of water transfer networks in order to speed up the transfer of water and reduction of water loss" with the lowest dispersion was the most important variable affecting public participation in agricultural water resource utilization, from the standpoint of respondents. These results are in line with Vermillion [22].

According to the results, we can say that the water network is main concern regarding the loss of water. Accordingly, the government must identify the best route for water transport, combining irrigation expert knowledge with local knowledge about water transfer routes. Although this has many difficulties ahead, but considering the importance of the issue, it can be realized through cooperation and public participation; and certainly will have a significant impact on preventing water loss.

The results also show that "government financial support in the agricultural-industrial sector in order to use new technologies" with the variation coefficient of 0.201 had the lowest variation coefficient. The results are in line with Zarei Dastjerdi et al [24] and Stoeckl et al [21].

Government has a role to play, too; since only public participation will not be enough in implementation of projects related to water to prevent a part of the water loss. State financial support to farmers is one of the measures that can help to repair or construct new transmission lines. Government providing credits and loans not only leads to proper utilization of resources on the one hand, it also paves the way for realization of goals and executive projects through encouraging farmers to use new irrigation projects, on the other hand.

In economic factor classification, it was seen that "preventing dehydration of Urmia Lake and its revival together with the fading role of ecotourism in local economy" with the variation coefficient of 0.202 and "increasing the access to financial resources for applying modern irrigation methods" with the variation coefficient of 0.224 had the lowest variation coefficient. These results are consistent with the results obtained by the Zarei Dastjerdi et al [24] and Khoshab and Namazi [9]. In other words, the variable "preventing dehydration of Urmia Lake and its revival together with the fading role of ecotourism in local economy" with the lowest dispersion was the most important variable affecting public participation in agricultural water resource utilization, from the standpoint of respondents.

Obviously, the Urmia Lake is known as one of the most important tourist sites in the region. Every year, many people from inside and outside the country come to visit the lake basin and the residents of Lake basin earn their living by relevant businesses such as working on boats, inns, tea houses which are family jobs for some of them. Fading ecotourism in the region caused many local businesses to be closed and many people to abandon their family jobs and turned to other jobs. Naturally, participation in the revival of the lake can play a very important role in the regional economy. This due to the lack of jobs will be of high importance for unemployed population, especially young people.

Regarding the social factors affecting people's participation in the agricultural water resources utilization, "avoiding economic, social, environmental and political losses due to Urmia Lake drying" with a variation coefficient of 0.226 had the lowest variation coefficient.

Obviously, Urmia Lake in addition to its effects in the economic sector is socially considered as the most important factor, too. Given the importance of the lake to the region, this factor should also be considered and studied socially.

Regarding the ecological factors affecting people's participation in the agricultural water resources utilization, "maintaining the diversity of plants and crops through water management and environmental management and environmental ethics" with a variation coefficient of 0.834 had the lowest variation coefficient. In other words, the variable "maintaining the diversity of plants and crops through water management and environmental management and environmental ethics" with the lowest dispersion was the most important variable affecting public participation in agricultural water resource utilization, from the standpoint of respondents.

Maintaining the diversity of plants and crops in the discussion of ecological factors is very important. Because this issue could be examined from the aspect of the ecotourism sector; so that with the public and state participation and support in protecting the environment, nature lovers and those who carry out research on the plant species and medical plants will not face problems doing their activities.

Regarding the discussion of educational factors affecting people's participation in exploitation of agricultural water resources, we saw that "the role of mass media such as radio and television, the use of other channels of communication in highlighting the importance of optimal water consumption" with the variation coefficient of 0.187 had the lowest variation coefficient.

In examining technical and infrastructural factors affecting public participation in water resource utilization, it can be seen that "government support for farmers to renew or launch pipeline for farms and gardens to prevent water losses" with a variation coefficient of 0.249 had the lowest variation coefficient. These results are consistent with the results obtained by Panahi et al [16].

The study political factors affecting public participation in water resource utilization showed that "government support for modern irrigation and adjustment of old transmission lines" with a variation coefficient of 0.207 had the lowest variation coefficient. These results are consistent with the results obtained by Panahi et al [16] and Zarei Dastjerdi et al. [24].

Also in the study of problems of the lack of public participation in water resource utilization, it can be seen that "the lack of cooperation between people and society" with the variation coefficient of 0.245 had the lowest value for variation coefficient; in other words with the lowest dispersion, it was the most important variable affecting public participation in agricultural water resource utilization, from the standpoint of respondents.

Lack of cooperation between people and society can be examined in economic, social, cultural and other aspects. The lack of cooperation can have economic consequences for people, especially farmers.

All farmers want to achieve maximum profit, so they have the desire to make maximum use of resources. Agricultural water is one of the main sources that can lead lack of cooperation to have maximum profitability.

On the other hand, we can examine this issue from the socio-cultural aspect: the lack of cooperation can vary according to the lifestyle.

Therefore, the necessary situation for public participation in proper water resources utilization must be provided either economically or in terms of socio-cultural aspect.

Some suggestions are requires:

(i)Improvement and shortening of water transfer networks in order to speed up the transfer of water and reduction of water loss

(ii)Government financial support in the agricultural-industrial sector in order to use new technologies

(iii)Preventing economic, social, environmental and political losses due to Urmia Lake drying
(iv)Maintaining the diversity of plants and crops through water management and environmental management and environmental ethics
(v)The role of mass media such as radio and television, the use of other channels of communication in highlighting the importance of optimal water consumption
(vi)Government support for farmers to renew or launch pipeline for farms and gardens to prevent water losses, as well as supporting new irrigation methods and repairing old transmission lines
(vii)Increasing cooperation between people and society and even the state regarding participation in the optimal use of water resources.

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MONITORING OF INNOVATIVE ACTIVITIES EFFECTIVENESS IN AGRICULTURE

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Abstract

The necessity of monitoring and improving the management of agro-industrial sector justifies the need for the research evaluation system which is considered to be highly effective. This article describes the foreign and domestic approaches to the assessment of agricultural and agro-industrial innovations. The cost behavior analysis in case of agro-industrial technological innovations has been conducted and the efficiency of the growth in high tech production and manufacture has been evaluated. A paradoxical regularity has been revealed: with the relatively stable investments in agriculture there is a sharp reduction in the use of intellectual property. This tendency dictates the need to improve the management system of the intellectual property application. In order to solve this problem, evaluation indicators of innovation efficiency have been proposed. These indicators are based on the results of expert surveys. A methodology for monitoring the innovation efficiency in agriculture has been developed: the criteria include the level of state significance, the technical-and-economic level, the degree of availability, the cost-efficiency, the level of security. This research proposes the directions of the innovation management improvement in agricultural and agro-industrial sectors. These directions have been found on the basis of the institutional approach development and the evaluation of the systemic innovation efficiency. Improving the quality of expertise in assessing agro-industrial innovations will allow us to select the most promising innovations with high-payoff technologies. In addition, it will be taken into account when assigning subsidies according to the industry-specific and regional characteristics.

Key words**:** *research evaluation system, agro-industrial complex, innovations, management system, monitoring, expert evaluation, innovation efficiency*

INTRODUCTION

Dynamic and effective development of innovation is one of the main conditions for the stable work and development of the economy. Today, the relevance of the innovative development of Russian and international organizations is associated with economic sanctions and growing international isolation. Remember the fact that the strategic competitiveness of the state on the world arena depends on the innovative activity and innovative susceptibility of regional economies and industries. Without integrated assessment of innovation development, the effective policy in the field of innovation is impossible. Achievement of the level reached by world leaders in the field of innovative economy can only be stepped up by the process of developing and implementing the methodology, conducting on the development of objective criteria for rating the ongoing innovation activity. This is one of the main conditions for achieving leadership in the innovation sphere. The need to accelerate the pace of innovative development of the agro-industrial complex (AIC) leads to the improvement of methods of differentiated

application of measures to support regional agro-systems from the budget.

One of the main conditions of scientific-technical progress in agriculture and agribusiness in the economy is the implementation of innovations in production. No less important is the concentration of innovation management with some extras to complex manufacturing processes, system of organizational and economic development of the new national economy areas [2]; the creation of an infrastructure environment conducive to rapid innovation and technological development; increase the investment attractiveness and realization of innovative projects in the agricultural sector of the economy. It is necessary to develop a system for introducing innovations in production in connection with the need to accelerate scientific and technological progress in the economy and to create national, technological, energy, economic and food security of the country [8].

To ensure and improve the competitiveness of the agro-industrial complex on the world market important for the creation of the state of the environment, which contributes to the development of enterprise and increase of innovative activity. It is logical that such an enterprise is much more difficult to control [9].

Innovative organizational forms of innovation areas are established on the principles of efficiency and localized in the places of concentration of major research centers and universities, known for its academic tradition and modern training base in the vicinity of large agro-industrial enterprises [12].

The following directions of development of agriculture and agribusiness will be: the creation of scientific-technological parks; development of small innovative enterprises producing of innovative products and agricultural products with improved properties and characteristics; the creation of research and scientific centers of private ownership, certification of existing facilities in determining their level of technological development, the development of independent innovation and technology audit. The result of the organization's information system must be up-to-date official assessment, providing the same model of reality for all departments whose activities should be carried out on a coordinated basis [14].

However, in order to effectively manage any system, one must first analyze the dynamics of its elements and rates their current state, and outline growth zones.

The evaluation of innovation activity in foreign countries is based on the use of different methods and approaches, such as the European Innovation Board of the European Innovation Scoreboard, the Technology Innovation Index, the Innovation Capacity Index, the World Innovation Index of the Boston Consulting Group (GIIBCG), the INSEAD World Innovative Index (GIIINSEAD), the Global Innovation Factor (Global Innovation Quotient). In addition, the values of the growth of the assessment of innovation activities of the regions are pointed out, and the Innovation Index in American regions, as well as the rating of the Australian agency “2thinknow” is considered.The National Agricultural Research Systems (NARS), the Agricultural Innovation System (AIS), the Agricultural Knowledge and Information System (AKIS) are identified among the support structures for agricultural research according to the World Bank (2006). Each system is characterized by its goals, factors, results, organizational principles of construction, the role of the policy pursued, as well as the mechanism for implementing innovations. According to the rating compiled by the Organization for Economic Cooperation and Development (OECD), the agricultural innovation system consists of three groups of determinants: the knowledge system in the field of agricultural economics, R & D, education; social, as well as users [3].Also on the basis of the Agricultural Science and Technology Indicators data, ASTI examines this type of indicator as an investment in knowledge creation for agriculture based on the intensity of agricultural R & D in the public sector [19].

In the work [15] on the basis of EU Framework 7 project Impreza the dynamics of expenses on research activity, assessment of efficiency of expenses on research and final

results of production activity were studied. The article reveals the tendencies of decrease in investments in agricultural science in the European Union since 2004, despite the high degree of their payback. Directions of development of innovative and investment potential were offered which will allow to increase efficiency of investments in science.

Special importance is the problem of developing and assessing the development of innovations in agriculture, increasing the innovative appeal of consumers, and stimulating the use of advanced production technologies [13].

Only a comprehensive trip can be considered a base for the transition of the modern innovative development path, as it works in the management of the agricultural sectors, actively use the results of scientific and technological progress.

In the researches of I.G. Ushachev, I.S. Sandu the necessity of evaluating innovation activity under modern conditions is substantiated, setting forth the methodological bases of this process. In addition, they announced the main directions for increasing the effectiveness of market relations, including in the sphere of education, science and education [23].

Generally, the scheme of development and implementation of innovations in agriculture can be represented as a set of the following areas: market research, development of innovations and ensuring the entry of innovations into the market. Marketing analysis of the innovation market includes the assessment of demand, supply, and evaluation of the competitive environment, price monitoring and the formation of the optimal price of innovation [4].

At the stage of ensuring innovation on the market, effective development and commercialization of innovations become important, which becomes an indispensable condition for generating and using scientific developments in the field of agriculture to increase the pace of economic development of the agro-industrial complex [1].

At the same time, within the framework of such development institutions as RUSNANO, Skolkovo, RVK, there were attempts to develop technological platforms. However, these efforts do not meet the large-scale tasks of innovative development of the country's agro-industrial complex [25].

For example, in foreign countries in the agro-industrial complex there are institutes of innovative development: agencies for marketing research, implementation of their results and provision of consulting services under the ministries of agriculture; "Technological valleys" and innovative clusters in agrarian universities; seed-growing, tribal private corporations [16].

The EC experience is indicative for the Russian AIC sector, within the framework of which there is a system of indicators aimed at coordinating innovation policy in the agro-industrial complex and facilitating the collection, analysis, evaluation and dissemination of information on commercialization and the state of innovation. These indicators include Trend Chart on Innovation in Europe (trends in the implementation of effective innovation in Europe), European Innovation Scoreboard (European Innovative Tabloid), which represents information about innovative behavior of companies and an innovative environment, CORDIS - Electronic Information Service for R & D, and Innovation Relay Centers - a local network of centers for the dissemination of innovations. The introduction of such systems will provide prompt and reliable information on promising developments and the pathways of innovative development and analysis of agricultural development trends from Federal level to enterprise level, including regional ones.

MATERIALS AND METHODS

For the purposes of analysis and evaluation of the dynamics of innovation in agriculture, Table 1 presents the costs of technological innovation in agriculture and the results of innovation, expressed in the production of high-tech products.

The analysis of innovative activity of agro-industrial enterprises shows that it remains low, while between the individual branches of the agro-industrial complex there are

significant disproportions, despite the growth of costs for technological innovation.

The data of Table 1 shows a paradoxical regularity: with a relatively stable investment in agriculture, incl. due to state programs, there is a sharp reduction in the use of intellectual property objects in comparison with the previous year more than 2 times, and in comparison with 2005 there was a reduction of more than 50 times - from 150 used intellectual property objects in 2005 to 3 objects in 2016. It can be assumed that this trend reflects the lack of practical application of the results of intellectual property in practice. In this regard, one of the main directions of innovation process management in the agro-industrial complex is the improvement of the susceptibility of innovations and scientific achievements on the part of consumers, the formation and development of a stable demand for this product.

Table 1. Indicators of costs for technological innovation in the agro-industrial complex and the production of science-intensive products, RF, 1992-2016

Indicators	2008	2009	2010	2011	2012	2013	2014	2015	2016
Costs for technological innovation, total (million rubles)	276,262	358,861	358,861	733,816	904,561	1,112,339	1,211,897	1,203,638	1,284,590
Costs for technological innovation of agricultural enterprises, (million rubles)	12,183	10,838	8,761	12,563	16,908	29,974	25,864	25,024	23,963
The share of expenses for technological innovations in the total amount of loaded goods, work performed, services enterprises of the agro-industrial complex,%	0.46	0.52	0.37	0.44	0.58	0.57	0.55	0.53	0.54
Created varieties and hybrids of agricultural crops	258	-	-	270	315	298	293	335	356
Selective forms of animals, birds, fish and insects	24	-	-	8	5	4	9	7	5
Developed: new and improved technologies	280	-	-	310	295	301	295	273	258
vaccines, diagnostics of minds, biopreparations	69	-	-	59	61	59	47	36	32
Developed new food items	1,167	-	-	528	400	364	392	214	192
Received patents and copyright certificates	722	-	-	735	724	755	751	741	738

Source: Rosstat data.

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The departure from innovative development is associated with a sharp decline in solvent demand for innovation and scientific

achievements in the agro-industrial complex due to the unfavorable financial condition of agricultural enterprises [21].

In recent years, the share of loss-making agricultural producers has ranged from 40 to 60%, which is largely due to the disparity of prices for agricultural products. Also in the agro-industrial complex there are no established mechanisms for the implementation of innovations, as well as structures dealing with the study of the demand for innovation.

The methodological approaches used in the Russian practice to distribute budget funds among agricultural producers need to be improved. Basically, in order to identify the subjects of the agro-industrial complex - the potential grant recipients of state regulation, a contest is held to include them in the state program. The criteria for making decisions are the performance of such indicators as: the number of jobs created; cost of production assets; livestock of farm animals; the area of land; absence of tax arrears; payback period of the investment project. However, this selection does not take into account the indicators that characterize the susceptibility of innovation. In opinion of A.N. Chekavinsky such criteria can act as resource criteria [5].

Specific weight of specialists with higher education, in general besides specialists, the cost of fixed assets per 100 hectares of arable land; electricity consumption is 100 hectares of arable land; The volume of mineral fertilizers applied per 1 ha of sowing area, Consumption of fodder for the production of 1 ts of products, ts feed. units; Specific weight of breeding animals in their total number of livestock, Number of heads of cattle per 1 operator; Specific weight of areas sown with elites of agricultural crops, Specific gravity of acidic soils, average indicator of humus.

As an effective criterion it is possible to note:

(i)Labor costs for the production of 1 ton of products, man-hours;

(ii)The cost of agricultural products per unit of material production costs, rubles. / rub.;

(iii)Gross yield of agricultural crops from 1 hectare, %;

(iv)Growth of productivity of 1 head of cattle, %;

(v)Reduction of losses during cultivation and harvesting of crops and livestock, %;

6. Improving the quality of the product (for example, milk fat content), %.

In the work [17] the researchers note the fact that, on the whole, the system of rating and accounting for innovations in the agrarian lecture school of modern Russia is imperfect. This is connected with the fact that innovations in the field of agriculture are practically uncovered by official statistics, and therefore information on them in the statistical compendium is included in a separate section. In addition, special methodological tools are lacking, which make it possible to combine the process of collecting statistical data into a single complex and the application of the state process' regulation of innovative activity in the countryside. The authors proposed methodological recommendations aimed at completing the existing systems for recording and evaluating the innovation process in agriculture. To do this, they are invited to introduce systematic detailed accounting, for which the specified appropriate evaluation and accounting criteria, a methodology is created that allows using the indicators of efficiency, intensity and effectiveness to assess the state of affairs in the field of innovation in agriculture. Universal system indicator on the basis of which one can estimate the level of innovative activity in agriculture is not developed at the moment. Foreign experience regulates the effectiveness of innovation in the production activities of enterprises and accordingly is reflected in statistical forms. In Russia, however, innovation statistics are tracked in industry and high-tech industries. In agriculture and the agro-industrial complex, it is extremely limited and in many industries is not sufficient for constructing estimates and forecast models. The development of a universal system of indicators for assessing the contribution of innovation to innovative regional development will, in practice, improve the targeting of financing in conditions of limited resources. Thus, despite the allocated effective and resource criteria, it

is problematic to build effective models for assessing the effectiveness of innovation implementation in the context of Russian regions due to insufficient consideration of the results of innovation activities in the context of enterprises and regions.

The attempt proposed in work is about to construct a universal methodology for monitoring the effectiveness of innovations for the agricultural sectors on the basis of qualitative characteristics based on the results of the focus groups. Analysis of scientific papers has shown that modern approaches to assessing the effectiveness of an innovative product in the agricultural sector to address this problem, based on the following: from the producer's point of view, which mainly deals with effective planning and product range development, from the perspective of consumer behavior analysis.

To determine the degree of importance of the organizational and economic foundations of the management system of innovative processes in the development of agricultural technology at the federal, regional and enterprise levels, a sociological research method was used among producers, consumers and governments in the development and promotion of innovative products.

Respondents were asked to rate on a 10-point scale the degree to which each of these elements of the system's mechanisms affect the efficiency of its functioning, as well as to offer its most important elements and actions that improve the closeness of the connection between science and from the point of view of the producer of products, and from the point of view of the customer, since the high efficiency of the system is achieved due to the complex interaction of its subjects on the basis of the principles of cooperation and complementarity (Fig. 1.).

Based on the statistical data on the federal level, we found that the greatest value for the effective functioning of the system is the state support of science by financing grants for the implementation of scientific achievements - 7.09, improving the legislative and regulatory framework - up to 6.43; improvement of the tax policy through the partial or complete release of research organizations from taxes - 5.70; insurance risks in the development of scientific development and improvement of the management system for the development of scientific achievements - 5.09; The element that influences least on the effectiveness of the promotion system, according to respondents, is to improve the pricing mechanism for scientific products - 4.82 (Fig.1.1).

At the regional level, the most important element is the element - the scientific infrastructure - X and other units of realization - 7.89; development of scientific and personnel potential - 7.52; the creation of a data bank is ready for the application of scientific developments - 6.91; analysis of the regional market for research and growth of development strategies for related segments 6.71; development of regional normative legal acts regulating the elaboration of scientific achievements up to 6.43; the improvement of the management system is estimated at 6.2 (Fig. 1.2).

At the enterprise level, according to respondents, the most valuable are indicators such as training and qualification of scientific and personnel potential - 7.96; development of scientific infrastructure - 6.69; marketing for the study of scientific developments - 6.65, customer access to the Bank's data - 6.48, expansion of the scope of application of scientific developments in the field and activities - 6.13; the lowest estimated value is elemental cooperation with other consumers of scientific developments - 5.9 (Fig. 1.3).

The third group of criteria determines the degree of scientific readiness and technical developments, the degree of completion of the stages of development of scientific and technological achievements, the suitability for use in production, and consists of five stages. The fourth group takes into account the cost in the ranking system, depending on which stage of the algorithm the promotion system is a scientific achievement, and determine the five steps presented in the model. All these steps in the groups of relevance and efficiency criteria, the development of completeness are ranked in an increasing order of step numbering. A consistent number of steps can

be taken for the value of the algebraic progression or geometric progression, or the expert in decision can be assigned a certain number of points. The last group of criteria (cost of realization) has a negative value and reduces the effectiveness of innovation.

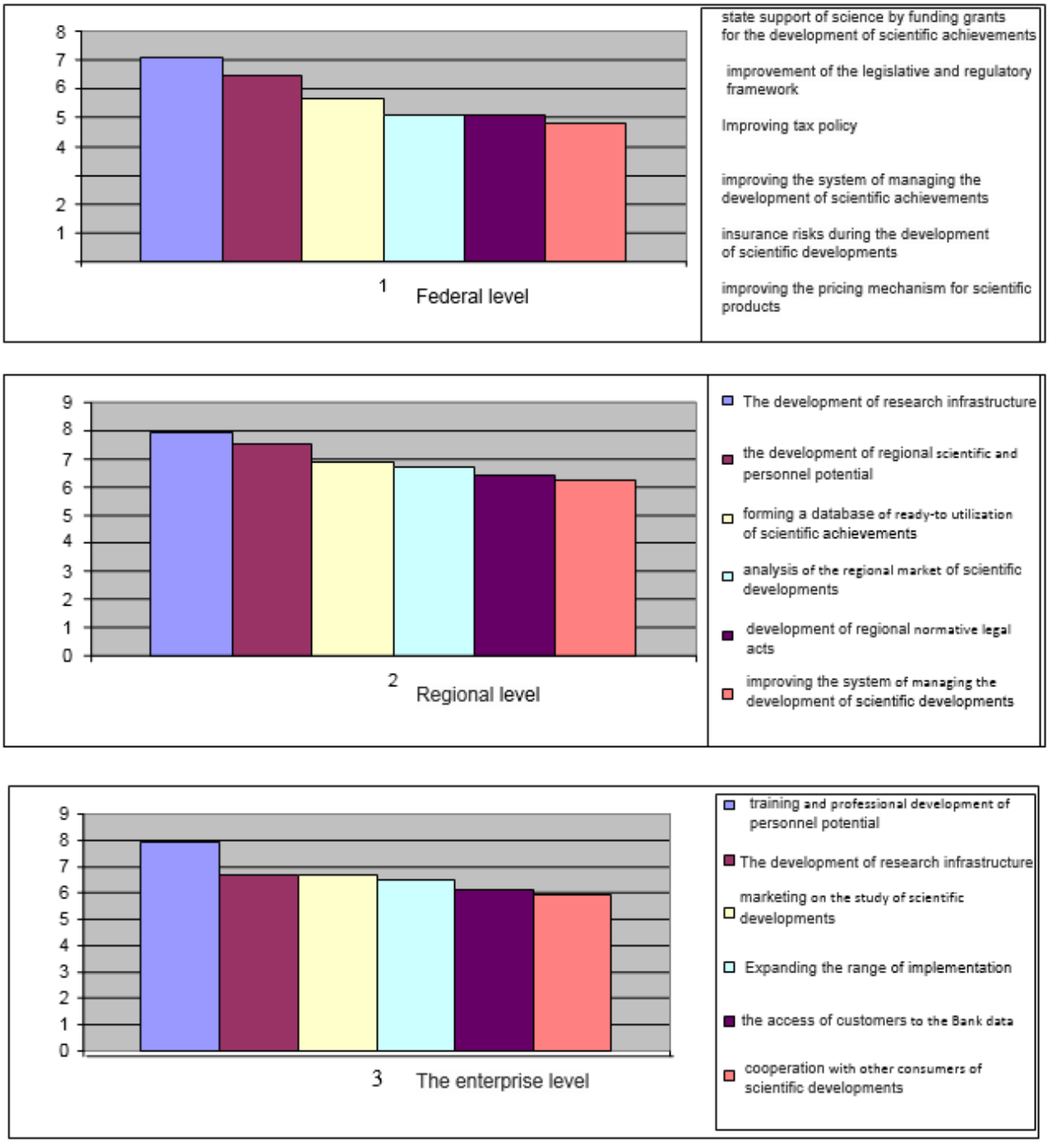

Fig. 1. The assessment of the importance degree of factors affecting the advancement of innovative products in the agricultural sector
Source: Own determination.

RESULTS AND DISCUSSIONS

Based on the results of our researches, we will build an economic and mathematical model that allows us to assess the level of innovative efficiency activities in the agro-industrial sector from the calculation of the rating each specific scientific development, formed using five groups of criteria.

We can name the following sections of the agro-industrial complex, classified according to this methodology:
(a)Issues of economics, management, personnel and social security.
(b)Seed breeding, breeding activities and activities in the field of plant protection, general farming issues.
(c)Livestock issues: veterinary, hygiene and sanitation.
(d)Mechanization of the agro-industrial sector.
(e)Activities in the sphere of forestry, melioration, fish farming and fishing.
(f)Innovations in the field of storage of agricultural products, as well as its processing.
The work in the field of search, analysis, evaluation or selection of promising innovations is proposed to be carried out taking into account the following groups of criteria:
(i)Importance for state policy in the field of scientific and technical development, improvement of innovative developments (scientific and technical level);
(ii)Identification of the level of efficiency or technical and economic level;
(iii)Indicators of readiness of innovative development for implementation;
(iv)The costs needed to absorb and realize the innovation.
As for the first group of criteria, the significance of innovation for public interests is devoted to, and it consists of ten stages:
1 stage - parameters that characterize the level of development of commodity producers, working in agriculture;
2 stage - regional and sectoral priorities;
3 stage - activities to solve the tasks set by the Federal Target program of the Russian Federation;
4 stage - new scientific and technical developments, ideas and proposals, aimed at improving those areas of scientific activity that should contribute to increasing the efficiency of the functioning of the AIC;
5 stage - the location of agrarian economics at the level of development, corresponding to the modern international;
6 stage - activities in the sphere of domestic invention and innovation;
7 stage - algorithms for solving problems included in the list of critical technologies;
8 stage - the amount of contribution to priority areas of domestic science;
9 stage - the commission of scientific discoveries;
10 stage - the solution of national and state problems.
The second group includes such criteria as efficiency and technical and economic level. It consists of 10 steps:
1 stage - increasing the effectiveness of the existing tax policy for the calculation of the release of organizations engaged in scientific and technical activities from taxes, fully or partially;
2nd stage - insurance of economic risks at the stage of development of new scientific and technical developments.
3rd stage is the reorganization of the mechanism of pricing for scientific products, in order to improve it, taking into account the solvency of the customer of the demand that has been formed on the market.
4th stage - the development of a system aimed at effective management of the processes of mastering scientific achievements.
5th stage - the formation of a database of discoveries and inventions ready for development and implementation.
6th stage - formation of strategy of promotion of scientific and technical developments on the basis of analysis of the regional market.
7th stage - the development of scientific and near-scientific infrastructure, for example, innovative organizations.
8th stage - a form of state support for scientific activity through the provision of its financing in the form of grants directed to the development of scientific achievements.
9th stage - the improvement of the existing legislative and regulatory framework in the field of innovation in the field of agro-industrial complex.
10th stage - the development of personnel, training and retraining them as a priority, while raising the level of human resources must be conducted at all managerial and production levels.
The third group of criteria contains indicators that indicate the degree of completion of a

stage in the development of scientific and technical achievements, as well as qualifications indicating their readiness to use them in the production process. It includes 5 stages:

1st stage - recommendations, concept, suggestions:

2nd stage - the economic-mathematical model;

3rd stage - applied methods;

4th stage - the project of innovative activity;

5th stage - replication of scientific achievements.

The fourth group of criteria includes such areas as production development and financing of the implementation of scientific development.

1st stage - completion of work in the field of R & D.

2nd stage - direct the process of creating scientific and technical products.

3rd stage - release of the results of innovation activities.

4th stage is the pilot experiment.

5th stage - creation of information and consulting service.

All levels placed in the groups of criteria are assessed by increasing their numbering, depending on the significance, effectiveness and completeness of scientific development. Each such step must take a number taken as the value of an algebraic or geometric progression. In addition, an expert can assign to any number a fixed number of points. Here it is worth noting that with the negative cost of implementation costs, which are included in the fourth group of criteria, you can consider the possibility of reducing the rate of filing for NTD [6].

In this case, the rating (R) is defined as the geometric sum of the degrees of the criteria of the three-axis rectangular coordinate system.

$$R = \sqrt{y_n^2 + (x_э - x_з)^2 + z_p^2} \quad \text{.....(1)}$$

where: y – is the level of group significance tests; $x_э$ – group performance criteria; $x_з$– stage group criteria development costs; z_p – group criteria of the development completion's degree. The total aggregate significance and efficiency are determined by the evaluation of assessment of the effectiveness of scientific developments R, calculated as the product of the K-security criterion and the geometric sum of the squares of the above criteria[6]:

$$R = K \times \sqrt{Y^2 + (X_e - X_z)^2 + Z^2}, \quad \text{.....(2)}$$

where: K –safety criteria value from 0 to 1; Y – criteria of national importance, the level of technical perfection, points; Xe – performance indicators; Xz – is an indicator of the cost of realization points; Z– is an indicator of the development completion's degree points.

Based on the developed methods of assessment, the technology assessment will be taken into account for five of the above criteria: a criterion of national importance - solving the problems of national priorities - 10 levels; in accordance with the criterion of effectiveness - improving the organization of the management process - the application of scientific developments - phase 4; in accordance with the criterion of implementation cost - stage 4; stage of completion of development - economic-mathematical model of the 2nd degree; and by safety criterion - 1 point.

$$R = K_{без} \times \sqrt{Y^2 + (X_э - X_з)^2 + Z^2}, \quad \text{.....(3)}$$

$$R = 1 \times \sqrt{100 + (16 - 16) + 4} = 10.2 \text{ points.}$$

The analysis of the scientific evaluation effectiveness and technological development was carried out by constructing a regression model in which the dependent variable is the estimated value of research and development, and independent variables - project cost, development cost, annual economic effect and development period.

The purpose of constructing this model is to determine the degree factors influence on the methodology for assessing the reliability of scientific research, developed sets of criteria and interdependence, increasing the scoring of scientific and technological developments taking into account economic indicators.

CONCLUSIONS

The developed technique using the method of correlation-regression analysis of the constructed model was based on scoring developments from the main economic indicators of innovative projects in agro-industrial complex which has the formula:

$$Y = -2.22 + 0.07X_1 + 0.23X_3 \qquad (R^2 = 0.9),$$

where: X_1 –the cost of the project development, thousand rubles; X_3 – profit from the development, thousand rubles; R^2 – the coefficient of determination.

Estimation of the regression parameters equation show that by increasing the amount of profit per 1 thousand rubles assess the importance of development increases by 0.23 points, increasing development costs 1 thousand rubles assessment of its significance is increased by 0.07 points. The linear coefficient of multiple correlation (determination) (R2 = 0.9) indicates a close relationship of factor characteristics with effective. In the future this technique can be widely used in assessing the efficiency of scientific research for selecting the most promising innovative products for agriculture with rapid return on investment.

While selecting innovative projects, their economic expertise and the study of performance indicators are recommended, and the realization schemes for agro-industrial production should be improved. Currently, agricultural science is able to provide agricultural producers with the latest developments, to guarantee the results of their realization. To this end, close interaction is necessary between agricultural science and agricultural producers in order to ensure the transfer of effective proven innovations to production. In addition, it is necessary to develop effective mechanisms for accepting completed innovations and their selection for implementation. To achieve this goal, it is necessary to improve the regulatory and legal framework for innovative development of the agro-industrial complex in order to form an institute of intellectual property in the agro-industrial complex. M. Porter noted that "prosperity, especially in advanced economies, stems from the ability of national companies to create and then globally to commercialize new products and processes, while mastering the frontier of innovation the faster the closer the competitors» [18].

The evaluation of innovative developments at all stages of the innovation process will make it possible to identify the most promising and priority ones and will allow to concentrate the limited resources on the most effective ones.

In the work [10] positive experience is shown presented in the work of innovation development in accordance with the application of the triple helix concept. In the article the application of the triple helix concept is offered which integrates science, business, and government in order to accelerate the production of promising innovations and their approbation in practice on the example of seven horticultural subjects of the Netherlands. The necessity of ensuring close communication links within the elements of the triple helix in order to stimulate innovation is substantiated.

To activate innovative activity Golubev A.V. offers an integrated approach that allows stimulating both demand and supply for innovative products, services and technologies [11]. Institutes of innovative agro-economics should be the infrastructure facilities of the agro-industrial complex-scientific and production partnerships, branch laboratories, educational organizations, training and experimental farms, small innovative enterprises, breeding and seed breeding and breeding and genetic centers and other organizations created in different institutional forms by the customer and participants complex scientific and technical projects for the purpose of finalizing and transferring the results of research and development, legal protection and management of the rights to such results for pilot production [22]. Infrastructure institutions should ensure the completion of innovations until the completed innovations with approbation or with direct transfer to a certain circle of producers for large-scale distribution. Sandu I considers the assessment of innovation activity of the regions [20].

Thus, the development of mechanisms to stimulate demand and institutional innovation infrastructure in the agro-industrial complex of the regions will increase their innovative activity aimed at increasing the competitiveness of the Russian agro-industrial complex and ensuring Russia's food safety [7].

Main research results: domestic and foreign approaches to the evaluation of innovative activities in the agro-industrial complex are systematized; The system of indicators of an innovative estimation potential of agriculture is offered; the possibility of applying the author's methodology for assessing the impact of stimulating demand on the level of innovative development of the Russian regions for the implementation system of innovations and scientific achievements in the agro-industrial complex is substantiated; perfection directions of realization management of innovations in agrarian and industrial complex on the basis of the institutional approach development in view of an efficiency estimation of system's innovations realizations are offered. This approach will ensure the implementation of innovations in production with approbation or with direct transfer to a certain range of consumers for the purpose of large-scale distribution and replication in agro-industrial production. Increasing the effectiveness of innovation in the agro-industrial complex of Russian regions on the basis of improving the quality of expertise of scientific developments at all links of the institutional chain will allow introducing promising innovations with high returns to the production process and can be taken into account when subsidizing the agro-industrial complex regions.

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GAME SPECIES FROM TULCEA COUNTY AND THEIR MANAGEMENT

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Abstract

Hunting has been always an important activity in Romania, not only due to the presence of high numbers of game species, but also for their variety. Tulcea County has a total of 54 hunting funds that account for 580.701 hectares, being one of the counties with high potential in terms of hunting. Amongst the main hunting species from Tulcea County (red deer, fallow deer, roe deer, European hare, pheasant, partridge, badger, fox, raccoon dog, jackal, ferret, weasel, stoat, musk, ducks, gooses) eight were chosen and prioritized based on nineteen criteria established within COST Action FP 1203. An analytical hierarchic process (AHP) was used and the analysis were performed by the aid of Expert Choice Desktop software package. The most important game species were the wild boar and the roe deer, while the least important were the golden jackal and the red fox. Specific game management measures were proposed.

Key words**:** *AHP, game management, hunting, Tulcea, wild animals*

INTRODUCTION

Hunting is the human activity of killing or trapping wild animals for different purposes. It appeared together with human evolution, while its methods and means were constantly improved as the human society developed. Nowadays, the concept of hunting includes besides the specific hunting activities a broad spectrum of measures for conserving biodiversity and managing the wild fauna. Moreover, the list of activities is completed by trainings for specialists, research and scientific studies, awareness actions for promoting the role of the wild fauna, sociological studies etc. These management measures and activities are needed because it is well known that the management of the game pool limits the number of hunted species and intends to conserve the habitats, including the biodiversity [21], [22].

Hunting has been always an important activity in our country, not only due to the presence of high numbers of game species, but also for their variety. It is well known that the diversity of Romania's natural ecosystems favored the conservation of a rich genetic fund in the case of mammalians [23]. Also, hunting offers not only food, but also other derived products (*e.g.* furs, trophies) [16].

The "game" concept refers to the totality of species of hunting interest present on a defined territory. Some of these species can be permanently hunted, while others are integrally protected. The protection category can change in time based on the evolution of the environmental factors and the size of the population. The hunter's obligation is to know the regulations related to the hunting of certain species and to contribute to their conservation [7].

In Romania, the national hunting fund is divided into 2,151 hunting units that are managed by private or state forest units and hunting associations [11]. The organization of hunting activity is regulated by the Law no. 407/2006 [18]. This law includes a list of 18 mammals and 39 birds for which the hunting is permitted, 11 mammals and 110 birds for which the hunting is prohibited, respectively.

Across Tulcea County, there are 54 hunting funds with a total area of 580,701 hectares, from which 21 are managed by Tulcea Forestry Directorate, a subunit of National Forest Administration Romsilva (37.6%), 11 funds are managed by the County Hunting and Sport Fishing Association (30.8%) and 3 funds are administered by the Sportive Fishing Associations (7.8 %). The main game species from Tulcea County are represented by: red deer, fallow deer, roe deer, wild boar, pheasant, partridge, red fox, raccoon dog, jackal, ferret, weasel, stoat, ducks and gooses. Most of the birds and fishes are found in Danube Delta, the biosphere reservation (declared by Law no. 82/1993 [19]), due to its specific ecosystems [28].
The aim of the study was to highlight the most important game species from Tulcea County.

MATERIALS AND METHODS

Tulcea County is located in the southern-eastern part of Romania, in Dobrogea region. Its neighbors are Constanța County in the South, Brăila County in the West, Galați County and the border with Ukraine in the North and the Black Sea in the East (Fig. 1).

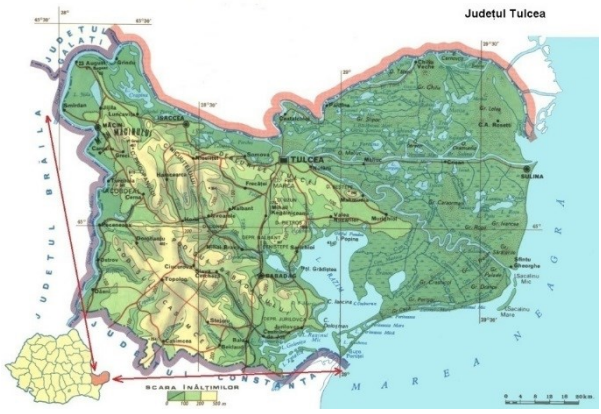

Fig. 1. Location of Tulcea County
Source: http://pe-harta.ro/judete/Tulcea.jpg, Accessed Feb.10, 2018

The climate in Tulcea has an excessive temperate-continental character, slightly moderate across Danube Delta. The annual rainfall amount accounts for 500-550 mm in North and West and decreases toward 400 mm or less in Danube Delta. The annual average temperature reaches 11°C in West and South areas and 11-12°C in Danube Delta. Summers are hot and dry, with few but torrential rains ussualy accompanied by hailstones and thunders, while the winters are moderately cold and the precipitations are lacking. However, winters are frosty, due to harsh and persistent winds, representing the most unpleasant climatic element.
The area of the forest fund in Tulcea County accounts for 105,000 hectares, out of which 93,600 hectares (89%) represent forests [17]. Forests are distributed only in high hills, forming compact stands (*e.g.* Slava Cercheza, Ciucurova, Topolog, Hamcearca and Luncavița areas). Tulcea is famous also for its special forests, such as Luncavița, a tertiary relict with representatives of genus *Fagus* L.
In order to determine the most important game species an Analytic Hierarchy Proces (AHP) was performed, by using the 19 criteria designated within COST Action FP1203 (www.nwfps.eu) and used in a study conducted in the case of Ialomița County aimed at highlighting the most promising non-wood forest products [9]. The list of the 19 criteria consists in: Criterion 1: Harvesting period (1: the shortest harvesting period … 8: the longest harvesting period); Criterion 2: Portfolio of derived products (1: the smallest number of deriver products … 8: the highest number of derived products); Criterion 3: Harvested quantity by one worker in 8 hours (1: the lowest quantity … 8: the highest quantity); Criterion 4: Harvesting cost (1: the lowest cost … 8: the highest cost); Criterion 5: Knowledge for recognition (1: most recognizable product … 8: hardest recognizable product); Criterion 6: Knowledge for harvesting (1: the less knowledge necessary … 8: most knowledge necessary); Criterion 7: Tools needed for harvesting (1: the least … 8: the more); Criterion 8: Complexity of harvesting process (1: lowest … 8: highest); Criterion 9: Distribution range (1: lowest … 8: highest); Criterion 10: Market potential (1: low … 8: high); Criterion 11: The price of raw product (1: lowest … 8: highest); Criterion 12: The price of the derived product (1: lowest … 8: highest); Criterion 13: Transport from the harvesting point to the storage center (1: the most easy … 8: the most complicated);

Criterion 14: Perishability (1: lowest … 8: highest); Criterion 15: "Celebrity" of the product on the market (1: the least known … 8: the most popular); Criterion 16: Market demand (1: lowest … 8: highest); Criterion 17: Biotic threats (1: the fewest threats … 8: the most threats); Criterion 18: Abiotic threats (1: the fewest threats … 8: the most threats); Criterion 19: Development of the process of harvesting (1: undeveloped … 8: extremely developed). The analyses were conducted with Expert Choice Desktop (v. 11.5.1683).

Based on the information available in official reports/documents and by taking into account the experts' knowledge, the following eight game species were chosen for analysis, namely: the mallard (*Anas platyrhynchos* L.), the white goose (*Anser anser rubrirostris* L.), the wild boar (*Sus scrofa* L.), the golden jackal (*Canis aureaus* L.), the roe deer (*Capreolus capreolus* L.), European mouflon (*Ovis orientalis musimon* L.), European hare (*Lepus europaeus* Pallas.) and the red fox (*Vulpes vulpes* L.). The AHP alternative ranking is present in Table 1.

RESULTS AND DISCUSSIONS

Table 1. AHP alternative ranking

Criterion	Game species							
	mallard	white goose	wild boar	golden jackal	roe deer	European mouflon	European hare	red fox
1	5	4	6	8	3	1	2	7
2	3	5	7	1	8	6	4	2
3	8	7	4	1	3	2	6	5
4	4	5	7	3	8	6	1	2
5	4	3	7	8	6	5	2	1
6	4	3	5	6	7	8	1	2
7	7	5	6	1	8	4	3	2
8	5	4	7	1	6	8	3	2
9	5	4	7	1	3	2	6	8
10	3	4	8	1	7	5	6	2
11	3	4	7	1	8	6	5	2
12	3	5	8	1	7	6	4	2
13	1	2	8	5	7	6	3	4
14	4	3	7	1	8	6	5	2
15	4	3	7	1	8	6	5	2
16	4	3	8	1	7	6	5	2
17	7	6	3	1	4	5	8	2
18	8	7	6	1	3	4	5	2
19	4	5	7	1	8	6	3	2

Source: Own results.

According to the AHP results, the most appreciated game species were the **wild boar** (ro. mistreț) and the **roe deer** (ro. căprior), while the ones with the lowest general score were the **golden jackal** (ro. șacal auriu) and the **red fox** (ro. vulpe) (Fig.2). In the case of **wild boar** similar results were obtained also in other countries, such as Argeș County, where the wild boar ranked second [10] and Maramureș County, where it was placed on the third position [8].

Roe deer is the main representative of family *Cervidae* that is found in almost all European countries (with the exception of Ireland, Cyprus, Corsica, Sardinia, Sicily and most smaller islands). This species has a high economic value for meat production and sport hunting [5]. The presence of roe deer in the North-West part of Tulcea County is an example of natural species expansion.

European mouflon (ro. muflon) ranked third. The **mouflon** was introduced in Balc City from Bihor County during the Second World War. Almost three decades ago, the managers of the hunting fund wanted to introduce it also in Retezat forests (southern-western part of

Romania), but the attempt failed due to snow and large predators [20]. Between 1966 and 1967, 37 individuals were freed in Dobrogea [6]. In Romania, the mouflon is considered an allochthonous species that has regained its importance and interest in the last years [3].

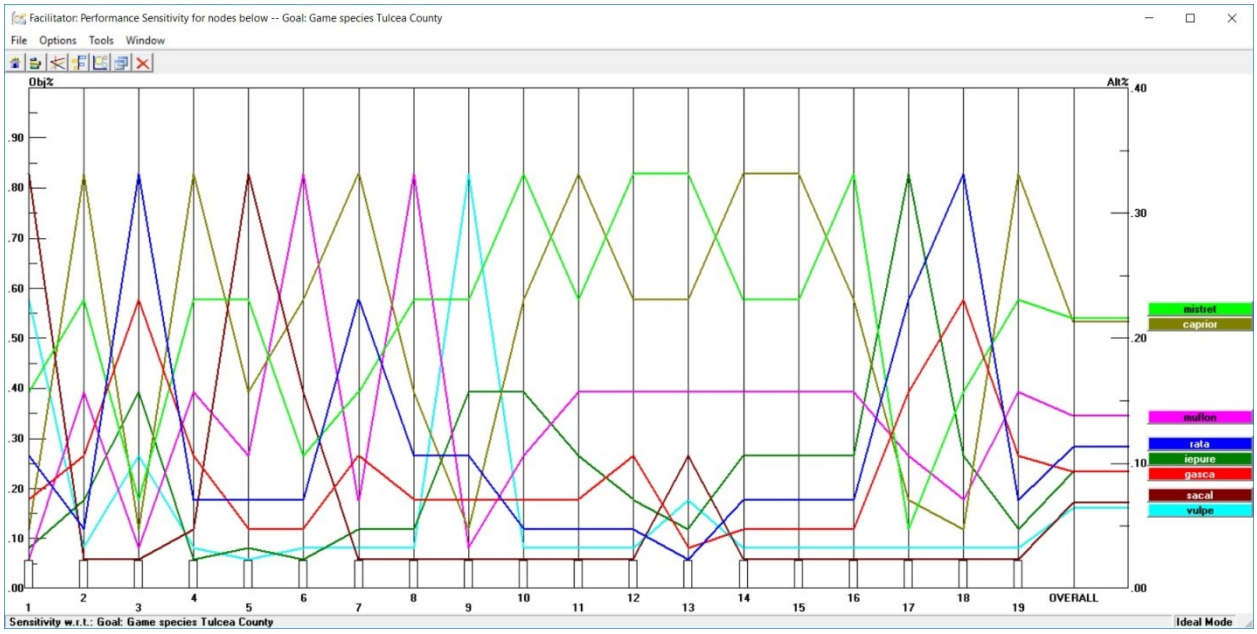

Fig. 2. Ranking of the selected game species
Source: original.

The **mallard** (ro. rață), which ranked fourth, is the most bidder bird species of hunting interest in Romania, its annual quota at national level being more than 131 thousands individuals. In the case of the second bird species from our study, namely the **white goose** (ro. gâscă), that was situated on the sixth place, the national annual quota is more than 60 thousands individuals [25], [26]. The lower performance of the white goose could be explained by the fact that it is one of the most sensitive species as regards the biotic and abiotic threats (criteria 17 and 18).

The **golden jackal** received the smallest scores in almost all the situations, with the exception of criteria 1 and 5, where it registered maximum values. This species is widespread in the entire country (from South-East towards North-West), in the ecological niche freed after the extinction of wolfs [1], [15], [24]. The largest populations can be found in the south area of the country, in Constanța and Dolj, followed by Călărași, Olt, Tulcea, Teleorman, Ialomița, Vaslui and Mehedinți Counties. In Dobrogea, the habitat conditions are favorable, as the climate is hotter and the competition reduced as wolfs have become very rare, while in Tulcea the last wolf was hunted in 1985, its place being taken by the jackal [2], [4], [13]. Largest populations of jackals (45 individuals) were found in in the southern part of Constanța County, in Cochirleni [12].

The last position in the top was occupied by the **red fox** that recorded good scores only for criteria 1 and 9. In our country, red fox populations are predominantly found in the Romanian Plain, Dobrogea, Sub Carpathian hills or Bucegi Plateau. For the previous year, it was estimated that approximately 700 red foxes would be harvested from Tulcea County.

Management measures regarding hunting in Tulcea County

In Romania, game management is determined by the hunting regime instituted through special laws and by the property regime of the territorial fund, some changes being recorded during the past century [14]. Nowadays, according to Article 58, paragraph (3) of the Forest Code (Law 46/2008), the fauna of hunting interest represent one of the main categories of non-wood forest products, together with fish from mountain waters,

forest fruits, forest seeds, truffles and edible mushrooms, medicinal plants, resin, a.s.o. Moreover, in accordance with paragraph (4) of the same article of the Forest Code, the forest products belong to their owners, with the exception of hunting and wildlife fish.

At a national level, the hunting quota for the game species is established, based on studies and field observation, by the central authority responsible for forests (*i.e*. Ministry of Waters and Forests) through a specialized directorate.

For example, in the case of crop goose the national annual quota was increased (by 7.4% times) from 3,436 (in the hunting season 2009/2010) to 25,536 individuals (in the hunting season 2015/2016). In the same timeframe, a similar trend was observed also in the case of summer goose and white-fronted goose, with an increase from 12,680 to 25,176 individuals and from 27,031 to 66,668 individuals, respectively. This fact alarmed the Romanian Ornithological Society (SOR), which protested many times against the game laws, the large harvest quotas and the extension of the hunting period for both goose species. For comparison, by taking into consideration that Romania shares with Bulgaria a large part of the habitat of the latter mentioned species, the most interesting thing is that in Bulgaria the summer goose is not hunted and white-fronted goose has a shorter hunting season. In Romania the habitat conditions are more favorable due to the lengthiness of humid habitats (especially in Tulcea County), where large goose populations are concentrated, both from hatching species (summer goose) as well as from winter guests (white-fronted goose). Along the Danube and even in the protected areas, the goose populations are much smaller [27]. The crop goose was excluded from the list of species that can be hunted due to the pressure posed by environment protection organizations, while the quotas for all the other species were reduced at national level in 2017-2018 hunting season (14,768 individuals in the case of the summer goose and 49,139 individuals in the case of white-fronted goose, respectively). This decrease has also affected Tulcea County [25], [26].

As regards the jackal, as a result of a national population increase, the quota established for this species during the last hunting seasons has increased from 7,383 to 8,298 individuals. However, for Tulcea County the quota has decreased from 572 to 501 individuals, but it could increase in future.

CONCLUSIONS

Game management must be based on scientific and organizational arguments amongst which, in our opinion, the followings are the most important ones:

- knowing the biology, morpho-anatomical, ethological and ecological aspects of the game species;
- respecting the hunting culture principles;
- protecting the game by ameliorating their life conditions, controlling the number of harmful species and fighting against poaching;
- the rational exploitation of game populations and the efficient capitalization of the resulted products and benefits.

The vegetation from Tulcea County, together with the climate specific to this area represent favorable conditions for the presence of a large number of bird and animal species. Amongst them, the most important game species are the wild boar and the roe deer, while the golden jackal and the red fox are the least important.

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ASSESSMENT OF LAND RESOURCES PRODUCTIVE POTENTIAL INFLUENCE ON AGRICULTURAL PRODUCTS GROSS OUTPUT IN UKRAINE

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Abstract

Ukraine is a country exporting vegetable agricultural products. Agriculture continues to actively develop and fill the state budget, despite political and economic problems, lack of agricultural land market. The productive potential of agriculture requires constant monitoring and effective regulation of land use. A case study was carried out for 2013–2016 at the administrative districts level of the Forest-Steppe Province of Kyiv Oblast, to analyze and evaluate the existing development of productive potential of agricultural areas. The dependence between the point of ecological and agrochemical evaluation of agricultural land and the result of water erosion of soils and their influence on gross output and its profitability was observed. An estimation of the differential productivity of grain crops is carried out. The economic (mathematical) description of the dependence between the productive potential of soils, its qualitative properties, the influence of erosion processes and grain crop yields is given. The production and economic losses caused by the reduction of the productive potential of agricultural land were calculated.

Key words**:** *productive potential, agricultural production of Ukraine, soil erosion, yield, ecological and agrochemical assessment point*

INTRODUCTION

Agriculture is one of the main sectors in the Ukrainian economy, which forms the gross domestic product and fills the state budget of the country. The production of agricultural products fully ensures satisfaction of the domestic market demand and generates exports.

The yield of agricultural crops, in particular grain crops, by regions and in general in Ukraine, tends to increase. The growth of the crop yields of the main crops was facilitated by the opening of the Ukrainian agrarian market to western technologies and more productive crop varieties. However, Ukraine has not reached the same level as Western European countries, even with positive dynamics over the past twenty years, despite 44% yield increase. In general, in France, Germany, Italy, Spain, soil quality is not better than one of Ukrainian black earth, but the yield of major crops is twice as high as in Ukraine. This means that, in addition to proper agricultural technology and environmental requirements Western European countries support and improve the quality of arable land. According to the Educational and scientific institute for economics and ecology of nature use ukrainian agricultural producers receive 79% of their profits due to natural soil fertility and only 21% as a result of technologies introduction (stand 09.12.2015) [4]. Therefore, Ukrainian agricultural enterprises receive high yields, which means additional profits, due to the high quality of soils.

However, there are several problems in general in the state, as well as in certain regions that restrain the development of agriculture. Most of arable lands has erosion influenced soils. Fertilization of soils during last 25 years wasn't fully effective, which adversely affected the overall quality of soils.

The question arises: which indicators should be used for the further forecast of crop yields.

For more effective research it is necessary to analyze these dynamics at the regional level.

The territory of the Forest-Steppe Province of Kyiv Oblast has been selected for the study as the territorial basis of natural-agricultural regionalization.

The purpose of the case study is to analyze and assess the impact of the productive potential of land resources on the gross output of agricultural products in the Forest-Steppe Province of Kyiv Oblast.

As a part of preparation to this case study a **literature review** was made.

Demidov *et al.* (2008) described the impact of energy-depleting crops on soil fertility and the consequences of intensive cultivation of these crops in case of non-compliance with crop rotation [2].

Kvasha (2011) proposed ways to improve the mechanisms for creating a market equilibrium in agricultural production [5].

Pankiv (2008) analyzed environmental problems in modern land use and proposed the main areas of land protection [7].

Shuvar (2011) emphasized the main problems of reducing the fertility of soils in Ukraine: inefficient agricultural use and intensified impact of degradation processes [8].

Panagos and Meusburger (2014) described the general system for erosion processes monitoring and their effectiveness in the European Union (EU) [6].

Borrelli and Paustian (2016) considered the problems of soil potential changing as a basis for growing agricultural products and impact on it of climate change and erosion processes [1]. They also considered the influence of agricultural and environmental conditions on erosion processes and analyzed the balance of nutrients in soils.

MATERIALS AND METHODS

To determine the economic (mathematical) description of the relationship between the productive potential of soils, its qualitative properties, the increase in yield and the impact of erosion processes, we use the formula as an algorithm for finding a solution for rational use of agricultural land.

In order to determine the impact of soil quality on the yield of gross plant products, in particular grains, it is necessary to calculate the approximate yield. To do this you need to know the qualitative soil condition, which is reflected in the points of ecological and agrochemical assessment.

According to the published methodology of agrochemical estimation of agricultural lands by the state institution "Soil Protection Institute of Ukraine", one (1) point of the **ecological and agrochemical evaluation** is equal to 0.41 quintals per hectare of grain units. That is, having 50 points of ecological-agrochemical assessment, we will receive 20.5 q/ha of natural productivity. Natural yield in this case is the minimum that can be obtained on these soils, using the productive fertility of the soil, without introducing agrotechnologies [9].

The coefficient of crop increment is an indicator of how many times the actual yield is greater than the natural. The coefficient of growth of yield is an indicator, which contains agrotechnology, agricultural machinery, high yield varieties of plants. It is relevant only for a specific research object, which is characterized by almost identical natural conditions and soil quality. The indicator, which is the largest among the administrative districts, is selected, if there is no obvious erosion on the territory with the maximum increase. For the territory of the Forest-Steppe Province of Kyiv region, the growth rate of the crop will be 3.4 for all administrative districts.

The coefficient of soil degradation (water erosion effect). By calculations of Dobryak et al. (2009), 19% of the total arable land of Ukraine are degraded and unproductive soils. Of course, their share is different for each administrative district. Their use is always risky. They have different degrees of impact on soil quality, which in the future will negatively affect the yield of crops [3]. This coefficient ranges between 0.7 and 1 in increments of 0.05.

The balance coefficient (humus and fertilizer) is characterized by the amount of used fertilizers and the actual humus balance in soils. When fertilizers are used in sufficient quantities, the humus balance is deficient. Humus balance does not directly affect the quality of the soil, on which also the yield of

crops depends. In the past 20 years, in general, organic and mineral fertilizers use have been insufficient in Ukraine. While natural fertility is very high, the deficit of humus balance did not negatively affect the yield of important crops. Beginning in the 2000s, a negative tendency was observed with a decrease in the qualitative characteristics of soils due to insufficient fertilization. Also, this negative trend is indicated by a decrease in the score of ecological and agrochemical assessment of soils. Consequently, the balance coefficient (humus and fertilizer), apart from erosion, began to affect the yield of crops, restraining it. This coefficient ranges between 0.7 and 1 in increments of 0.05.

The differential yield for grain crops (q/ha) can be calculated according to the following formula:

$$Dy = Pea * 0.41 * Ci * Cd * Cb$$

where:

Dy – The differential yield for grain crops (q/ha);

Pea – score of the ecological and agrochemical evaluation;

Cg = 0.41 – coefficient for grain crops (1 point = 0.41 q/ha);

Ci – coefficient of crop increment;

Cd – coefficient of soil degradation (water erosion effect);

Cb – balance coefficient (humus and fertilizer);

Pea*0.41 – natural fertility, if Dy is less than natural fertility, the cultivation of agricultural crops is ineffective.

The results are displayed in the Table 2.

RESULTS AND DISCUSSIONS

First of all, we briefly analyze the existing productive potential of agricultural land on the basis of collected data and then the results of our calculation.

Agriculture in Ukraine is one of the leading industries. Its Forest-Steppe Province of Kyiv Oblast, as an element of natural and agricultural zoning, has the most favorable conditions for the development of agriculture. This is facilitated by: convenient economical and geographical location, favorable natural and climatic conditions, developed logistics network of roads, production and market infrastructure, as well as the possibility of using and attracting investment. According to the Main Department of Statistics in Kyiv Oblast, 559 agricultural enterprises are registered, 541 of them are non-state and 18 state enterprises. The total area of agricultural land used by these enterprises is 1,517.5 thousand hectares. 361 agricultural enterprises were registered in the Forest-Steppe Province. The total area of agricultural land used by these enterprises is 630 thousand hectares. Almost 93% of these lands are rented by agricultural enterprises [10].

Crop production in Ukraine prevails over animal husbandry. In the Kyiv Oblast there is a ratio of 62% (crops) to 38% (animals). The main areas of crop production on this territory are the cultivation of grain crops, sunflower, sugar beet, soya, rapeseed, and others. The largest gross output of plant products in the Forest-Steppe Province of Kyiv Oblast is represented by following of crops: corn for grain, sugar beet, wheat, sunflower seeds, soybeans, barley and rape. Their share in the grown is 98% on the territory of the research object and 75% in the Kyiv Oblast. Corn for grain, sunflower and rape occupy more than half of the fields in the Forest-Steppe Province of Kyiv Oblast. These crops intensively deplete the soil in case of intensive cultivation and interrupting the crop rotation [10].

In Table 1 it can be seen that the Makarivsky, Kyiv-Svyatoshinsky and Fastivsky districts have the lowest ecological and agrochemical score of 26-42 points, which affects the low level of gross output. Also, having similar qualitative soil composition, the gross output in the Makarivsky district is almost twice as high as in the Kyiv-Svyatoshinsky district.

Stavishchensky, Rokitnyansky and Taraschansky districts have some of the most favorable soil-climatic conditions on the investigated territory. According to the state institution "Institute of Soil Conservation of Ukraine" (Stand 11.08.2017) on the territory of these regions, the ecological-agrochemical assessment score characterizes the condition

of the soils as medium and high quality in the range of 50-66 points.

Table 1. Interdependence between environmental and agrochemical estimation, gross output and profitability in the Forest-Steppe Province of Kyiv Oblast for 2013–2016

№	Administrative units, raion (district)	Ecological and agrochemical score in points for 2015	Yield of grain crops, q/ha	Gross output		Profitability, %
				Of research object, %	Of Kyiv Oblast, %	
1	Kyiv-Sviatoshinsky	28	39.0	0.7	0.3	10
2	Makarivsky	26	37.7	1.2	0.6	19
3	Fastivsky	42	57.3	0.7	0.3	34
4	Bohuslavsky	41	50.4	2.5	1.2	38
5	Obukhivsky	59	54.8	2.0	1.0	27
6	Rokytniansky	66	56.0	4.1	2.0	27
7	Stavyschensky	50	52.7	4.4	2.1	30
8	Taraschansky	48	50.6	4.0	1.9	27
9	Volodarsky	46	51.5	5.6	2.7	45
10	Kagarlytsky	67	56.5	5.7	2.7	35
11	Skvyrsky	60	50.1	6.5	3.1	23
12	Bilotserkivsky	64	53.4	6.9	3.3	36
13	Tetiivsky	50	54.8	6.1	2.9	26
14	Vasylkivsky	60	58.1	28.4	13.7	85
15	Myronivsky	52	51.4	21.2	10.2	13
Total for research object		51	51.6	100.0	48.2	32

Source: The Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

According to the data of the Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), the share of manufactured products in Vasylkivsky and Myronivskiy districts is 13.7% and 10.2%, the largest in the Forest-Steppe Province of Kyiv Oblast. These districts have almost the same ecological and agrochemical score of 52-60, which characterizes the state of the soil as medium and high quality. However, in terms of profitability, these districts are fundamentally different. Vasylkivskyi district has a profitability of 85%, almost the highest profitability among districts of Kyiv Oblast. Unlike Mironivskyi district, where the profitability rate with 13% stays at the level with Makarivsky and Kyiv-Svyatoshinsky districts. Profitability is a more economical category, and besides the quality of soils and the amount of cultivated crops, it is also influenced by demand on the foreign market.

There is a dependence between the ecological and agrochemical score, the gross output and the profitability of agricultural enterprises. Territories with similar qualitative features give almost the same amount of products and profitability of farms, the deviation caused by different agrotechnics and a more successful selection of the nutritional complex.

Also, the indicators of gross output and profitability are affected by existing erosion processes on agricultural land. There are significant areas of soil that are negatively affected by water erosion on the territory of the Forest-Steppe Province of the Kyiv Oblast. On these soils, the stock of humus, nitrogen, phosphorus, potassium and other

nutrients decreases, which leads to loss of productive soil fertility.

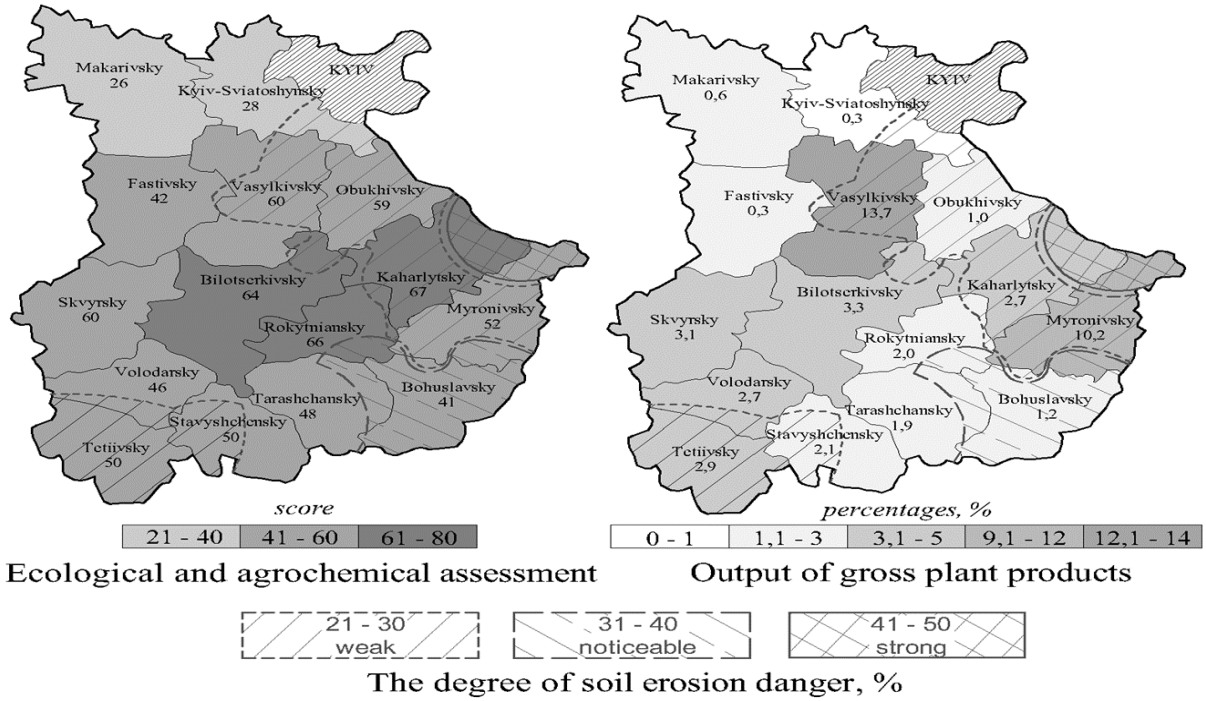

Fig.1. Influence of erosion on soil quality and yield of plant products in the Forest-Steppe Province of Kyiv Oblast for 2013–2016 years
Source: Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

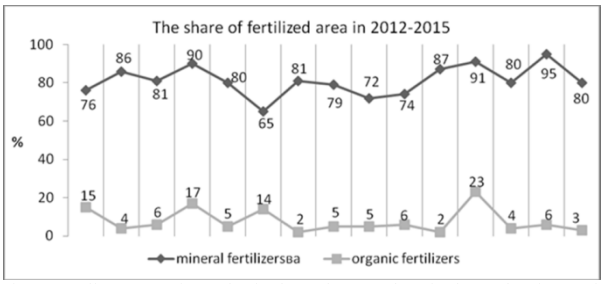

Fig.2. Indicators of ecological and agrochemical evaluation of agricultural land quality in the context of the administrative districts of the Forest-Steppe Province of Kyiv Oblast for 2010–2015- The share of fertilized area in 2012-2015 (%)
Source: Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

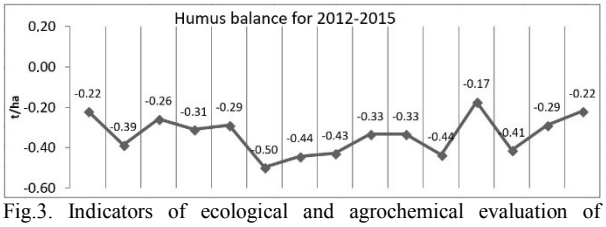

Fig.3. Indicators of ecological and agrochemical evaluation of agricultural land quality in the context of the administrative districts of the Forest-Steppe Province of Kyiv Oblast for 2010–2015, Humus Balance for 2012-2015 (t/ha)
Source: Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

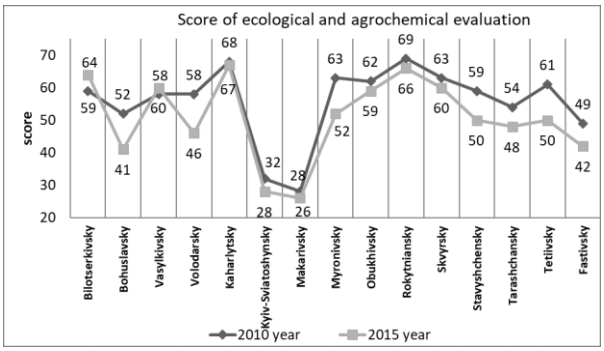

Fig.4. Indicators of ecological and agrochemical evaluation of agricultural land quality in the context of the administrative districts of the Forest-Steppe Province of Kyiv Oblast for 2010–2015, Humus Balance for 2012-2015 (t/ha) – Score of ecological and agro-chemical evaluation.
Source: Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

In general, the productive potential of agricultural land can have three elements of obtaining plant products. The first element of obtaining gross output due to the natural fertility of soils. The second element is the non-exhaustion of soils, i.e. the quality-derived soil characteristics reduced by harvested crops and can be returned in the form of fertilizers and have a positive balance

of humus. The third element is like the second, but it multiplies the qualitative properties of soils and has a deficit-free humus balance.

In carrying out an analysis of existing use of productive potential of agricultural land on the territory of the Forest-Steppe Province of Kyiv Oblast, the amount of gross agricultural output is achieved exclusively due to natural fertility, which decreases with each passing year. For 20 years, it tends to decrease and produces negative indicators of humus accumulation. Soil quality is one of the main indicators that affects the final cost of grown products (Fig. 1, Fig. 2, 3 and 4).

The next step is to calculate the differential yield for grain crops (q/ha) using the formula described in materials and methods chapter:

$$Dy = Pea * 0.41 * Ci * Cd * Cb$$

The results of these calculations are displayed in the Table 2.

Table 2. Calculation of the differential yield of grain crops in the context of administrative districts of the Forest-Steppe Province of Kyiv Oblast for 2013–2016

№	Administrative units, raion (district)	Pea – score of the ecological and agrochemical evaluation for 2015	Cg – coefficient for grain crops	Ci – coefficient of crop increment	Cd – coefficient of soil degradation	Cb – balance coefficient	Dy – The differential yield for grain crops, q/ha	Sy – Yield according to statistics, q/ha
1	Kagarlytsky	67	0.41	3.4	0.75	0.8	56.0	56.5
2	Bilotserkivsky	64	0.41	3.4	1	0.8	71.4	53.4
3	Skvyrsky	60	0.41	3.4	1	0.7	58.5	50.1
4	Rokytniansky	66	0.41	3.4	0.8	0.75	55.2	56
5	Vasylkivsky	60	0.41	3.4	0.9	0.8	60.2	58.1
6	Obukhivsky	59	0.41	3.4	0.85	0.8	55.9	54.8
7	Myronivsky	52	0.41	3.4	0.8	0.8	46.4	51.4
8	Taraschansky	48	0.41	3.4	0.9	0.8	48.2	50.6
9	Tetiivsky	50	0.41	3.4	0.9	0.85	53.3	54.8
10	Stavyschensky	50	0.41	3.4	0.9	0.9	56.5	52.7
11	Bohuslavsky	41	0.41	3.4	0.8	0.8	36.6	50.4
12	Volodarsky	46	0.41	3.4	0.9	0.85	49.1	51.5
13	Fastivsky	42	0.41	3.4	1	0.95	55.6	57.3
14	Makarivsky	26	0.41	3.4	1	0.95	34.4	37.7
15	Kyiv-Sviatoshinsky	28	0.41	3.4	1	0.95	37.1	39
Average		51	0.41	3.4	0.9	0.8	51.6	51.6

Source: The Main Department of Statistics in Kyiv Oblast (Stand 11.06.2017), State institution "Soil Protection Institute of Ukraine" (Stand 11.08.2017) and calculations of authors

As a result of the calculation of grain crop yields, it was possible to reach the medial value of the data of the State Statistics Service. The correlation coefficient between the differential yield and the actual yield on the average statistical data was 0.81, which is high for the comparison of two values that lie in one linear plane of the calculation. Consequently, spatial differential yield can be considered very close to statistical yields within the margin of error up to 3%.

However, calculated differential yield in certain districts: Bilotserkivsky, Myronivsky and Bohuslavsky differ from the statistical

yield significantly. This difference is due to a sharp change in the score of ecological and agrochemical assessment for these areas, as well as other factors inherent in these areas. Excluding the data of these districts from the general calculation will not affect the significance of the study and lead to increase of correlation coefficient, which without excluding, should be 0.73.

To compare the changes in the productive potential of arable land, a similar calculation was made, using the score of the ecological-agrochemical assessment for the 2010 survey tour, which is shown in Figure 4. Other indicators remain stable. Thus, the average differential yield of grain in terms of administrative districts was 55.3 q/ha in 2010, which is 10% more than the differential as well as statistical yield for 2013-2016 – 51,6 q/ha. Consequently, with the same application of agronomic technologies, it was established that the reduction of soil quality, led to a loss/shortage of 10% of the grain crop gross output for each year. It is a significant decrease over the term of the study.

Having an average sale price of grain crops in the administrative districts of Kyiv Oblast, we can calculate the economic losses of farmers from potentially lost harvest.

Thus, in 2013, agricultural producers could receive additional income of UAH 16 million, which at the rate of 2013 was $ 2 million. In 2014, additional profit could be up to UAH 81 million, which is equal to $ 5 million. In 2015 – UAH 148 million, equivalent to $ 9 million. In 2016 – UAH 324 million, or $ 12 million. Therefore, over the past four years, agricultural enterprises and farmers has lost an additional net income of $ 28 million due to soil quality degradation.

CONCLUSIONS

As a result of the study, the influence of productive potential of land resources on agricultural products' gross output in the Forest-Steppe Province of Kyiv Oblast was proved. Reducing the quality of soils causes a loss of 10% of the grain crop for each year, even with increased yields due to weather conditions and growing technologies.

The negative trend in quality indices of agricultural soils reduction with insufficient fertilization of soils and existing erosion processes affects the gross output of agricultural products. Reducing the quality of soils leads to increased economic losses and violates the humus balance which restoration requires a significant amount of years. It leads as well to significant financial losses by agricultural enterprises and farmers ($28 million in 4 years).

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LOCAL SHEEP BODY WEIGHT SELECTION RESPONSE ON VARIOUS SELECTION INTENSITY IN PURWAKARTA, WEST JAVA, INDONESIA

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Abstract

Research about the local sheep body weight selection response on various selection intensities has been held in Purwakarta, West Java, Indonesia, on November 2017. The aim of the research is to know the heritability and body weight selection response of local sheep as the genetic parameters. The purpose sampling data from 144 sheep (75 male and 69 female derived from six sires), are birth weight (January 2016 until December 2016) and corrected weaning weight on 100 days of age. The variety components and the heritability value were used variance analysis pattern of half-sib correlation. Fixed effect were used sex (male and female) and type of birth (single and twins) the average of birth weight was 2.73 Kg; weaning weight were 6.43 Kg and corrected weaning weight on 100 days of age were 9.32 Kg. Results of analysis data were shown the heritability value of birth weight was 0.32 is high category and the heritability value of corrected weaning weight on 100 days of age was 0.36 also is high category. The highest value of selection response body weight by heritability corrected weaning weight on 100 days (of one sire and eight ewes) with selection intensity 2.03 was 4.22 Kg.

Key words**:** *local sheep, selection response, body weight, heritability, selection intensity*

INTRODUCTION

The development of sheep farming in Indonesia has never been detached from people's lives, because some people raise sheep for consumption needs while some other people maintain sheep for hobbies. Sheep spreads almost in all parts of Indonesia. Sheep is one of the genetic resources that need to be developed especially for consumption of red meat other than other ruminant animals. Indonesian local sheep are named according to their regions and characteristics, such as *Donggala* sheep, *Garut* sheep, *Kisar* sheep, Fat Tailed Sheep, *Java* Thin Tailed Sheep, *Sumatra* Thin Tailed Sheep, and others.

Seedlings are livestock that have superior properties and bequeath superior properties and meet certain requirements for breeding [12]. Sheep seeds for livestock businesses have an important meaning in supporting the success of the business carried out. Selection of sheep depends on the tastes of consumers and the purpose of the farm business, and these factors are related to the type of sheep that are commonly maintained and also marketing. Selection of sheep that will be selected as seed or going in principle based on age, shape outside the body, the power of growth and behavior of livestock. Selection is used in nursery programs to select or replace elders in the next generation. Selection aims to produce sheep seeds of good quality, and improve the genetic quality of sheep populations. One type of sheep that has the potential to be developed is Local sheep. Local sheep breeding sites at *Kampung Nenggeng, Purwakarta,*West Java, Indonesia was established to preserve the purity of local sheep. For this reason, an effort to improve genetic quality is better. The correlated selection response is basically a comparison between the average phenotype of children and the average phenotype of parents. This response illustrates the genetic progress obtained from the selection results. Estimating correlated nature selection responses is very important for breeders, because it can predict

genetic progress earlier, saving time, effort and costs. The use of selection intensity to determine the correlated selection response between birth weight and weaning weight is not yet known, especially in the local sheep breeding site. Therefore, it is necessary to estimate the body weight selection response at various local sheep selection intensities. The problem is, how much is the heritability value (h^2) of local sheep body weight in the local sheep breeding site, based on birth weight and corrected weaning weight at 100 days of age and also how much is the value of the local sheep's body weight selection response in the local sheep breeding site at various selection intensities.

Individual appearance is determined by genetic factors and environmental factors. Genetic factors are determined by the composition of genes and chromosomes that these individuals have. Environmental factors consist of a temporary and permanent environment. Mathematically, the influence of genetic factors and environmental factors can be written as follows:

Performance = Genetic + Environmental [7].

Generally sheep that are raised in Indonesia are used for meat production, then the target of breeding is the number of lambs born and the body weight of lambs to increase meat production. The theory of grouping sheep based on the shape of the tail, among others: groups of thin-tailed sheep (thin tail), groups of thick-tailed sheep (fat tail) and groups of triangular tailed sheep (*Garut* sheep) [8]. One measure of whether or not a lamb is raised is to know the birth weight and weaning weight.

Birth weight is the weight of the lamb weighed within 24 hours after birth. Weaning weight is an indicator of the ability of the parent to produce milk and the ability of lamb to produce milk and grow. The speed of growth greatly determines the efficiency and profitability of the farm business because it is closely related to efficiency and conversion of feed use.

Selection is usually interpreted as an activity to get rid of livestock that have low production quality and maintain livestock that have high production quality for breeding. Selection will be effective if the genetic parameters of the characteristics used in the selection criteria are known, including: heritability (h^2), intensity of selection (i) and various phenotypes (σ_p). The selection intensity is a selection differential expressed in standard deviation. The size of the selection intensity depends on the proportion of livestock that will be selected to become elders in the next generation. The accuracy of selection for each trait is the same as the correlation between genotypes and phenotypes. The accuracy of selection is the root of the heritability value, so the size of the selection accuracy will depend on the value of the heritability obtained. The accuracy of selection will increase with increasing heritability and vice versa [14].

The influence of the selection program that will be implemented can be known by estimating one of the genetic advances, namely the selection response. Selection responses are simple quantitative predictions for change. The usefulness of the correlated selection response is if the second trait is too long to wait or has a very small value of heritability, so selection is better based on other properties that have a correlation.

After the superior sheep seeds are obtained, the next step is to increase sheep breeding. This can be realized with the support in the field of breeding. Considering the importance of breeding programs for the development of superior sheep seeds, a study was conducted on estimating the value of body weight selection response on various local sheep selection intensities.

MATERIALS AND METHODS

The breeding objective were birth weights and weaning weights of local lambs that has complete production records, including: sex, type of birth, time of birth, time of weaning, birth weight, weaning weight, parent identity, and sire identity. The data used are birth weight and weaning weight from January 2016 to February 2017, of 144 local sheep, consisting of 75 rams and 69 females from 6 sires; type of birth single and twins. The data is then compiled, coded, and processed, then

entered into tables using Microsoft Office Excel software; starts from the male identity number, parent, child, sex, type of birth, birth weight, date of birth, weaning date, and weaning weight, then the data is sorted from top to bottom based on weaning date.

Data encoding consists of fixed effects that are given a code based on their respective criteria, namely: (a) sex, the code number 1 for male and 2 for female, (b) type of birth, code number 1 single, and 2 for twin births.

Data Processing, after collecting and coding data, then tabulated on the table using Microsoft office excel software which consists of original data, the original data that has been multiplied by the correction factor into corrected data, and continued with the analysis of corrected data to obtain genetic parameter values.

Variables observed, were birth weight and weaning weight. The methods for measuring these two variables are as follows: (a) birth weight, is obtained from the results of weighing when the lamb is born or within 24 hours after birth. (b) weaning weight, are obtained from the results of weighing when the lamb is weaned, then corrected in corrected weaning weights at the age of 100 days.

Statistical Analysis

The variance component is assumed by the various patterns of Paternal Half-Sib Correlation Analysis, using Microsoft excel to estimate the variance component and the heritability value.

Weaning weights at the age of 100 days:

$$WW_{100} = \left(BW + \frac{WW\ when\ Weight - BW}{Age\ when\ weight}\ X\ 100 \right) X\ FCTBXFCF$$

Notes:

BS_{100} : weaning weights at the age of 100 days

BW : birth weight

WW : weaning weight

TBCF: type of birth correction factor

SCF: sex correction factor [7]

Selection intensity:

$$i = \frac{z}{p}$$

Notes:

i is selection intensity

z: phenotype coordinate curve function

p: sheep proportion for stock. [7].

Selection response:

$$R = i\ x\ h^2\ x\ \sigma_p$$

Notes:

R : selection response

i : selection intensity

h^2 : Heritability

σ_p : phenotype standard of deviation . [7]

RESULTS AND DISCUSSIONS

Birth weight and Weaning weight

In Table 1, can be seen the birth weight and weaning weight of the local sheep

Table 1. Birth weight and Weaning weight

Data	n	Mean	SD	Min	Max	CV
		-----	Kg	-----		%
BW	144	2.73	0.61	1.50	4.70	22.40
WW	144	9.43	1.15	8.00	19.20	12.20

Notes :
BW = birth weight
WW = weaning weight
n = sum of the sheep (population)
SD = standard deviation
Min = minimum weight
Max = maximum weight
CV = coefficient of variation
Source : own calculation

The average local lamb birth weight is 2.73 kilograms and the weaning weight is 9.43 kilograms. Livestock populations are considered effective for selection if the coefficient of variation is more than 10% [13]. Coefficients of Variation were analyzed to find out the diversity of a measured characteristic, to compare the diversity with other population groups, and determine whether or not the selection was effective. The coefficient of variation in local sheep birth weight was 22.4% and local sheep weaning weight was 12.2%.

Weighing weights in the Nenggeng Village Local Sheep Nursery is not yet fully carried out at the same time. The weaning age used in this study is 100 days. Weaning weights at the age of 100 days were obtained using a correction factor. The use of correction factors

in this study was carried out to homogenize local sheep weaning age at age 100 days, the condition was based on weaning time which was not entirely same at the age of 100 days.
The correction factor in this study was based on sex and type of birth at the local sheep breeding center *Margawati Garut*. The correction factor for birth type is standardized to the second type of birth and is presented in Table 2. The standardization is needed to compare the performance of individuals with different types of births [3].

Table 2. Correction factor for birth type

birth type	correction factor
1	0.77
2	1.00
3	1.23
4	1.44

Source: [3]

The sex correction factor is standardized to male sex. These conditions are needed to compare the performance of individuals of different sexes and are presented in Table 3 and Table 4.

Table 3. Standardized Sex Correction Factor (Single Birth Types)

Sex	**Characters (corrected)**	**Age** (day)	**CF**
Male	The weight of 100 days	100	1.00
Female	The weight of 100 days	100	1.074

Source: [3]

Table 4. Standardized Sex Correction Factor Twins Birth Types

Sex	**Characters (corrected)**	**age** day	**CF**
Male	The weight of 100 days	100	1.00
Female	The weight of 100 days	100	1.074

Source: [3].

Corrected weaning weights at 100 days of age, are presented in Table 5.

Table 5. Corrected weaning weight at 100 days of age, based on sex correction factor and type of birth

Data	**N**	**Mean** ------	**SD** Kg	**Min** ----	**Max**	**KV** %
BW	144	2.73	0.61	1.50	4.70	22.44
WW	144	9.32	2.17	6.25	25.10	23. 30

Notes: BW = birth weight
WW = weaning weight
n = sum of the sheep (population)
Source : own calculation

The average local lamb birth weight is 2.73 kilograms and the corrected weaning weight at 100 days is 9.32 kilograms, more heavier than the sheep at *Margawati Garut* breeding center from 1994 – 2001; the average is 1.93 Kg (birth weight) and 8.39 Kg (weaning weight) [5]. The coefficient of variation of local lamb birth weight was 22.4% and the corrected weaning weight at 100 days was 23.3%. These results indicate that the conditions in this local sheep breeding center are still diverse, so the selection is still effective and the selection value of the local sheep body weight will be heavier.
Birth weight is a determining factor for the survival of sheep breeding businesses, because the birth weight is positively correlated to livestock survival and development after birth. Sheep with high birth weight will have better resistance and adaptation to the environment, faster weaning time and higher post weaning body weight gain [6]. Weaning weights have a close relationship with birth weight, both are positively correlated so birth weight can be emphasized in the indirect selection program, namely the response to selection of weaning weights based on birth weight [14]. Local sheep body weight is influenced by several factors, namely sex, type of birth, parity, and season. All of these factors are then used as a fixed effect in the analysis of genetic parameters [1]. Type of birth is a description of the number of children born to a mother sheep. The number of children born with one baby is called single birth and if more than one is called twin births. Based on the number of lamb born to a sheep, the sheep population in the breeding center can be grouped into two types of birth, namely single and twins. Distribution of birth types is presented in Table 6.

Table 6. Distribution of birth types

Birth type	**n**	**Percentage**
	head	------%--------
Single	94	65.28
Twins	50	34.72

Source: own calculation

Table 6 shows that the percentage of single birth types was 65.28%, and twins were

34.72%. When compared with the results at *Margawati Garut*, from 2011 – 2012, the proportion of single births was 44.02%, the birth of twins was 46.82%, triplets is 8.65%, and quadruplets are 0.51%. [3]. The parents originating from multiple births will reduce twins more than parent from a single birth. Likewise, males from twin births will lose more twins than males from single births [4].

Based on several studies conducted in various livestock companies in Indonesia that the factors of season, rainfall, rainy days, temperature and humidity have less influence on the diversity of livestock body weight. This can happen even though in Indonesia there are only two seasons (rainy and dry seasons), but the difference in seasons is relatively not as extreme as in the subtropical regions [9].

Value of Heritability

Data analysis with various patterns analysis of Paternal Half-Sib Correlation, using Microsoft Excel to predict the value of heritability and variance components. The estimation the heritability of local sheep body weight including birth weight and weaning weight of 100 days is presented in Table 7.

Table 7. Heritability (h^2) Estimation Pattern of Paternal Half – Sib Correlation on Local Sheep for Breeding

Character	h2
birth weight	0.32
weaning weight of 100 days	0.36

Notes : h^2 : heritability
Source : own calculation

The estimated heritability value with the paternal half-sib correlation pattern on local lamb birth weight is 0.32 and the corrected weaning weight at 100 days of local sheep is 0.36. Heritability value of birth weight is included in the high category (h^2> 0.3), and the heritability value of weaning weight corrected at 100 days also in the high category (h^2> 0.3) [15]. This heritability value can be influenced by the shared environmental and genetic influences of the parent. The influence of the parent is higher on the weaning weight than the birth weight, can be caused by the breastfeeding factor of the mother and the parent's age when giving birth to a child. Based on the heritability value of birth weight and corrected weaning weight at 100 days, it can be assumed that the selection response will produce good value.

Selection intensity

Because of the different numbers of male and female, will make selection intensity different between the male and female. The magnitude of the average selection intensity is the number of male selection intensities and the female selection intensity is divided into two [7]. The selection intensity in various proportions of selected male and female sheep is presented in Table 8.

Tabel 8. Selection intensity in various proportions

	%♂	1.33	2.67	4.00	5.33
%♀	head	1	2	3	4
11.59	8	2.03	1.93	1.87	1.82
23.19	16	1.85	1.76	1.69	1.64
34.78	24	1.73	1.63	1.57	1.51
46.38	32	1.62	1.53	1.47	1.41
57.97	40	1.53	1.44	1.37	1.32
69.57	48	1.45	1.36	1.29	1.24
81.16	56	1.36	1.27	1.21	1.15
92.75	64	1.27	1.18	1.11	1.06

Source: own calculation

Tabel 8. Selection intensity in various proportions (continued)

	%♂	6.67	8.00	9.33	10.67
%♀	*head*	5	6	7	8
11.59	8	1.77	1.73	1.70	1.67
23.19	16	1.60	1.56	1.52	1.50
34.78	24	1.47	1.43	1.40	1.37
46.38	32	1.37	1.33	1.30	1.27
57.97	40	1.28	1.24	1.21	1.18
69.57	48	1.19	1.16	1.12	1.09
81.16	56	1.11	1.07	1.04	1.01
92.75	64	1.02	0.98	0.95	0.92

Source: own calculation

Table 8 shows the highest selection intensity value is 2.03 which is achieved using 1.33% (1 male) with 11.59% (8 females). Genetic progress achieved in the population will be fast because of the balanced population because according to the male and female ratios that are used and seen in terms of livestock raising efforts will be more effective. The ratio between males and females used for sheep is 1: 8.

Estimated Response Value of Body Weight Selection

The average value of selected livestock breeding over all livestock available for selection depends on three factors, genetic diversity, selection intensity, and accuracy in estimating breeding values [10]. The amount of genetic progress obtained as a result of selection, can be estimated by calculating the magnitude of the alleged selection response. the value of selection response is influenced by heritability (h^2), selection intensity (i) and standard deviation phenotypes (σ_p). An optimal selection response can be obtained by stimulating the value of the male or female selection intensity that will be used as elders in the next generation [2]. The value of local sheep body weight selection response which includes birth weight and weaning weight corrected at 100 days, is useful to estimate the magnitude of the genetic progression of local sheep body weight in the next generation. The selection response can be calculated by the formula:

$R = i \times h^2 \times \sigma_p$ [7]

Notes:

R : Selection response

i : Selection intensity

h^2: Heritability

σ_p: Standard Deviation Phenotypes

Tabel 9.The estimated value of the selection response of local sheep body weight based on heritability (h^2) birth weight

	%♂	**1.33**	**2.67**	**4.00**	**5.33**
%♀	head	1	2	3	4
11.59	8	1.51	1.44	1.39	1.35
23.19	16	1.38	1.31	1.26	1.22
34.78	24	1.29	1.22	1.17	1.13
46.38	32	1.21	1.14	1.09	1.05
57.97	40	1.14	1.07	1.02	0.99
69.57	48	1.08	1.01	0.96	0.92
81.16	56	1.02	0.95	0.90	0.86
92.75	64	0.95	0.88	0.83	0.79

Source: own calculation

The estimated value of the selection response of local sheep body weight based on heritability (h^2) birth weight of 0.32 and standard deviation of phenotypes (σ_p) of 0.61 in various selection intensities are presented in Table 9.

Tabel 9.The estimated value of the selection response of local sheep body weight based on heritability (h^2) birth weight (continued)

	%♂	**6.67**	**8.00**	**9.33**	**10.67**
%♀	Head	5	6	7	8
11.59	8	1.32	1.29	1.27	1.25
23.19	16	1.19	1.16	1.14	1.11
34.78	24	1.10	1.07	1.04	1.02
46.38	32	1.02	0.99	0.97	0.95
57.97	40	0.95	0.93	0.90	0.88
69.57	48	0.89	0.86	0.84	0.82
81.16	56	0.83	0.80	0.77	0.75
92.75	64	0.76	0.73	0.71	0.68

Source: own calculation

Table 9 shows that the selection of selected livestock affects the size of the selection response. If the proportion of selected livestock is higher, it will reduce the selection intensity and the selection response value will be smaller; and the response value of local sheep body weight based on the highest heritability of birth weight (1.51 Kg) which was achieved in the proportion of male livestock 1.33% (1 head) and of female livestock 11.59% (8 heads). Based on these results it can be expected that the increase in local sheep body weight at birth is 1.51 Kg in the next generation. This condition can occur due to the parent's genetic influence, maintenance during the pregnancy phase, and the number of livestock used as elders in the next generation.

Table 10. The estimated value of the selection response of Local sheep body weight based on heritability (h^2) corrected weaning weight at 100 days

	%♂	**1.33**	**2.67**	**4.00**	**5.33**
%♀	head	1	2	3	4
11.59	8	4.22	4.02	3.88	3.78
23.19	16	3.85	3.65	3.52	3.41
34.78	24	3.59	3.40	3.26	3.15
46.38	32	3.38	3.19	3.05	2.94
57.97	40	3.19	3.00	2.86	2.75
69.57	48	3.01	2.82	2.68	2.57
81.16	56	2.84	2.64	2.51	2.40
92.75	64	2.65	2.45	2.31	2.21

Source: own calculation

Table 10. The estimated value of the selection response of Local sheep body weight based on heritability (h^2) corrected weaning weight at 100 days (continued)

	%♂	**6.67**	**8.00**	**9.33**	**10.67**
%♀	head	5	6	7	8
11.59	8	3.69	3.61	3.54	3.48
23.19	16	3.32	3.24	3.17	3.11
34.78	24	3.06	2.98	2.91	2.85
46.38	32	2.85	2.77	2.70	2.64
57.97	40	2.66	2.58	2.51	2.45
69.57	48	2.48	2.41	2.34	2.28
81.16	56	2.31	2.23	2.16	2.10
92.75	64	2.12	2.04	1.97	1.91

Source: own calculation

The estimation of response value of local sheep body weight based on heritability (h^2) corrected weaning weight at 100 days of 0.96 and standard deviation of phenotypes (σ_p) of 2.17 at various selection intensities are presented in Table 10.

Table 10 shows the highest response value of the selection of local sheep body weight based on the corrected weaning weight at 100 days was 4.22 Kg which was achieved in the proportion of male livestock 1.33% (1 head) and of female 11.59% (8 heads). Based on these results it can be expected that the increase in local sheep body weight when weaned corrected by 100 days is 4.22 Kg in the next generation. This condition can occur due to the influence of milk production produced by the parent for the lamb weaning time and the number of livestock used as elders in the next generation.

Nurseries are cultivation activities to produce livestock for their own needs or for sale [11]. The use of the highest selection intensity in this study was caused by this local sheep Breeding Site is one of the nurseries in this regency. Thus, greater intensity of selection is used for multiplication

Estimating the selection response is useful for estimating the performance of local sheep in the next generation. In this study the increase of local sheep body weight through estimation of the value of heritability based weighing selection response of birth weight was 1.51 Kg and corrected weaning weight at 100 days was 4.22 Kg.

CONCLUSIONS

Based on the discussion it can be concluded that the average local lamb birth weight in this breeding center is 2.73 Kg, weaning weight is 9.43 Kg and the corrected weaning weight at 100 days is 9.32 Kg; the heritability value of local lamb birth weight nursery is 0.32 and the corrected weaning weight at 100 days is 0.36.

The heritability value of birth weight is included in the medium category, but the heritability value of weaning weight corrected at the age of 100 days is included in the high category.

The response value of selection of local sheep body weight based on the highest heritability of birth weight is 1.51 Kg which is achieved in the proportion of rams 1.33% (1 head) and of female sheep 11.59% (8 heads). The response value of selection of local sheep body weight based on heritability corrected weaning weight at the highest 100 days was 4.22 Kg which was achieved in the proportion of rams 1.33% (1 head) and the proportion of female sheep 11.59% (8 heads) .

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HOW MANY PEOPLE ARE NEEDED TO MANAGE A FOREST IN EUROPE AND IN ROMANIA?

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Abstract

The total forest area in Europe accounts for 215 million hectares. In Europe, forest management is done both by private-owned and state-owned enterprises, companies, agencies or other structures. The European State Forest Association (EUSTAFOR) represents a forum of 33 national forest administrators (NFAs) originating from 22 countries, that are managing 30 million hectares of state-owned forests. The main aim of this study was to compare the data provided by EUSTAFOR for the NFAs regarding the managed forest areas. Secondly, the share of managed forest area per employee was assessed for each of the 23 members for which the information was available on the official website. The NFA that is managing the highest forest area is Metsähallitus (Finland), with more than 9 million hectares. As regards the average annual harvested wood quantity, the NFA from Poland, namely LASY PAŃSTWOWE, is the leader, with more than 37 million cubic meters. Based on these results, it seems that the highest share of managed forests per one employee was recorded in the countries situated in the northern part of Europe, namely Norway, Finland and Sweden. ROMSILVA, together with the NFAs from Germany and England ranked on the last positions as regards the share of the managed forest area by one employee.

Key words**:** *Europe, EUSTAFOR, forest management, ROMSILVA*

INTRODUCTION

According to recent statistics, the total forest area in Europe accounts for 215 million hectares, out of which 165.9 million hectares are available for wood supply [6].

In the last decades, the restitution and the privatisation of the lands across Europe generated significant changes in forest land ownership [3]. In the former socialist countries, significant transformations occurred also in the economic and political systems [10]. Due to these changes, a decreasing of the state-owned forest area was recorded and new private-owned administration structures were founded.

Across European countries, there is a high difference regarding the ratio between the state-owned and private-owned forests. For example, Bulgaria is one of the countries with the lowest percentages of private-owned forests (13%), while in Portugal, almost all of the forest lands (98%) are in private ownership [7].

In most of the European countries, the state-owned forests are managed by the National Forest Administrations (NFAs) that are members of the European State Forest Association (EUSTAFOR). EUSTAFOR represents a forum of 33 state forest agencies, companies and enterprises originating from 22 countries. In total, these NFAs are administrating an area of more than 30 million hectares of forest stands, a high share of them being certified by independent certification bodies. Out of the total area, more than a quarter is included in several categories of protected areas [5].

As regards the employment rate, EUSTAFOR offers jobs for more than a hundred thousand people, mostly in rural areas [8].

In Romania, shortly after the fall of the communist era, changes started to occur in the ownership status of the forest fund, the area of the public-owned forests being reduced from 6.37 million hectares (in 1990) to 5.99 million hectares (in 2000) [2]. Also, a labor migration from the state enterprise to other private structures was recorded, ROMSILVA losing more than 13,000 employees in less than 12 years, from 39,561 employees (in 1991) to 25,830 employees (in 2003) [1].

In Romania, ROMSILVA is the main forest administrator that is managing more than 3.2 million hectares of state-owned forest lands through its more than 320 forest districts. ROMSILVA promotes a forest management that is focused on timber production, little attention being given to the management of non-wood forest products [4], [11].
The main aim of this study was to compare the data provided by EUSTAFOR for the NFAs as regards the managed forest areas. Secondly, the share of managed forest area per employee was assessed.

MATERIALS AND METHODS

The total area of the managed forest area [hectares], number of employees and the annual wood harvested quantities [cubic meters] were centralized in an Excel file from the official website of EUSTAFOR [5].
In order to determine the number of the employees needed for managing a certain forest area in the case of each NFA, an easy arithmetic operation was applied, dividing the area of the administrated forests by the number of the employees.

RESULTS AND DISCUSSIONS

For 23 out of the 33 members of EUSTAFOR the complete datasets were available on the website. The total managed forest area, the total number of employees (both office and field staff) and the annual wood harvested quantity are given in Table 1.

Table 1. Total managed forest area, number of employees and annual harvested quantity

No	Country	Name of the company	Managed forest area [ha]	No of employees	Annual harvest [c.m.]
1	Austria	Österreichische Bundesforste AG	510,000	1,100	1,528,000
2	Belgium	Natuurinvest	42,300	43	107,000
3	Czech Republic	Lesy České republiky, s. p.	1,200,000	3,376	7,704,000
4	England	Forest Enterprise England	193,000	850	109,000
5	Estonia	Riigimetsa Majandamise Keskus	900,000	740	3,300,000
6	Finland	Metsähallitus	9,100,000	1,450	5,860,000
7	Germany	Landesbetrieb ForstBW	320,000	3,600	2,200,000
8	Germany	Bayerische Staatsforsten AöR	808,000	2,600	5,430,000
9	Germany	ThüringenForst AöR	197,000	1,360	1,200,000
10	Germany	Staatsbetrieb Sachsenforst	200,000	1,400	1,108,303
11	Germany	Niedersächsische Landesforsten	307,000	1,290	1,607,000
12	Germany	Landesbetrieb Forst Brandenburg	252,000	1,600	1,057,000
13	Germany	Landesforst Mecklenburg-Vorpommern	193,500	1,020	942,000
14	Ireland	COILLTE	397,000	790	1,680,000
15	Latvia	Latvijas valsts meži (LVM)	1,407,000	1,000	5,500,000
16	North. Ireland	Northern Ireland Forest Service	62,000	205	400,000
17	Norway	Statskog	1,007,000	130	355,000
18	Poland	LASY PAŃSTWOWE	7,294,000	25,300	37,759,000
19	Romania	ROMSILVA	3,202,000	16,500	8,972,000
20	Scotland	Forest Enterprise Scotland	390,000	830	3,600,000
21	Slovakia	LESY Slovenskej republiky, š. p.	893,000	3,500	4,206,000
22	Spain	MALFF of Catalonia	274,000	220	114,828
23	Sweden	Sveaskog	3,118,000	700	6,500,000

Source: EUSTAFOR, www.eustafor.eu

The NFA that is managing the highest forest area is Metsähallitus from Finland, with more than 9 million hectares (Fig. 1). The top three is completed by the NFAs from Poland and Romania, namely LASY PAŃSTWOWE (7.3 million hectares) and ROMSILVA (3.2 million hectares). The lowest managed forest areas by a state-owned enterprise are found in Northern Ireland and Belgium.

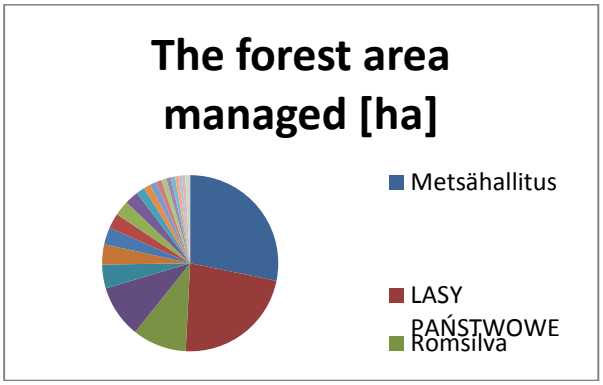

Fig.1. The area of the managed forests by the NFAs
Source: EUSTAFOR, www.eustafor.eu

The first two positions in the top of the NFAs with the highest number of employees are the forest state enterprises from Poland and Romania, respectively (Table 1).

As regards the annual harvested wood quantity, the NFA from Poland, namely LASY PAŃSTWOWE, is the leader, with more than 37 million cubic meters, followed by the NFAs from Romania, namely ROMSILVA (9 million cubic meters) and Czech Republic, namely Lesy České republiky (8 million cubic meters) (Fig. 2).

The share of managed forest area per one employee for each of the 23 members of EUSTAFOR is given in Table 2.

Based on these results, it seems that the highest shares were recorded in the countries situated in the northern part of Europe, namely Norway, Finland and Sweden. The main explanations consist in the fact that the forests from these countries are dominated by softwood species, especially Norway spruce [*Picea abies* (L.) H. Karst.] or pine (*Pinus* L.) monoculture and the terrain is plain, thus the timber harvesting is mainly done by forest machinery.

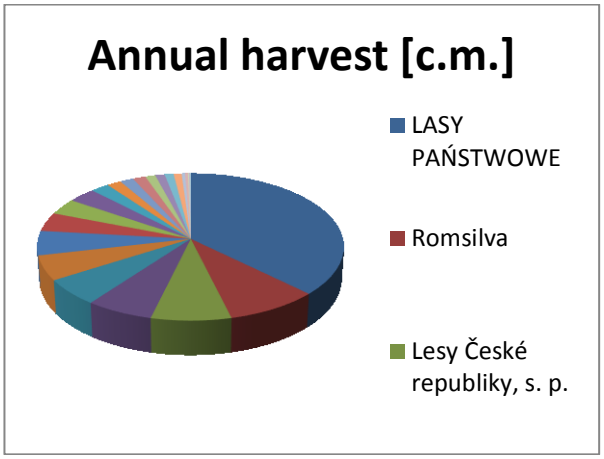

Fig.2. Annual harvested wood quantity
Source: EUSTAFOR, www.eustafor.eu

ROMSILVA, together with the NFAs from Germany and England ranked on the last positions as regards the share of the managed forest area by one employee (Table 2).

Table 2. The share of managed forest area per one employee

Name of the company	Managed area [ha]
Statskog	7,746
Metsähallitus	6,276
Sveaskog	4,454
Latvijas valsts meži	1,407
MALFF of Catalonia	1,245
Riigimetsa Majandamise Keskus	1,216
Natuurinvest	984
COILLTE	503
Forest Enterprise Scotland	470
Österreichische Bundesforste AG	464
Lesy České republiky, s. p.	355
Bayerische Staatsforsten AöR	311
Northern Ireland Forest Service	302
LASY PAŃSTWOWE	288
LESY Slovenskej republiky, š. p.	255
Niedersächsische Landesforsten	238
Forest Enterprise England	227
ROMSILVA	194
Landesforst Mecklenb-Vorpom.	190
Landesbetrieb Forst Brandenburg	158
ThüringenForst AöR	145
Staatsbetrieb Sachsenforst	143
Landesbetrieb ForstBW	89

Source: EUSTAFOR, www.eustafor.eu

CONCLUSIONS

The state-owned forest companies with the lowest numbers of employees and with the highest performance are located in the Northern Europe.

The National Forest Administration from Poland and Romania are managing the highest areas of forest lands, having also the highest numbers of workers.

If the managers of the NFAs with high number of employees would like that their enterprises to become more productive, they could analyze and adopt the best practices from the countries with similar forest management framework. This would be a great challenge by taking into consideration that big groups of people, such as the one from Romsilva, are highly heterogeneous, incorporating humans with different educational, social and cultural backgrounds [9].

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WASTE MANAGEMENT FOR SMOKING SALMON BY- PRODUCTS TO EXTRACT OMEGA-3 FISH OIL

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Abstract

The main objective of this investigation was to study the possibility of producing fish oil from smoking salmon waste by using cold pressing and wet rendering methods. The amount and the properties of extracted of oil were tested. The samples were used about 33.810 kg., smoked fish caused about 9.610 kg. As a Salmon waste (skin, viscera, backbone frames and cuts off) it's recorded about 20% of the total mass from salmon slices. The results showed the smoking salmon waste have more than18% of oil fish per one kg of salmon waste. The oil weight from Salmon by-products was increased with pressing time increase as well as oil yield increased. The oil extraction increased and characterization of quality. The optimum conditions at pressing time was 180 min., oil weight was 93 g. oil/500 g. Salmon by-products, oil productivity was 18.00%, and extraction efficiency were 98.46 % at constant pressure. The oil weight from Salmon by-products was increased with heating time increase as well as oil productivity increased. The oil extraction yield increased with the wet rendering processes at heating time of 60 min. have oil weight about 90 g. oil/500 g. Salmon by-products , oil productivity about 18.00%, and extraction efficiency was 95.23% . The oil yield increased with both processes and cold pressing methods gave good looking and high quality of oil fish.

Key words*: extract, efficiency, yield, smoking salmon, waste, fish oil, cold pressing, wet rendering.*

INTRODUCTION

Management and handling of fish waste is an environmental, social priority for many countries and is more problematic because of rising production volumes. The fish processing industry causes a large quantity of tissue waste and by-products which tend to be either discarded or retailed at low value for fertilizer or animal feed. [5] The fish by product is nearly (skin 6 % - viscera 7% - off-cuts 10% - head 18% - backbone frames10%). [8] The fish processing industries produce large quantities of fish waste which often represent about 20-50% of the total fish weight. [3] Waste generated from fish processing plants is approximately 50 wt. % of harvested fish depending on the kind of fish product and processing techniques. [9]
Laboratory experiment illustrations that green extraction methods make available an excellent alternative to traditional methods – the volume of fish oil produced and the quality is comparable or even healthier. But, these methods need more research. It is necessary to advance the technology of pre-processing and the extraction method.

Conventionally, the oil fish was obtained as a by-product of the fish meal industry. Also smaller fish and spoiled fish have high fat content. The oil fish line considers the anchovies, sardines, herring, and others in the centre of attention as a raw material. Now fish oil has played a important role in the human diet addition to the demand for oil fish is still growing. [7]
The wet rendering extraction process involved first cutting the viscera still frozen into small pieces and putting them in 550 mL boiling water for 20 minutes. Then cooling down for 40 minutes and filtering in a strainer with fast flow rate. The process was repeated and after separation from water, the supernatant was filtered again using a fine sieve and brought to the fire for 30 minutes. [6]. The best conditions to extract oil fish from tilapia by-product by using heating temperature at 70°C for 35 minutes. [12]

The solvent extraction is another process that yields fish oil as a by-product. In this process, most of the water and some or the entire fat are removed using suitable chemical solvents. Normally, the solvent is recovered in the process and reused. The problems of solvent extraction method are complicated equipment and the high cost. [2] Dark salmon have 12.5% fats and oils 2.1% fats and oils and 17.5% protein, whereas the light salmon muscle had and 20.4% protein.[14] Salmon have higher fat content in the viscera than the fillet. [11] Tilapia viscera composition of 14.62% ± 0.79 protein, 10.75% ± 0.97 lipids, 60.44% ± 0.27 moisture and 4.90% ± 0.61 minerals. [10] The oil fish have long chain fatty acid, the prominent ones being EPA and DHA making it an attractive edible oil. [11] Fish oil is a very effective nutrient and contains omega 3 that can be absorbed easily. [7] A lot of studies recommended amounts of fish oil supplements to reduce the risk of heart attack and strokes. [1] The largest producer of by-product fish oil in Europe and big volume of fish waste from Asia. The fish by-product contributes the percentage of fishmeal to 33%, while fish oil being at 26%. [4]

Fish waste materials should be treated and disposal to avoid potential effects to the environment and human health. It can be by-product of a manufacturing process or an obsolete commercial product such as oil fish that can no longer be used for intended purpose and requires disposal. This study aimed to using the salmon waste material for producing fish oil and determines the optimum extract methods treatment addition to conserve the environmental during smoking processes.

MATERIALS AND METHODS

Experiments were designed to extract fish oil from waste of salmon smoking processes and compare between two different oil extractions methods

Sampling

Samples were collected from Bentleys Egypt company one from Egyptian industrial group, the by-products of salmon smoking (skin, viscera, backbone frames and off cuts), weighted 500 grams and package under vacuum.

The raw material of Salmon waste (skin, viscera, backbone frames and off cuts) frozen at -12 °C for one day before it was used in the experiment. It was used from Bentleys Egypt company one from Egyptian industrial group

Extract methods

-The cold pressing processes: using plastic bag under vacuum with 0.5 kg, from fish waste were processed to keep the waste material and put five bags in the pressing box have about 10 cm in deep, 30 cm in long, 15 cm in wide and two plate with the same dimensions one of them acting load on the sample's as a small prototype for cold pressing methods.

Different compressed times from 10 to 260 min. at constant pressure were approximately 20 kilograms per square size of samples.

-The wet rendering processes: in this method 500 g. of salmon waste put in 500 mL of water in a stainless cooker at 100 °C and heated for 20 minutes.

At high temperature is expected to rupture the fat cells, the sample lift a lot of time to cool down and separate the fish oil from sample component and wastewater. Different heating times 20, 30, 40, 50, 60, 80 and 100 min at a constant temperature 100 ºC

Fish Oil properties: the biochemistry analyzer model Erba Chem-7 were using to test triglycrides Total cholesterol, Triglycerides, HDL, LDL and VLDL cholesterol, were 493.9, 173.8, 281.4, 178.2 and 34.8 Mg/dl.

Measurements

Oil weight (g) = Extract oil from fish by product sample (500,g.)

Oil productivity, % = Extract oil /Weight of fish by product × Average weight of fish.

Extraction efficiency, % = oil mass after extraction, g./ oil mass in sample, g.*100

Oil mass in sample determined three times for 500 g. of Salmon by-products by cold pressing and wet rendering methods the oil content ranged between 18.45 and 18.89 g/100 g.

Also through enzymatic extraction method at the same conditions for samples of salmon,

the oil content obtained ranged between 16.234 and 18.212 g/100 g. [13]

RESULTS AND DISCUSSIONS

Salmon fish components: The results in Fig. 1 showed the components out from salmon fish, waste of fish percentage include water lose and fish by product were nearly from 43.65%, water lose from (change in freezing, 0.45%, salting 2% and smoking10.8%). While the fish by product percentage include (head-bone, 15.90%, and disposed off, 27.20%. Also edible portion nearly from 56.35% include trimmings, 4.90% and salmon slice, 51.45%.

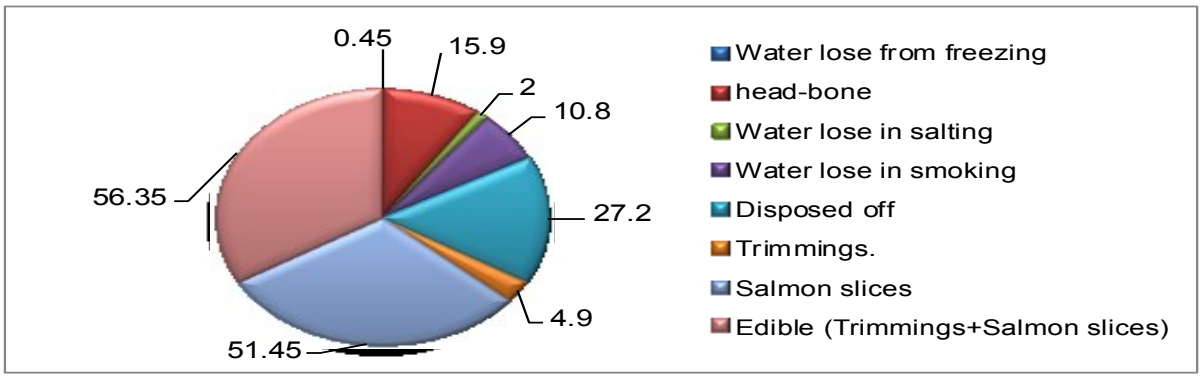

Fig. 1. Average components of salmon fish by-products percentage
Source: author's results.

Oil productivity with wet rendering:
The results in Fig. 2 showed that the oil weight from Salmon by-products was increased with heating time increase as well as oil productivity increased.

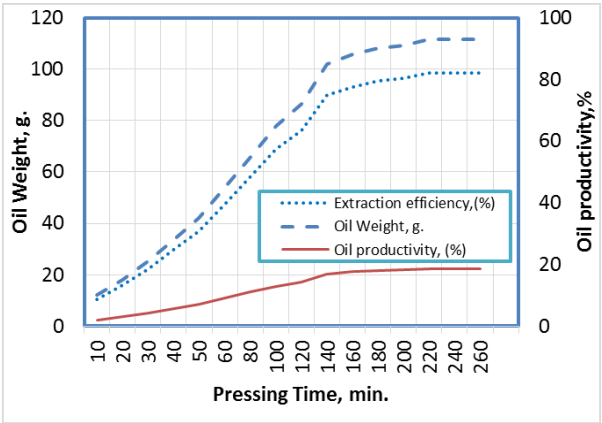

Fig. 2. The oil extracted from salmon by-products with heating time and oil productivity and oil extract efficiency.
Source: Own results

The effect of heating time on amount of oil extraction from Salmon by-products was tested at constant temperature. The results showed that heating time increased from 10 to 60 min. oil weight increased from 40 to 90 g. oil/500 g. Salmon by-products, oil productivity increased from 8.00 to 18.00%, and extraction efficiency increased from 42.35to 95.23% at constant temperature 100 ºC.
This temperatures reason's cell separation and so enable oil extraction and increase the oil yield. The results showing steady behaviour after 60 min. increased with heating time increase as well as oil productivity increased.

Oil productivity with cold pressing:
The results in Fig. 3 showed that the oil weight from Salmon by-products was increased with pressing time increase as well as oil productivity increased.

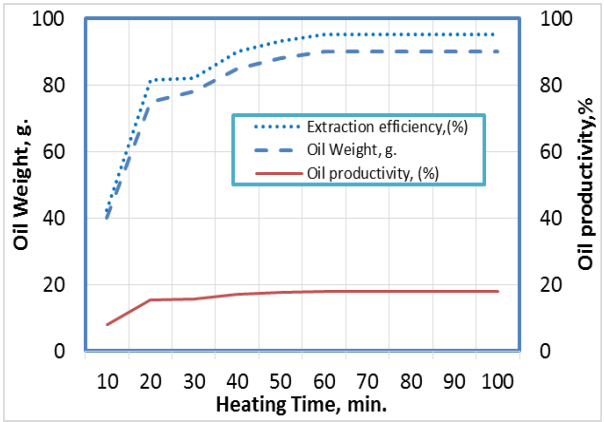

Fig. 3. The oil extracted from Salmon by-products with pressing time and oil productivity and oil extract efficiency.
Source: Own results.

The influence of pressing time on oil extraction from Salmon by-products was examined.

The results showed that pressing time increased from 10 to 260 min. oil weight increased from 10 to 93 g. oil/500 g. Salmon by-products, oil productivity increased from 2.00 to 18.60%, and extraction efficiency increased from 10.58 to 98.46 % at constant pressure, stress. This pressure causes oil extraction. The results showing steady behaviour for oil productivity and oil extract efficiency after 180 min.

CONCLUSIONS

The important results obtained were summarized in the following:

-The optimum conditions with wet rendering at a constant temperature 100 ºC and heating time 20 min., oil productivity about 15.40% and extraction efficiency was 81.52%

-The preferred using cold pressing, oil extraction yield increased and characterization of quality. The optimum conditions at pressing time was 180 min., oil productivity was 18.00%, and extraction efficiency were 98.46% at constant pressure.

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REFLECTION OF CONTEMPORARY SOCIO-CULTURAL FACTORS ON YOUNG RURAL FAMILY AS A PROBLEM OF RURAL DEVELOPMENT. A STUDY CASE - THE REPUBLIC OF BASHKORTOSTAN

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Abstract

This article analyzes the situation prevailing in recent years with young families. The family today has become almost the sole cultivator of traditional culture and values. A special role in this process is played by the rural family, as the village, rural lifestyle for centuries performed a stronghold of conservative moral and spiritual ideals and values. However, negative changes also affect the rural family, change its structure, composition, functions, the attitude of family members to each other, which leads to social problems of rural development. Based on the studies conducted, the main problems related to the migration of rural youth to cities or larger and more developed rural settlements are considered in the article. The paper updates the rural population aging, the village devastation, the orphan lands, the threat to the national security of the country. New data on the population census reveals the ongoing changes in the structures of rural and urban families. As a consequence of the research results, it was found that the principal problem of the state policy in relation to the rural young family, today, is the uncertainty of the Russian authorities on the future of rural areas.

Key words: *rural family, optimization, social infrastructure, urban family, social problems of rural areas, the future of rural area*

INTRODUCTION

At present the family being the only source of population reproduction, is one of the main society institution and its role cannot be overestimated. The family, possessing great economic and intellectual potential, performs not only reproductive, economic, educational, recreational functions, but it is also a source of accumulation, preservation, transfer of human and labor capital, norms of behavior, values, culture, lifestyle. The family is a powerful factor of preservation of ethnic identity of the population.

Currently, modern socio-cultural and socio-economic factors, controversial and complex processes lead to such negative phenomena as the family size reduction, the family children number, the increase of divorces, unmarried young people, unregistered families and births, weakening of intra-family communications, destruction of value foundations and others. As a whole the changing forms and functions of the family don't correspond to its essence, historical role and place in the society. Rural young families are acutely affected by these processes. The problem is aggravated by the fact that under existing conditions of globalization, urbanization and wide spread of Internet the rural young family wants to live "like in the city". This desire is explainable, because large urban centers give more opportunities for self-realization.

Thus, there is a contradiction between the objective needs and interests of young people and lagging behind social conditions in rural areas. Young people are trying to leave a modern village, characterized by narrow areas of application of labor, low income, underdeveloped forms of social protection, lack of opportunities and places for spending free time.

As noted by the authors of the article "Socio-Cultural aspects of modernization processes in the Republic of Bashkortostan" "nowadays modern Bashkir society is going through a very painful social transformation caused by transition from agricultural traditional way of life to the society of urban culture. It is known, a huge historical period, began with the Soviet modernization and ended (conditionally) in 2010 dismantling "authoritarian regime of M. Rakhimov". The lagging character of the urbanization transition makes the process not only painful but also conflicting. This process requires special attention due to fact that Bashkirs are the fourth numerous people in the Russian Federation (after Russians, Tatars and Ukrainians).

Socio-economic conditions and global transformation of society value orientations [9, 16], systemic economic crisis in the rural areas lead to gradual changing family, marriage, reproductive values and aims of villagers, their attitude to marriage, children, parents, relatives. Moreover, the problem is that the minds and behavior of rural young families change. So, first, in the rural family compared to the urban one, the adoption of the traditional values is dominant, and secondly these values are significantly transformed, which leads to divorces, unregistered cohabitation and unregistered births, and the decline of the family number of children. The structure of the rural young family, its composition, lifestyle and values, the distribution of gender roles in the family are gradually approaching to the urban family model. The problem is that living environment, occupation and peasant farming peculiarities contradict the urbanizing style and mode of the rural life.

Moreover, the gradual decline of the traditional big family, young people's desire to live separately from their parents led to misunderstanding its functions, since the problem of unemployment, low living standards, providing with kindergartens and schools is much more acute than in the city.

Scientific research of the family development has passed several stages. In the middle and the second half of the nineteenth century, in the period of formation of sociology as a science, the family as a micromodel of society was represented in the theories of classics M. Weber, G. Simmel, O. Comte, K. Marx, H. Spencer, and others [5]. At the same time, anthropological and ethnographic studies of the family are in the focus of social scientists. The main regularities of historical development of the family and marriage are analyzed in the works by E. Vesterbacka, M. M. Kovalevsky, J. Laboca, D. F. Mac-McLennan, G. Mayne, L. G. Morgan, F. Engels etc. [6].

In the middle of twentieth century, the family was studied within the framework of structural-functional analysis (E. Durkheim, R. Merton, T. Parsons, A. Radcliffe-brown, P. Sorokin) [3, 1]. The transformation of the family structure and functions as a social institution was the focus of research.

In the twentieth century, foreign research of the family developed various approaches and directions, so we can distinguish: evolutionary; functional; interactionist; empirical; ethological; socio-psychological; sociobiological; economic; feminist. Evolutionary approach (J. Bachofen, John.Labbok, L. G. Morgan, I. Kohler, M. M. Kovalevsky, L. Sternberg, F. Engels, S. I. Golod) [4, 19], emphasizing historical predetermination, influence of social environment and society on the family, considers the evolution of family relationships in a progressive direction.

Functional approach (A. I. Antonov, E. Burgess, E. Westermarck, E. Durkheim, B. Malinowski, R. K. Merton. U. Ogborn, P. Sorokin) analyzed changes in the structure and functions of the family under the influence of global changes in the society [1, 23, 25].

The subject matter of interactionists' research (G.M. Andreeva) is the processes of family members' social interaction [7]. The economic approach (J. Homans, G. Becker) considers the family and family-marriage relations through the prism of economic categories "utility", "marriage market", "profit", "costs", etc. [8]. Choosing a marriage partner, creating the family, giving birth to children are analyzed through a balance of costs and rewards. The feminist approach focused on gender issues.

The scientific works by T.I. Zaslavskaya, R.I. Kapelyushnikova, Z.I. Kalugina, V.I. Nechaeva, A.A. Paptsova, V.I. Perevedentseva, A.N. Petrikova, L.L. Rybakovsky, V. I. Staroverova are devoted to various aspects of socio-economic and socio-demographic analysis, rural development from the point of view of food security of the state and to factors of significant impact on the current state of rural areas [2, 11].

The main research direction of the rural youth and the rural young families are socio-demographic, socio-economic problems, migration, unemployment, living standards and quality of life, value orientations. It should be pointed out works by V.V. Paciorkovsky among the young family researchers. He paid special attention to the transformation processes of rural households composition and structure of [20].

The research of rural families, including rural young families, represents a special group of studies. Thus, a significant contribution to the rural family research was made by T. Shanin. A project aimed at studying the history of rural families and villages, analyzing the budget of incomes and expenditures as well as the budget time of village population [21].

Peculiarities of the family institution and marriage in the ethnic, regional sections became the object of study by A.V. Artyukhova, V.N. Arkhangelsky, A.S. Barashkova, A.I. Kuzmina, A.R. Mikheeva [17, 18]. The research works by A. Galina, F. B. Burkhanova, R. M. Valiakhmetova, S. A. Laraway, F. A. Mostovoy, R. R. Salakhutdinov, G. F. Hilario are devoted to the analysis of the rural population problems, the youth and the family in the Republic of Bashkortostan [2].

Thus, we know scientific researches of the family as a social phenomenon, its structure, historical development and transformation of its functions. There are researches devoted to the young rural family in various areas of Russia. However, these studies don't fully reflect modern realities [13]. The rural young family as an object of sociological study requires additional researches of its development in modern socio-economic conditions in concrete areas of the Russian Federation [14, 15].

The main object of the article is to establish necessity of providing all necessary social infrastructure facilities for comfortable young families living in rural areas in the Republic of Bashkortostan.

MATERIALS AND METHODS

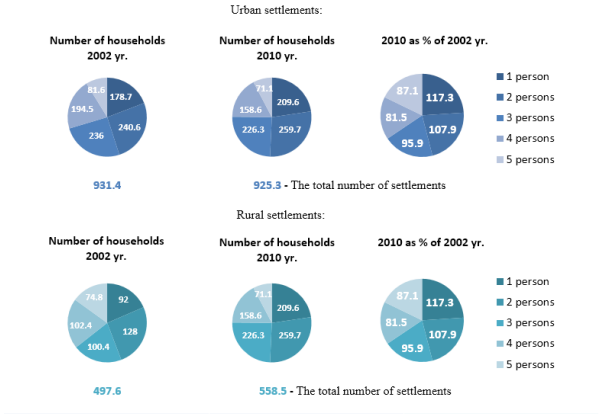
The population of the Republic of Bashkortostan ranks first in the Volga Federal District and the seventh among the subjects of the Russian Federation. There are representatives of more than 160 nationalities in the republic according to the population census of 2010. Three nationalities (Russians, Bashkirs and Tatars) account for 90% of the republic's population [2].

The quota of rural people in the population structure is relatively high in the Republic of Bashkortostan. According to the 2010 population census, the quota of the rural population in the region was 1,610.6 thousand people, or 39.6%, of urban residents, respectively, 2,461.7 thousand people, or 60.4%. The weight of the Republic of Bashkortostan is 2.3% of the urban and 4.3% of the rural population of Russia, 11.6% and 18.5%, respectively, of the Volga Federal District population (Fig. 1).

Majority of rural households (58.3%) consist of spouses with or without children, corresponding to the type of nuclear family.

Approximately one in five households (21.3%) consists of one person. Another 13.1% of households correspond to incomplete or mixed family - parents with a

child or one of the parents with a child or one of the grandparents.



	Urban settlements			Rural settlements		
	2002 yr.	2010 yr.	2010 as % of 2002 yr.	2002 yr.	2010 yr.	2010 as % of 2002 yr.
The average household size (person)	2.8	2.6	x	3.0	2.9	x

Fig.1. Number and composition of urban and rural households
Source: Data from Brief results of the census of 2010 in the Republic of Bashkortostan [10]

Only 3.2% of households can correspond to so-called extended or complex (multicultural) family. The family consists of spouses (with or without children, with one of grandparents, other relatives or without them). Thus, many rural families, including young ones, are a nuclear family type.
The object of our research is rural young families living in the Republic of Bashkortostan. The subject of our research is the respondents' subjective estimation taken from sociological survey. The main part of the analyzed empirical base of the research was collected by means of questioning:
1. Questioning of rural young families in the Republic of Bashkortostan (research topic: "Young rural family: problems and characteristics"). More than 750 spouses aged 18 to 30, living in the villages and urban-type settlements were studied in 2014-2015. The sample is random, representative by age, place of residence, socio-economic zones of the region. Questioning of young urban and rural families in the Republic of Bashkortostan (research topic: "Young family in modern conditions"). The questioning was conducted in 2016.
2. In addition to urban young families, 870 representatives (one of the spouses) of rural young registered and unregistered spouses were included. The sample is multi-stage, territorial, quota. By questioning we conducted a comparative analysis of life quality and lifestyle of rural and urban young families.
The statistical data taken from the state committees collections of the Russian Federation and the Republic of Bashkortostan statistics; doubled analysis of all-Russian researches results and sample survey of the population - "Russian monitoring of the economic situation and health of the population", "Comprehensive monitoring of population living conditions" were used in the article as well.

RESULTS AND DISCUSSIONS

The most important function of the family is giving birth to children and upbringing. This function is partially replaced by children's educational organizations (kindergartens) and schools in modern conditions of high economic activity of women. Despite the statements of regional authorities that the problem with kindergartens is gradually being solved in the republic, statistics show that it becomes more complicated in rural areas.
In whole, there were 1,333 pre-school educational institutions (PSEI) in the Republic of Bashkortostan at the end of 2015. Over the past two years the number of pre-school educational institutions has decreased significantly from 1,630 to 1,333 in 2015. More than half of pre-school educational institutions (723) are located in the rural areas. Over the past fifteen years, there has been a tendency for a gradual reduction of pre-school educational institutions number in the rural areas. There has been even a slight increase pre-school educational institutions number in the city over the past five years. Their number has begun to decrease again since 2014. (Fig. 2).
There are about 400,000 pre-school children in the region. By the end of 2015, the number of children in pre-school educational institutions was 213.3 thousand, while in urban areas - 156.2 thousand, in the rural areas - 77.6 thousand.

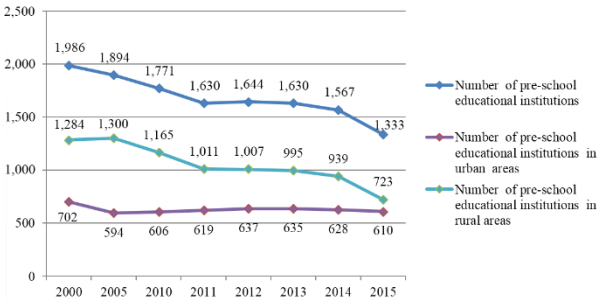


Fig. 2. Number of pre-school educational institutions (at the end of the year)
Source: Bashkortostanstat Data, 2016. pp. 25 [12]

There has been a significant increase of children number in pre-school educational institutions (PSEI) in both urban and rural areas since 2000. It may be explained as a consequence of large generation born in the late 1980s entering into reproductive age and socio-demographic policy of the state.
The republic is actively working on solving the problem of kindergartens queuing. However, the emergency in pre-school educational institutions remains high, there is a deficiency of pre-school educational organizations: there are 114 pretenders to 100 places in pre-school educational organizations (PSEO), 120 in urban areas, and 104 in rural areas. Only 69.2% of corresponding age children, 74.6% in urban areas, 60.4%. in rural areas are embraced by pre-school educational organizations. Thus, about 40% of children of the corresponding age are not provided with pre-school educational organizations in the village. (Fig. 3).

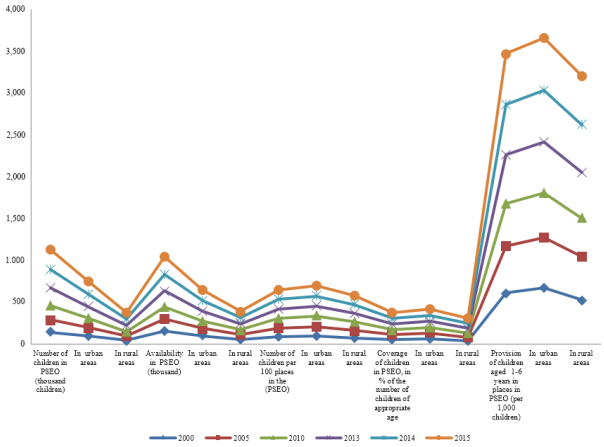


Fig. 3. Number of children in pre-school educational organizations (at the end of the year)
Source: Bashkortostanstat Data, 2016. pp. 28 [12]

As for general educational institutions, their number has also been gradually decreased in the last quarter of a century. This trend is typical as for rural so as to urban regions. The general educational institutions reduction is due to decline of trainees number in them.
As statistics show, in recent years, despite even a slight fluctuation of students number in general educational institutions, the number of schools has declined significantly. So at the beginning of the 2010/2011 academic year there were 1,840 general educational organizations, their number was reduced to 1,375 (reduction by 465 units) in the republic at the beginning of 2015/2016 academic year. At the same time, students number in daytime general educational institutions in 2015/2016 was 444,442 people (625 more than in 2010/11academic year) (Figure 4-7).

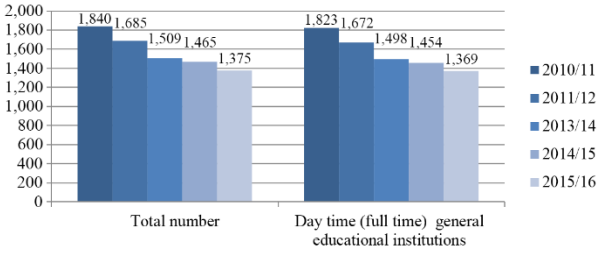


Fig. 4. Number of general educational institutions at the beginning of academic year
Source: Bashkortostanstat Data, 2016. pp. 29 [12]

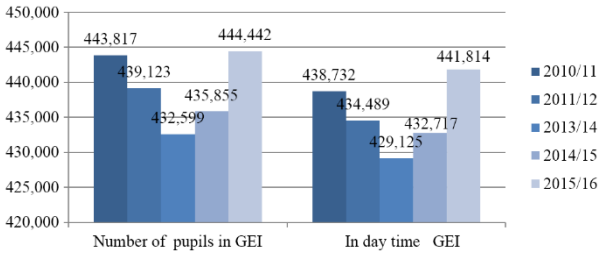


Fig. 5. Number of pupils in general education institutions at the beginning of academic year
Source: Bashkortostanstat Data, 2016, pp.29 [12]

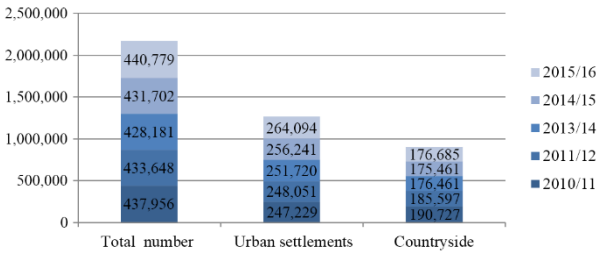


Fig. 6. Number of pupils in day time municipal and state general education institutionsat the beginning of school year
Source: Bashkortostanstat Data, 2016, pp.29 [12]

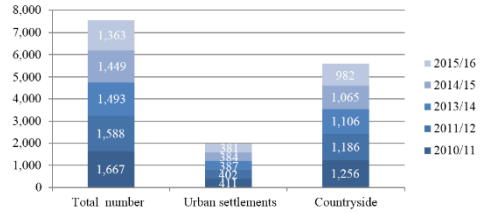


Fig. 7. Number of day time municipal and state general educational institutions at the beginning of academic year
Source: Bashkortostanstat Data, 2016, pp.29 [12]

In rural areas, in contrast to urban, there is a significant reduction of daytime state and municipal general education organizations number against the students decline. At the same time, there is a tendency of commercialization of these institutions. As noted J. A. Skryabina, due to the reduction of schools number "there is a massive and widespread destruction of education in rural areas. Tomorrow there won't be a single young family in the village ..." [20]. A young family needs not only kindergartens and schools, but also cultural and recreational facilities (Table 1).

Table 1.Institutions of cultural and recreational type

	2000	2005	2010	2012	2013	2014	2015
Total number							
Number of institutions	2,556	212	2,371	2,330	2,269	2,204	**2,114**
per 10,000 people	6	6	6	6	6	5	**5**
Number of places in institutions	451.7	439.3	411.2	401.8	384.6	335.6	**322.2**
per 1,000 people	110	108	101	99	95	82	**82**
Number of cultural and recreational establishments (thousand)	14.9	18.1	19.1	19.4	19.1	18.9	**18.3**
Number of participants in them (1,000 people)	222.8	265.2	276.0	283.8	276.2	271.3	**263.8**
children in them (thousand)	6.2	7.7	8.7	8.4	8.2	8.1	**7.7**
participants in them (thousand)	94.3	109.7	121.7	119.8	116.3	115.2	**110.6**
Urban areas							
Number of institutions, (units)	100	93	84	86	78	70	**67**
for 10000 people	0.4	0.4	0.3	0.3	0.3	0.3	**0.3**
Number of places in them (thousand)	47.0	39.3	33.1	32.7	28.3	26.0	**25.4**
for 1,000 people settlement (units)	18	16	13	13	11	10	**10**
Rural areas							
Number of institutions (units)	2,456	2,419	2,287	2,244	2,191	2,134	**2,047**
For 10,000 people settlement	17	15	14	14	14	14	**14**
Number of places (thousand).	404.6	400.0	378.1	369.1	356.3	309.6	**296.8**
per 1,000 population	**274**	**245**	**235**	**234**	**227**	**198**	**198**

Source: Bashkortostanstat Data, 2016. pp.86 [12]

According to the Bashkir State Committee on Statistics data (Bashkortostanstat), there is reduction of cultural and recreational facilities in the region. Their number has decreased by 227 units (from 2,114 to 2,341 units); accordingly, the number of places in them has also decreased from 404 to 322.2 units, as well as the number of cultural and leisure groups (from 19.4 to 18.3 thousand units) from 2011 to 2015. The number of participants in cultural and leisure establishments has also declined (from 277.1 to 263.8 thousand people), children (from 8.4 to 7.7 thousand people). Significant reduction of cultural and recreational facilities is going on in rural municipal areas. These trends have the most negative impact on rural young families. The sociological research results also affirm rural young families' limitations in satisfying their cultural requirements.

So, for the last six months before the survey, 82.4% respondents said that they had never attended theaters, concerts, museums, exhibitions, half of the young families spent their vacations at home - 49.8%, 21.8% had no vocations at all, and 9.7% had to work during the holiday. As a consequence of the research results, it was found that representatives of rural young families are less satisfied with their recreational and cultural facilities compared to their urban peers (Figure 8).

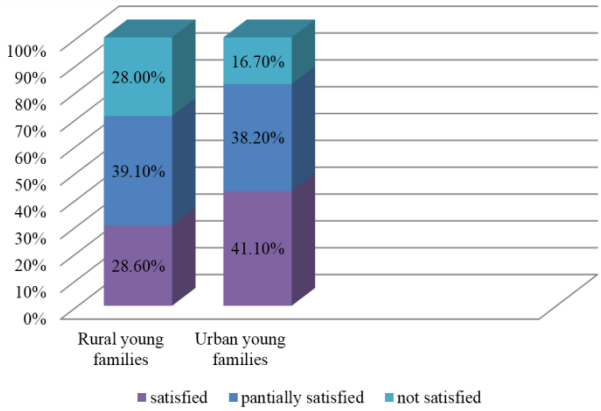


Figure 8. Satisfaction of respondents with opportunities for recreation, entertainment, cultural leisure, in%
Source: Bashkortostanstat Data, 2016. pp.86 [12]

The structure of leisure activities reflects young families' interests and needs structure, among which we can distinguish two main components.

The first is household (68.1%), which includes the work in the garden or in the kitchen garden (54.2%), since in rural areas the maintenance of a personal subsidiary farm (PSF) is not only a traditional occupation, but also a source of products and additional earnings in case of selling products. The second and the most popular way of free time spending is communication and getting information, including watching TV (51.5%),

spending time in the Internet (35.1%), reading newspapers, magazines and books (31.4%). Other common way of spending free time, but requiring more activity than watching TV is visiting friends (32.7%), and going in for sports (16.1%). The considerable dissatisfaction with the opportunities for leisure and entertainment is partly connected with the fact that there is mismatch the real possibilities and respondents' desires to spend their leisure time [22, 24].

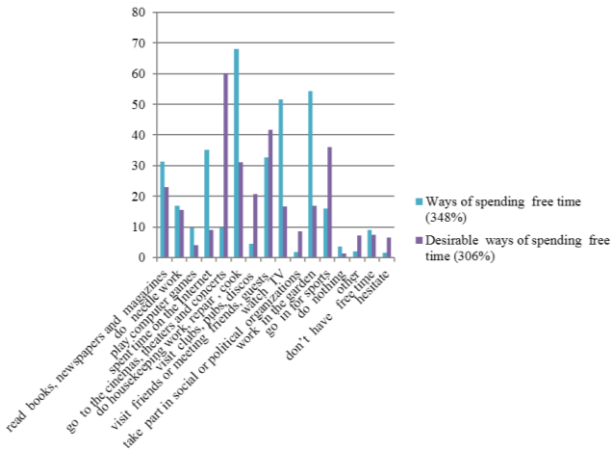


Figure 9. Ways of spending free time: real and desirable in %
Source: Field survey, 2016

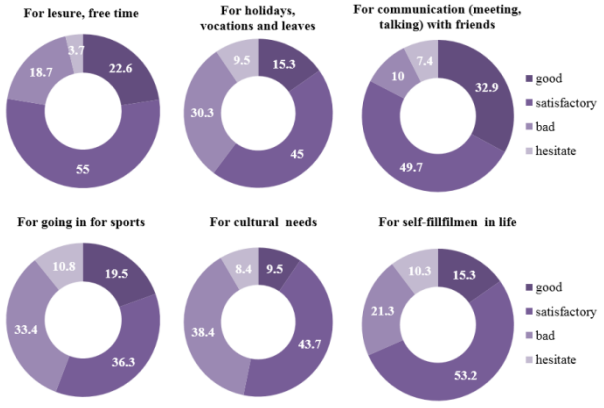


Figure 10. Assessment of conditions for recreation and leisure
Source: Field survey, 2016

It can be noted that much less number of respondents would like to continue to do household duties (31.1%) and to work in the garden (16.9%), to watch TV (16.7%). There is a significant desire to spend leisure time more actively, to go to the cinema, theater or to concerts (60.1%), to visit friends or meet guests (41.8%), to go in for sports (36.1%) (Figure 9).

In general, rural young families appraise the conditions for leisure as good (22.6%), satisfactory (55%) (Figure 10).

CONCLUSIONS

The reduction of social infrastructure significantly worsened rural residents' social services, which contributed the growth of young rural families migration from small villages to regional centers. So, first, statistical data point to a significant reduction of pre-school educational institutions compared to their considerable enlargement. This process is not due to the construction of new modern educational organizations, often thanks to concentration of kindergartens so creating additional loads on their infrastructure. According to opinion of rural young families representatives, the least satisfactory conditions are formed in the sphere of realization of cultural needs, physical education and sport, taking holiday, self-realization in life. It should be noted out that not only the deficiency of social infrastructure facilities, but also low material standards is an obstacle to satisfy requirements in recreation, entertainment, development in rural regions.

Summarizing the research results, the following conclusions are drawn. Nowadays, to our mind, one of the main problems in the formation of the state policy towards rural young families is the uncertainty of the Russian authorities over the future of rural areas. The indefinite position is expressed in the contradiction between the declared statements and real acts. So, in words we can hear the revival of the village and population well-being, but the statistical data and the results of sociological studies state the opposite. The limited financial and budgetary resources compel the state to follow social infrastructure optimization. The closing of inefficient educational and medical institutions, clubs, etc. violates the existing optimal settling of rural population and declines life standards.

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THE IMPACT OF THE SOCIAL DEMOGRAPHIC CHARACTERISTICS OF THE RURAL YOUNG FAMILY ON THE TERRITORIES' DEVELOPMENT. A STUDY CASE - THE REPUBLIC OF BASHKORTOSTAN

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Abstract

The article deals with the problem of impact of modern social cultural and economic factors upon the young rural family. The problems of these contradictory and complex impacts led to such negative phenomena as reduction of its size, the growth of divorces and the share of people who have never been married, the growth of unregistered unions and births, the decrease in the number of children, the weakening of intra-family communications, the destruction of value foundations, and others. The problem of the rural territories' development becomes urgent as in the globalization and urbanization conditions the youth strives to leave the modern village which is characterized by the scarcity of the labor application spheres, a low income level, the underdevelopment of population social protection forms, the lack of possibilities and places for spending a spare time. The author's view on the young family problems has been given. The sociological studies made it possible to analyze social demographic situation presupposing the population decrease in connection with the number and the youth share decrease, the birth rate reduction alongside with a gradual transfer to the European family model, the women education growth and the value orientation change of the rural youth will cause serious problems of the territories' occupation and the traditional economic direction development-the agricultural industrial complex of the Republic of Bashkortostan. The statistics data and the studies' analysis have defined the directions of the young rural family model improvement.

Key words**:** *young rural family, rural territorie' development, social economic life conditions, social demographic characteristics, agricultural industrial complex*

INTRODUCTION

Contemporary processes in the rural young family due to both the existing historic, cultural civilized, demographic factors and socio-economic living conditions. We can't change considerably the first factors in our days, but social- economic factors may and must be influenced by the state regulation methods [1, 4].

A rural young family is a family that lives in a rural area. In the Concept of Sustainable Development of Rural Territories of the Russian Federation, rural territories are defined as "the territories of rural settlements and the corresponding inter-settlement territories (i e, territories that are outside the boundaries of settlements)" (Concept of Sustainable Development of Rural Territories [12]. According to the Organization for Economic Co-operation and Development (OECD) the rural regions (districts) embrace the population, the land and the other resources of the open landscape and the small settlements beyond the borders of the direct economic regions under the impact of the

major city centers [13]. Rural areas, especially in comparison with urban regions, characterized by narrow relationships industries and low population density. In most rural regions priority lesson is agricultural work, the less the degree of socio-economic development, a small set of types of work, most professional and social homogeneity of the population [13].

Socio-economic conditions and global transformation of value orientations of society, systematic economic crisis in the countryside, gradually changing family and marriage, reproductive values and attitudes of the villagers, their attitude to marriage, children, parents, relatives. Moreover, the problem is that there are various trends in the minds and behaviour of the representatives of the rural young families. Thus, on the one hand, in the rural young family, compared with the urban one, the commitment to traditional 5 values dominates, and on the other hand, these values are significantly transformed, which is reflected in the spread of divorces, unregistered cohabitations and unregistered births, reducing the number of children in the family.

The structure of the young rural family, its composition, the lifestyle and values, the gender roles' distribution is gradually reaching the city model of the family. The problem consists in the fact that the environment, the occupation, the features of the household contradict the urbanized style and the lifestyle of the rural youth.

Moreover, the gradual decline of the traditional extended family and the desire of young people to live separately from parents led to the modern structure of the young family that doesn't fulfil its functions, because the problem of unemployment, low levels of life, availability of kindergartens and schools in rural areas is much more sharper than in the city. Modern rural family is characterized by trends such as the growing number of divorces, the decrease in the number of children in the family, the increase in the proportion of single people, consciously choosing solitude and refuse marriage, individualization of family members. Nowadays the family is characterized by diversity, ambiguity, uncertainty, of its future.

Nowadays the family is characterized by the diversity, the variants' ambiguity, the indefiniteness of its future, the variety of its development trends. A valuable thing to prove our viewpoint about a gradual loss of its functions by the rural family is the work of the structural functionalism representative William Fielding Ogborne who in the work "The changing family" [3] proves that 5 functions of the family out of 6 defined by him (the affective, the economic, the educational, the religious, the recreational, the protective) gradually transform beyond the borders of this institute. He refers to the following trends as the arguments: 1) the family ceases to be the productive cell; 2) the economic everyday function is more often realized by the public service sphere, as many domestic works transform beyond the borders of the house (e.g., the family members seldom cook at home but eat in the cafes o the restaurants; the family more often utilizes the laundry services rather than washes the cloths at home); the school bears more responsibility for the children education; the religious education is redistributed in favor of the church. The changes of family relations formulated by W. Ogborn sounded like this "the loss of family's functions. The loss of its functions is not a problem yet as it may mean its narrow specialization. However, alongside with the loss of the functions the system of the social communications changes, that is, as it was supposed by W. Ogborn and M. Nimkoff, "the family patterns are becoming more disorganized" [10]. Disorganization refers to increased conflicts, divorces. This point of view is valuable for us in terms of considering the relationship between changes in the structure and functions of a rural young family and modern processes, among which are the growth of the number of unregistered marriages and births, divorces, changing reproductive attitudes towards childlessness. The rural family is currently undergoing a crisis of Patriarchal family. Gradually, it is replaced by a married family [9]. It can be noted that due to the influence of traditions, the formation of a married family in the

village is slower and harder than in the city. That certainly affects the development of rural areas. However, the development of the rural family repeats the main stages of development of the family as a whole, so the spread of the married family, which, however, is a less stable form of family, in rural areas, is likely to be inevitable.

MATERIALS AND METHODS

Let's consider first of all the changes in the rural settlement structure and the most important characteristics of the young rural family in the Republic of Bashkortostan. By the quantity of the population the Republic of Bashkortostan occupies the first place in the Volga federal region and the seventh place among the Russian Federation subjects [2]. On the Bashkortostan territory according to the census data from 2010 there live the representatives of more than 160 nationalities [3]. From this number three nationalities (the Russians, the bashkirs and the tartars) make up 90% of the population in the region

First of all, let us consider the changes in the structure of rural settlement and some of the most important characteristics of a rural young family in the Republic of Bashkortostan.

In terms of population, the Republic of Bashkortostan ranks first in the Volga Federal district and seventh in the Volga federal region and the seventh place among the Russian Federation subjects [2].

According to the 2010 census, representatives of more than 160 nationalities live in the territory of Bashkortostan [2]. Of these, three nationalities (Russians, Bashkirs and Tatars) account for 90% of the population of the Republic [2].

The part in the Republic of Bashkortostan makes up 2.3% of the urban population and 4.3% of the rural population in Russia. 11.6% and 18.5% belongs to the Volga federal region respectively [2]. To study the changes in the demographic behavior of urban and rural families, a survey of young urban and rural families in the Republic of Bashkortostan was conducted. The survey was conducted in 2015. In addition to urban young families, the sample included 870 representatives (one of the spouses/partners) of rural young registered and unregistered couples. The sample is multistage, territorial, quota. The survey allowed for a comparative analysis of the marriage and reproductive attitudes of rural and urban young families.

In the article the statistic data were used presented in the collections of the state Committees of the Republic of Bashkortostan; the secondary analysis of the all-Russian study results conducted by the Russian Public Opinion Research Center (the All-Russian Center of the Public Opinion study), the POF (the Fund "public opinion"), the Levada center and others and the selective studies of the population-RMES (the Russian monitoring of the economic situation and the public health), KOUZ (Complex Observation of the life conditions of the population) and others [2, 7, 8, 9, 11, 12, 13].

RESULTS AND DISCUSSIONS

Having considered some aspects of rural settlements in the region, let's turn to the analysis of the characteristics and trends of rural families in the Republic of Bashkortstan. The part of the young people in the region is gradually decreasing because of the total number of the young people in the population pattern (Fig. 1).

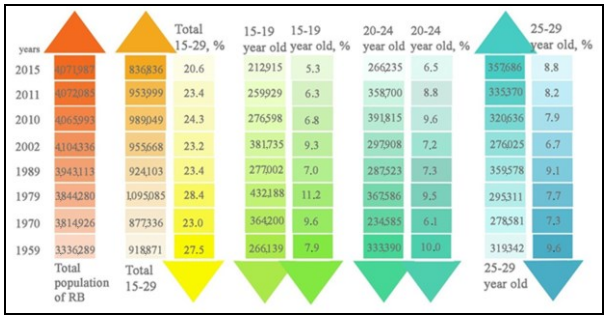

Fig. 1. The dynamics of the young people number and the specific value in the Republic of Bashkortostan
Source: Survey Data [8, P. 123].

According to the demographers' forecasts in the perspective the youth number and its specific value in the aggregate population have the further tendency to decrease.

The 2010 census showed significant disparities in the population by sex, which

directly affects the marital status of the inhabitants of the region. Traditionally, men in the region are fewer than women. On the average for the Republic of Bashkortostan there are 1,139 women per 1,000 men. The results of the census show an aggravation of the problem of the ratio of male and female population in urban areas of the republic (1,185 women per 1,000 men) [2].

However in various age groups the male and female ratio is not the same. As a rule, the male are more often born than the female. But towards 30 there are less male than the female.

Nowadays the demographers are alarmed, marking a considerable settlement gender disproportion of the population in the village [8]. The women are more mobile. A hard life in the village, the underdevelopment of the social infrastructure, the unemployment makes for the female population urbanism of the employable age to the cities. That's why from the young age (15-19 years old) the female population predominates in the cities and their peers, the men, mainly stay in the villages.

Fig. 2. The male and female ratio of the age population groups of Republic of Bashkortostan (1,000 men and 1185 women)
Source: Survey Data [2, P. 14].

Figure 2 shows that according to all-Russian census results 2010 there were only 913 rural women and 1,000 rural men of the same age [2]. Besides, for the last inter census period the share of the women for 1,000 men decreased from 058 to 913 persons. This index shows as well as some other indices that the rural and the urban settlements have a considerable differentiation. For instance, in 2014 in the c. of Sibay for 1,000 men of the employable age there were 1,214 women. In Birsk there were 1,204 women. At the same time in Mishkin region for 1,000 men of the same age category there were only 758 women, in Baltach region there were only 766 women, in Askin region there were 774 women [7, 8]. The rural population is distributed, that's why the gender difference in the marital age is substantial in some settlements.

In the village we may observe a considerable gender differentiation in the young age groups in the households where there's only one person (Fig. 3).

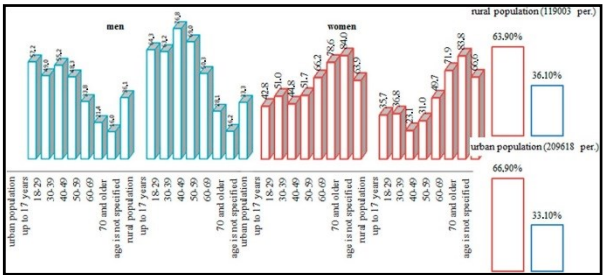

Fig. 3. The proportion of the urban and the rural population, in %
Source: Survey Data [8, P. 89].

Among the urban population at the age of 18-49 years old, the households where there's only one person, are distributed according to the gender identity almost uniformly. At the same time in the rural households, as a rule, there live only men. At the age from 30 to 31 the number of such households is thrice as much as the number of the households where lives only one woman of the same age. It is worth noting that the unmarried rural women due to the specificity of the rural lifestyle prefer to live together with the relatives and the unmarried urban women on the contrary, prefer to live alone.

Nevertheless, the problem of a significant shortage of women of marriageable age in the countryside has a place to be. Marriage behavior of rural youth as well as their urban peers from the late 80's. XX century. was transformed: a decrease in the number of young people who are married (Fig 4), the number of the divorced has increased. And this happened in representatives of all the numerous nationalities that inhabit the republic.

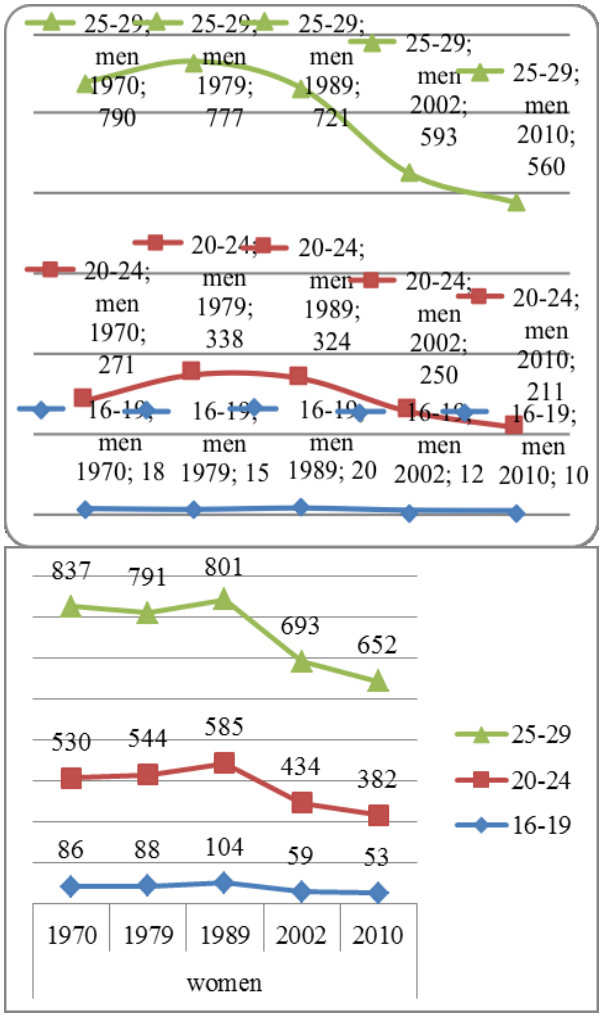

Fig. 4. The population distribution aged under 30 by their marital status, according to the census in the Republic of Bashkortostan.
Source: Survey Data [2, P. 11-12, 27].

Among the women and the men from 16 to 29 for the last 40 years the share of those who were not married greatly increased. This was due to the increase of marriage age and the increase of population proportion, never held in marriage. For twenty-five years, the proportion of men to 25 years old, married, fell twice. If in 1990 among women up to 25 years, almost 70% were already married, but in 2015, 2010. there were only 40.7%. Thus, over the past quarter century there has been a significant increase in the age of marriage, including and among the rural population. In many ways, this was due to various socio-economic factors, urbanization, globalization and individualization of society. Table 1 reflects changes in marital behaviour of the population.

Table 1. The age structure of the married population, in RB, %

year	1990	2000	2005	2010	2014	2015
	Men					
The total number of married	100	100	100	100	100	100
Up to 18	0.6	0.4	0.2	0.1	0.1	0.1
18-24	53.3	48.4	43.3	37.2	25.8	24.7
25-34	33.3	33.9	37.5	44.6	52.5	53.3
35 and older	11	13	13.5	12.7	16.1	16.9
	Women					
The total number of married	100	100	100	100	100	100
Up to 18	3.5	3.4	1.9	0.8	0.9	0.8
18-24	64.6	61.8	59.3	52.6	40.9	39.9
25-34	20.8	21.8	25.3	33.9	42.1	42.4
35 and older	11	13	13.5	12.7	16.1	16.9

Source: Survey Data [2, P. 37, 38].

Despite a significant transformation, the rural family institution is still distinguished by more traditional values. For example, young respondents from rural young families differ from their peers with negative attitudes toward early (under 16 years) sexual life. With regard to sexual experience, the urban youth acquires it at an earlier age. Thus, 67.1% of the polled urban respondents mentioned that they got their first sexual experience up to 19 (among the rural respondents it is 37.2%). The majority of the rural respondents got their first sexual experience at the age of 19-22 (38.8%) (Fig. 5).

Simultaneously with the above-mentioned processes there is a high growth of the of the unregistered marriages' share (in the RB there are 12. 5% for men and women).

The comparison of the regional indices with the all-Russian ones shows that among the Bashkirian youth, especially among the young men, the unregistered marriages are less popular than among their peers from other regions, that is obviously specified by a high rural population share.

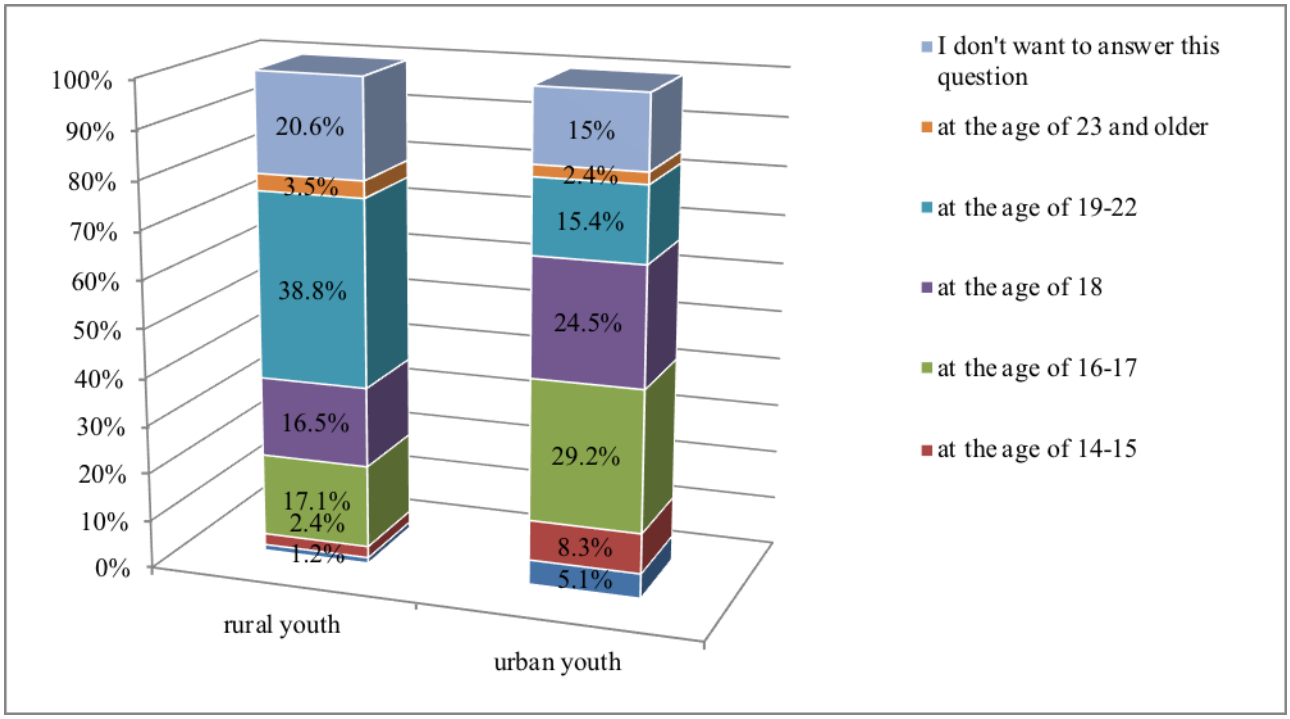

Fig. 5. The age of getting the first sexual experience among the rural and the urban respondents.
Source: Field survey, 2016.

Among the rural population as a whole the unregistered marriages are more widely spread than among the urban residents. However, this does not belong to the young cohort. Among the young rural men there is a smaller amount of persons who had the unregistered relations than among the young urban residents (Table 2).

Table 2. The dissemination of the unregistered marriages among the urban and the rural young people in the Republic of Bashkortostan among the age groups.

	urban population				rural population			
	2002		2010		2002		2010	
	m.	f.	m.	f.	m.	f.	m.	f.
total population at the age of 16 and more. per.	8.1	8.1	12.1	12	10.4	10.4	13.2	13.3
Among them at the age of 16-19	30.9	27.4	58.6	46.5	33.4	33.3	40.3	39.2
20-24 years	15.5	13.8	28.1	22.5	16.9	14.9	22.5	20.1
25-29 years	11.2	10.9	15.4	14.1	13	11.8	15.4	16.2

Source: Survey Data [2, P. 37, 38].

At the same time the census data allow to note the following trend: while the part of the young urban residents for the last inter census period has greatly increased, the rural young residents' part has a slight increase. To our mind, the reasons for it are a more traditional imagination of the rural residents about the family and a critical attitude towards unmarried relations. The young rural families' representatives as a whole regard the unmarried unions positively. But they are fully approved of only by one-third of the

respondents. The half of the youth polled, despite of the partial approval, see the underwater stones of such relations. At the same time there are some differences in the urban and the rural young families' answers. Thus, 30.7% of the rural young families and 40.6% of the young urban families fully agree with the statement "This is normal when an unmarried couple leaves together even if they are not going to legalize their relations". At the same time, among rural youth, the share of answers " I agree in something and I disagree " (52.4%) compared to urban (39%).

At this point we note some gender differences. As it was expected, the young rural men approve of a joint living before the marriage in comparison with the young rural women who disapprove of it. Both the urban women and the rural women in contrast to the men look at the unregistered marriages more negatively. (Table 3).

Table 3. The opinion about the conformity with the cohabitation social norms of men and women who are not going to get married.

	All the respondents	rural	urban
Men			
Fully agree	42.6%	34.2%	47.8%
I agree in something and I disagree in something	41.5%	54.8%	33.0%
Fully disagree	11.2%	9.6%	12.2%
It's difficult to answer	4.8%	1.4%	7.0%
total	100.0%	100.0%	100.0%
Women			
Fully agree	32.2%	28.3%	34.8%
I agree in something and I disagree in something	46.7%	50.0%	44.4%
Fully disagree	17.2%	14.1%	19.3%
It's difficult to answer	4.0%	7.6%	1.5%
total	100.00%	100.00%	100.00%
Both men and women			
Fully agree	36.9%	30.9%	40.8%
I agree in something and I disagree in something	44.3%	52.1%	39.2%
Fully disagree	14.5%	12.1%	16.0%
It's difficult to answer	4.3%	4.8%	4.0%
Total	100.00%	100.00%	100.00%

Source: Field survey, 2016.

It may be noted that among the urban people the share of the persons who occupy categorical positions of those who agree and those who disagree, is much higher than among the rural ones. Rural representatives of young families differ in the uncertainty of their position ("somehow they agree, or disagree"): more than half of rural young married and married men and women found it difficult to state their opinion regarding the social norms of living together of men and women without setting marriage.

According to the results of our study almost one-third of the respondents fully agree with the statement that if the couple is unhappy in their marriage, the divorce is quite admissible even if they have children. More than the half of the respondents mentioned that they agree in something with this opinion and disagree in something with it.

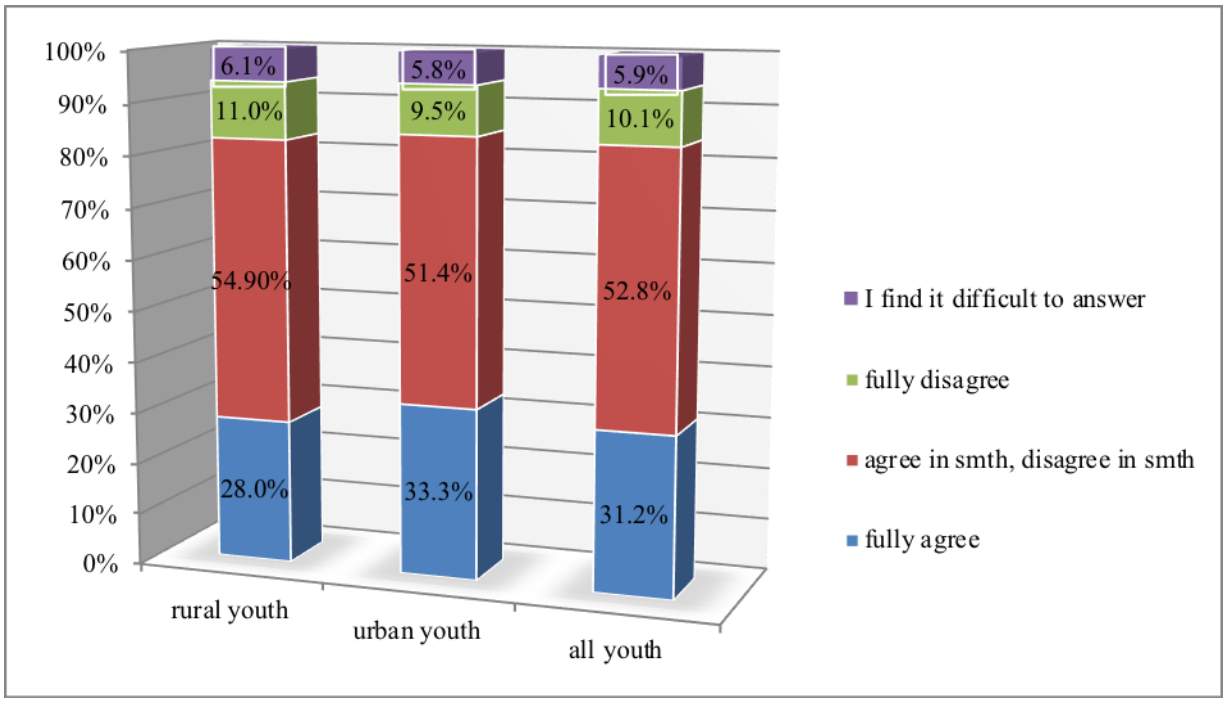

Fig. 6. The respondents' view on the divorce in a family having children, %.
Source: Field survey, 2016

The majority of the young rural respondents, having families, believe that is better to divorce than to live in an unhappy marriage. There were no great differences in the rural and the urban respondents' opinions. (Fig. 6). Though among the young urban families' representatives (33.3%) the share of those who agree with the proposed statement is a little higher than among the rural ones (28%). While in the patriarchal family flourish period the main reason of the divorce was the women's fertility, nowadays it is alcoholism, drug dependency (69.3%), conjugal misconduct (50.6%), material problems (50.6%), different views of life, the absence of mutual understanding, respect (36.6%), interference of parents (relatives) in the family affairs (36.4%), an accidental marriage or an interested marriage (33.8%). The difference in the answers of the rural and the urban respondents are shown in Fig.7.

Thus, the divorce is considered to be as one of the widespread ways of solving the family problems by the young respondents and becomes a usual, a matter of fact phenomenon. Instead of the constructive ways of solving the family contradictions, the young spouses prefer to divorce rapidly, often bringing some private problems into the next marriage.

It should be noted that all those processes that we analyzed above: the growth of the share of single young people, unregistered marriages, divorces has an impact on fertility, and in the most negative way. Let us illustrate the above-mentioned statistics and the results of sociological surveys of young families [5, 6].

The Republic of Bashkortostan by the index "the general birth coefficient" which reflects the number of the births for 1,000 persons of the population, by the results of 2015 and occupied the 21-st place in the Russian Federation and the 4-th place in the Volga Federal region: the general birth coefficient in 2014 was 14.8%, in 2015 it was 14.5% [11].

However it is difficult to speak about the regions' rating according to births as it does not reflect the gender age structure of the population.

Another indicator-the total fertility rate (the number of children per woman aged 15 to 49 years) was in 2015 for the Republic of Bashkortostan 1,939, which is slightly higher than in the Russian Federation as a whole – 1,777 and in the Volga region – 1,818. [11]

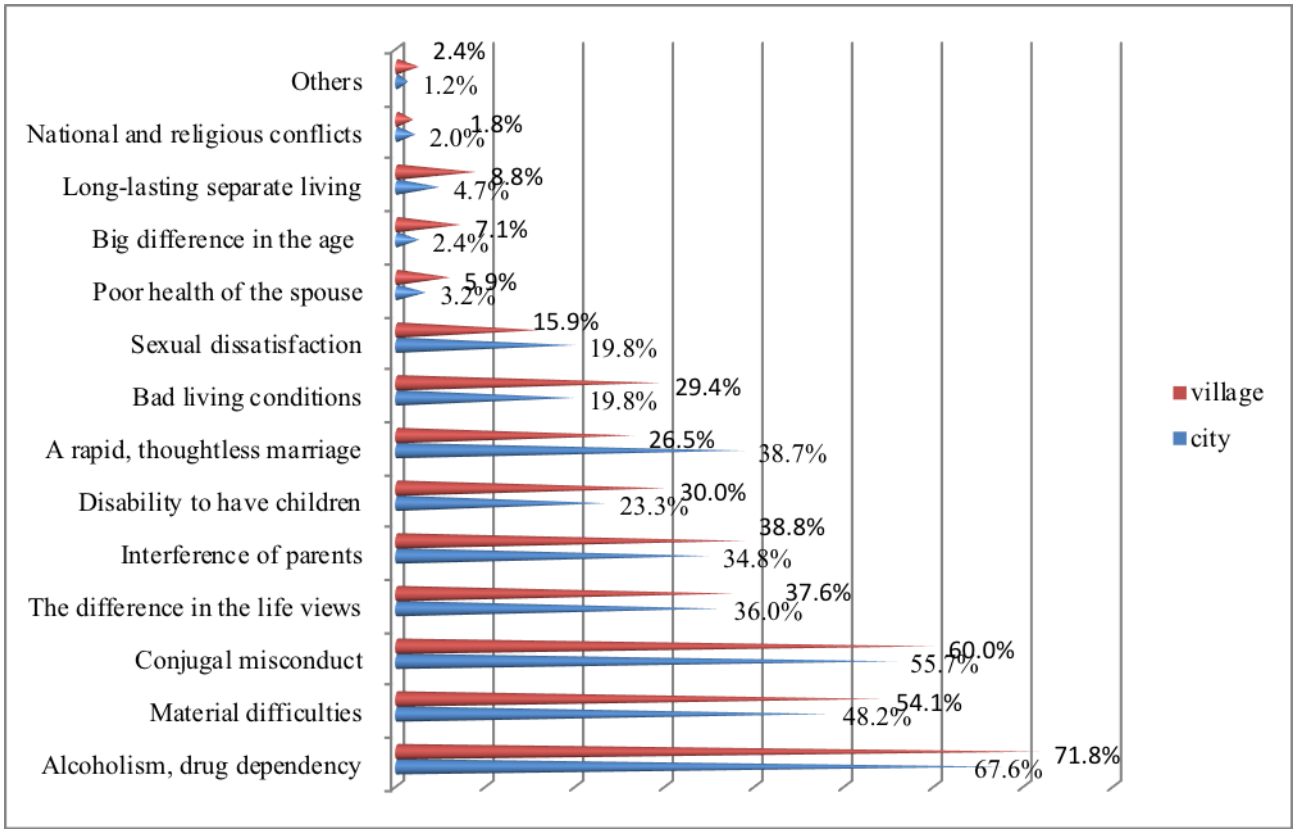

Fig. 7. The answers of the rural and the urban respondents about the reasons of the divorce.
Source: Field survey, 2016

Thus, we may say that the region is one of the Russian Federation subjects with relatively high birth rate. Birth rate in the region as in city and rural areas above, than in Russia in general. At the same time the birth rate in the village in the region is higher, than in the city: for example, in 2014 the total fertility rate was 2,532 that corresponds to expanded type of reproduction of the population; in the city – 1,737.[Own calculation]. At the same time the general birth coefficient the same year made up 15.2% for the city for the 1,000 persons and only 14.2% for the village that is due to a high share of the older generation representatives in the structure of the rural population and a low share of the young cohorts [Own calculation].

For the last quarter century, fertility rates have developed cyclically. In 2000, in the entire population, the birth rate has almost halved compared to 1990: if in 1990, there were 68.1 births per 1,000 women aged 15-49, in 2000 only 37.6, the most significant decrease was among the rural women (from 93 in 1990 it became 49.6 in 2000) [11]. A favorable gender age structure of the population (the male generation who were born in the late 80-s reached the reproductive age), the state measures taken had a positive impact on the birth rate growth: from 2007 it began to increase and reached its maximum indices in 2014 (67.6 births for 1,000 women at the age of 15-49) [11]. However, it could not reach the indices of 1990: both the absolute and the relative birth indices decreased in all the female groups, both in the city and in the village. Demographers expect a further birth rate decrease among the urban and the rural population caused by a number of facts.

One of the negative demographic trends is the decrease of the reproductive stands of the contemporary youth among the rural and the urban one. Statistic data [11] and the sociological studies' results show that the family today, despite of the place of living, has one or two children. The following table vividly shows the changes in the reproductive behavior of the rural population.

Table 4. The structure of the children born among the mothers of the Republic of Bashkortostan, in %

number of children	urban population						rural population					
	years						Years					
	1960	1980	1990	2000	2013	2015	1960	1980	1990	2000	2013	2015
1	40.5	59.9	51.5	62.3	48.1	42	25.1	42.3	39.7	43	37.9	32.7
2	31.2	33.1	36.8	29.1	39.5	44.1	22.3	29.3	32.6	33.5	36.6	39.2
3	15.4	5.2	9.1	4.8	10.2	11.4	18.7	13.8	17.3	14.6	17.1	18.6
4	6.8	1.1	1.5	0.9	1.5	1.8	20.7	8.2	8.2	4.1	5.3	5.8
5 and more	6.1	0.7	1.1	0.6	0.6	0.7	20.7	8.2	8.2	2.7	3	3.7
not known	0	0	0	2.3	0.1	0	0	0	0	2.1	0.1	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Source: Survey Data [8, P. 59].

CONCLUSIONS

By the results of the studies it is possible to make a conclusion about the traditional imagination of the rural youth, about the impact of the rural society on the behavior and value orientations of young people. The rural society is less individualized, here the people are in a more close link with each other. Any family is in the full view. Since in the rural society the cohabiting marriages, as a rule, are disapproved of, one of the main obstacles on the way to the unregistered union is the fear of the public condemnation. Not only the young people are condemned but their parents too. While for the former the other persons' opinions are not so important, they are very important for the latter.

Besides, the stamp in the passport, to their parents' opinion, is a guaranty of a stable marriage. But the younger generation, realizing the current situation in the country (lack of legislative base, instability of the state as a whole), understands that love, trust, responsibility for a loved one, mutual understanding and mutual respect is more important than an indicative rich wedding. In our opinion, in the near future, the decline in population, coupled with a decrease in the number and proportion of young people, a decrease in the birth rate, along with a gradual transition to the European family model, an increase in the level of women's education and a change in the value orientations of rural youth, will entail serious problems of settlement and the traditional economic direction development the agro-industrial complex of the Republic of Bashkortostan.

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THE SHEEP AND GOAT FARMING SECTOR IN ROMANIA – A NEW DEVELOPMENT PERSPECTIVE

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Abstract

In the period 2003-2017, Romania became an important export source of live sheep and goats, both for the intra-Community trade and for third countries in particular. From food security perspective, for Romania, sheep and goat meat (accounting for 3.5% of total meat consumption in the year 2016) has a particular importance both for dietary diversification and for the complex contribution to putting into value the country's agricultural resources, the sheep species having the exceptional capacity to valorize the land from the areas with natural handicaps (80% of these areas are valorized by the ovine species). Although Romania ranks 6th in EU-28 in terms of total sheep and goat herds, it ranks 10th in terms of meat production (in carcass equivalent), yet on the rise compared to the pre-accession period. Considering that self-sufficiency in sheep and goat meat on the EU-28 market is only 88% and demand is increasingly higher on the markets from Asia, South America and Middle East, Romania must capitalize on these opportunities and develop its sheep and goat sector on the long term.
The growth of middle-income population from Asia, Latin America and Middle East and the increasing demand of ovine meat implicitly represent an export opportunity that Romania has to valorize, also having in view that Romania, as supplier of live animals, is also appreciated for raising animals under extensive grazing system.

Key words**:** *sheep and goat meat production, consumption, trade*

INTRODUCTION

The livestock sector in Romania has experienced a difficult period, due to land fragmentation, decreasing trend of livestock herds, insufficient national financial support, as well as to the fact that only a small number of livestock farmers are eligible for receiving coupled livestock support (supplementary payment from EU funds introduced in the year 2015).

In terms of food security, sheep and goat meat (accounting for 3.5% in the structure of total meat consumption, in the year 2016) is quite important for Romanian consumers, both for dietary diversification and for its complex contribution to the valorization of the country's agricultural resources, the ovine species having an exceptional quality to put into value the land in the areas with natural handicaps (80% of these areas are used by the ovine species).

The growth of medium-income population from Asia, Latin America and Middle East, and implicitly the growing demand of sheep meat, represent an export opportunity that needs to be valorised, also taking into consideration that Romania, as a supplier of live animals, is also appreciated due to the livestock farming system based on extensive grazing.

Considering that self-sufficiency in sheep and goat meat on the EU-28 market is only 88% and demand is increasingly higher on the markets from Asia, South America and Middle East, Romania must capitalize on these opportunities and develop its sheep and goat sector on the long term.

The sheep and goat meat production increased by 4.3% in the first half of the year 2017(+19,500 tons), as against the same period of the previous year, both in EU-15 and in EU-13 [2]. This increase fully results from sheep slaughter (+5%), while goat slaughter decreased by almost 2%. About 50% of this increase can be attributed to the United Kingdom, while the difference to Ireland (14%), Germany (9%) and Romania (6%).

It is estimated that the world total meat production (in carcass equivalent) will

increase up to 357,454 thousand tons by the year 2025. Sheep and goat meat production will also increase significantly, from 14,137 thousand tons (2013-2015 average) to 17,438 thousand tons in 2025, the developing countries contributing significantly to the increase of sheep meat production on the long run. It is estimated that the following countries will largely contribute to this increase: China by about 45% and the Saharan Africa Sub-Region by about 27% [7].

The EU exports, mainly the exports of live animals (about 8% of its total production) mainly go to Middle East and North Africa, while meat and meat products have mainly the Far East as main destination. The EU imports, around 212 thousand tons in the year 2016, mainly came from New Zealand and Australia (94%), accounting for about 23% of the EU's consumption [5].

Although the European Union improved its access to the Asian market, the competition from North America and South America will make it difficult to take full advantage of this opportunity. Australia and New Zealand will continue to be world leaders in the sheep meat market, meeting the medium-income population demand, on the rise, from China and Middle East [7].

The main characteristic of the sheep sector both in Romania and in EU-28 member states is that sheep farmers, mostly elderly farmers, generally obtain low incomes from the farm production activity, due to low productivity, being highly dependent on the support from subsidies [1]. The sheep and goat farming sector provides high quality products to consumers. From this point of view, also taking into consideration that self-sufficiency in this sector on the EU-28 market is only 88%, new development opportunities on the long term are expected for the sector [2]. Sheep and goats have an important role in environment and biodiversity improvement, mainly in the areas with natural constraints and other specific constraints. At the same time, we can add the socio-economic role of this species, in terms of labour employment in the rural areas [2].

In this respect, the financial support provided to the sheep and goat sector, as well as the maintenance and consolidation of coupled support under the future reform of the Common Agricultural Policy (CAP) in order to reduce the abandonment of this production in the European Union, as well as state aids and compensations of 100% in case of attacks by wild animals, represent proposals that are in the attention of the European Parliament Committee on Agriculture and Rural Development [10].

In the European Union, sheep meat has the lowest share in total meat consumption (2.9%), consumption permanently decreasing in the last 15 years from 3.8 kg/capita in 1999, to 2.1 kg/capita in 2015 [2]. Australia and New Zealand are the countries where a slight decrease of ovine meat consumption is expected on the long term, due to the competition from other types of cheaper meat types (poultry and beef). Ovine meat consumption will continue to increase instead in countries like China and in those countries with tradition in the consumption of this meat type, like in the Middle East, under the background of middle class expansion and population growth [2]. As a result, at the European Commission level, a program promoting sheep meat was initiated, in order to reconnect consumers to sheep meat consumption in the European Union, highlighting the positive attributes of sheep meat [4].

As regards the price of sheep meat in carcass equivalent (2015), we must mention that there is a significant gap between the EU price (5,097 euro/ton) and the world price (3,229 euro/ton) due to the protection of the European Union's borders. On the long term (2026), due to the steady increase of demand in Asia (in China in particular) and in the Middle East (mainly in Saudi Arabia), it is estimated that the EU sheep meat price will increase to 5,224 euro/ton [3].

MATERIALS AND METHODS

The analysis referred to the period 2007-2016. The analyzed indicators in this period, presented in evolution, refer to the sheep and goat herds and the production of meat from these animals, the consumption of sheep and

goat meat, self-supply in sheep and goat meat, trade (import/export) with live sheep and goats. The research was conducted both for Romania and for several countries of the European Union (Germany, France, Hungary, Bulgaria, Poland).

Self-sufficiency in sheep and goat meat in the investigated period was calculated using an analysis model (of food balance sheets) used by the National Institute of Statistics, in conformity with the FAO and EUROSTAT methodologies, the main indicator being the utilizable production, on the basis of which the supply availability is obtained (by adding imports and subtracting exports). The ratio of utilizable production to supply availability, in percentage terms, represents the self-supply level (indicator expressing the self-sufficiency rate for the respective product).

The documentation and synthesis of the main ideas necessary to conduct this study was based on the consultation of materials from the national and world literature on the sheep and goat market evolution at European and world level (reports, studies, forecasts, other EUROSTAT and FAOSTAT publications).

As information source, we mention the "Tempo-online database" – time series – National Institute of Statistics, ANSVSA data, "Food Balance Sheets" and "Population's Consumption Availabilities", as well as EUROSTAT and FAOSTAT data for the period 2007-2016.

RESULTS AND DISCUSSIONS

Evolution and development of the sector after accession

Unlike other livestock farming sectors (cattle, pigs), the accession to the European Union in the year 2007 has contributed to the revival of the sheep and mainly goat farming sector in Romania, the goat herds steadily increasing, without being affected by the crisis. In the investigated period 2007-2016, the total goat herds increased by 71%, while the sheep herds by 16% [11].

The support to the sheep and goat sector by EU funds, as well as the Romanian consumers' demand for ewe and goat milk products represented motivational factors for farmers, materialized into a relatively constant milk production in the investigated period (Figure 1).

Fig. 1. Evolution of sheep and goat milk production in the period 2007-2016 – thousand hl
Source: Tempo on line, National Institute of Statistics, [12]

With a meat production (carcass weight) of 9.3 thousand tons in the year 2015, Romania ranks 10th in the 28 member states, although it ranked 4th as regards the total sheep and goat herds, after the United Kingdom, Spain and Greece.

Keeping in top four was due to programs aimed at stimulating the organization of farms or associations for young sheep raising and fattening to provide meat to the domestic and foreign markets, to increase farmers' incomes through the sale of marketable production and to modify the priority operating directions for meat – milk production [8].

At the same time, the sheep breeds for meat production have been improved by using artificial insemination and breeding rams for meat production, improvement of size structure of farms for young sheep fattening and introducing the carcass classification grid, according to EU standards.

Although the share of slaughter in specialized units increased from 3% (1.8 thousand tons) in 2007 to 16% (8.5 thousand tons) in 2016, it is still low compared to other European states. In this context, we mention that sheep farmers signal out a stringent problem that they are facing, namely the lack of animal slaughter centers. The operation of a larger number of such centers, with sanitary-veterinary accreditation, would make it possible for sheep farmers to sell better their meat production, and consumers would have the guarantee that the high food safety standards have been met (Figure 2).

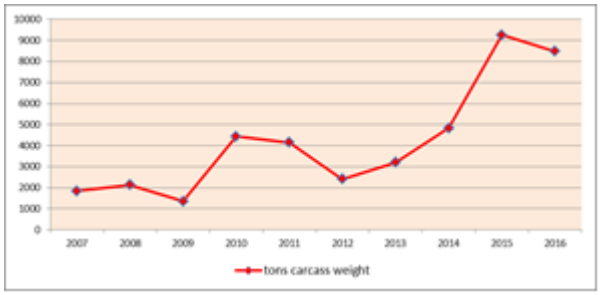

Fig. 2. Evolution of sheep and goat meat production obtained on industrial units, in the period 2007-2016 – tons carcass
Source: Tempo on line, National Institute of Statistics, [12]

As regards the average slaughter (carcass) weight in specialized units (slaughterhouses), Romania ranks among the countries with the lowest average weight (12.8 kg/head), as against Denmark (22.2 kg/head), Germany (20.5 kg/head) or the United Kingdom (20.4 kg/head) [6].

Development opportunities for the sector

As it has been mentioned before, Romania has a numerous sheep population. The highest consumption of sheep and goat meat by the Romanian consumers is during the Easter holidays and in the autumn months, while in the rest of the year consumption is only occasional. In fact, it decreased as share of total meat consumption per capita, from 5.6% in 2000, to 4.0% in 2015 and 3.5% in 2016.

The Romanian consumers' preferences for sheep meat differ across regions; higher consumptions are met in the regions Sud-Est, with Greek and Turkish influences, and Centre, with tradition in sheep grazing.

It should be noted that the meat processors and traders, as well as the Romanian restaurants, prefer meat from imports, due to its higher quality specific to specialized meat breeds, to the detriment of meat obtained from domestic production. This because the sheep breeds from Romania are not specialized in meat production, but rather in the production of lambs and milk.

Compared to other countries from EU-28, consumption in Romania (3.3 kg/capita) is higher than that in Poland (0.05 kg/capita), Hungary (0.1 kg/capita), Germany (0.8 kg/capita), Italy (1.1 kg/capita), close to that of Spain (2.7 kg/capita) and France (3.3 kg/capita), yet lower than that of Greece (12.8 kg/capita) or Iceland (22 kg/capita).

In order to stimulate sheep meat consumption in Romania, and the consumption of Romanian products in general, in the year 2017, the Ministry of Agriculture and Rural Development initiated the scheme "Choose the Sheep" with two axes: scheme popularization throughout the country and developing the infrastructure, i.e. opening specialized stores to meet the consumer demand for sheep meat and products. According to the available information, in the year 2018, six well-known retailers (Metro, Selgros, Auchan, Kaufland, Mega Image, Penny) selling sheep meat in 262 stores every day, sold more than 37 tons sheep meat per month [9]. At the same time, this scheme also intends to stimulate sheep meat consumption in restaurants, and in this respect consumers will be presented specific sheep-meat based menus.

This scheme also aims at capitalizing on sheep meat production, increasing the export value through processed products, attracting labour force in the sheep meat processing sector, while preserving the sheep-based food traditions, mainly in the mountain areas.

The final objective of this campaign is to inform consumers on how to cook sheep meat and meat preparations, as well as to develop a culinary culture based on sheep meat consumption. At the same time, the program intends to provide support to sheep farmers and to establish a wholesale market that will represent an intermediary between the sheep farmers and the marketing channels (retail and proximity shops).

Another opportunity for sheep farmers in Romania is that there is a growing demand for wool for the textile industry and tourism industry both on the world market and on the domestic market. From this point of view, Government's Decision no. 500/2017 was adopted on the scheme *"De minimis aid for the implementation of the program supporting sheep farmers for selling wool"*.

In this direction, a measure was set up for the identification of wool collection centers. Thus, at present, there are 20 centers that collect wool from sheep farmers, with a

total capacity of about 30,000 tons. These are located throughout the country, in the counties: Bacău, Bistrița Năsăud, Brăila, Constanța, Galați, Maramureș, Sibiu, Suceava, Tulcea and Vaslui. The context of adopting this *de minimis* aid scheme to support sheep farmers is that from experts' estimates it resulted that about 70% of the obtained wool was not valorized.

The value of financial support representing this *de minimis* aid is 1 RON/kg of wool. The financial resources necessary to implement this scheme total 36,000 thousand RON and are paid from the state budget, within the limit of budgetary provisions approved for this destination by the Ministry of Agriculture and Rural Development in the year 2018.

The first results of the support scheme for wool commercialization, with regard to the establishment of the wool collection centers have already appeared. Thus, in the first months of the year 2018 (with the beginning of the sheep shearing season), about 8,865 tons of wool were collected, out of which 3,444 tons were exported to Turkey, India, China and Italy [11]

The effects of the scheme also target the wool selling price: while before the scheme was initiated, the wool price was much too far from farmers' requirements, at present, on the basis of competition, a certain price began to be formed, depending on quality, which currently ranges from 2 to 4.5 RON/kg.

The justification of the low sheep meat consumption by the Romanian consumers is based on the consumption habits and the relatively high price, as compared to poultry or pig meat (Figure 3).

Fig. 3. Sheep meat price (carcass under 13 kg) – euro/100kg
Source: Eurostat.

Yet the sheep carcass (under 13 kg) price, of 236.8 euro/100 kg, is one of the lowest in the EU, compared to France (623.1 euro/100 kg) and to the EU-28 average (493.3 euro/100 kg).

In the year 2016, the Romanian farmers received 7.5-8 RON/kg live weight (1.7-1.8 euro/kg) at the export of live sheep, which is a low price if we take into consideration that on the Arab market the live weight price is 4.8-5.2 euro/kg. This is why the Romanian farmers are discontented, as they consider that for them 2.5-3 euro/kg live weight would be a satisfactory price to cover their costs and to obtain profit.

The analysis of self-supply level (indicator expressing the self-sufficiency rate) in the period 2006-2016 reveals 100% and over self-sufficiency from domestic production (107% in 2014, 115% in 2015). The significant growth of imports starting with 2012 (2.3 times compared to previous year) and the exports that dropped more than half resulted in a higher self-sufficiency level in the year 2015 (Figure 4).

Fig. 4. Evolution of self-sufficiency level in sheep and goat meat, 2006-2016 - %
Source: Bilanțuri alimentare 2007-2016, National Institute of Statistics, [12]

The trade balance in live sheep was positive in the period 2003-2016, due to permanent export growth. Since 2009, Romania has no longer imported sheep and goats from the extra-Community area. The imports from intra-Community countries have significantly increased instead, mainly after 2013, 72% of imports originating from Spain and 19% from Hungary, in the year 2016.

The sheep export almost fully depends on the export orders from North Africa and Middle East and has as main destinations the following extra-Community countries: Jordan

(58%) and Libya (26%). In the year 2016, according to the data from the National Institute of Statistics, Jordan was the main export destination, with a value of 73.4 million euro, representing 58% of the total value of extra-Community sheep export. In the intra-Community area, the export destinations include Greece, Italy and Bulgaria.

CONCLUSIONS

With a meat production of 9.3 thousand tons, Romania ranks 10th in EU-28; however, it ranks 4th in terms of total sheep and goat herds, after the United Kingdom, Spain and Greece. Its position in top four was due to the programs that targeted the organization of farms or associations for young sheep raising and fattening in order to provide meat on the domestic and foreign markets.

The financial support to the sheep and goat sector from EU funds and the increased consumer demand for goat milk and dairy products represented motivational factors for farmers, materialized into a constant sheep and goat milk production in all the regions from Romania. In the period 2007-2016, farmers preferred to slaughter their animals in specialized units, and so the slaughter production increased from 3.7 thousand tons live weight in the year 2007 to 18.6 thousand tons in 2016.

Although the share of slaughter on specialized units increased from 3% in 2007 to 19% in 2015, it is still low compared to other EU member states; as regards the average slaughter weight, Romania is among the countries with the lowest average slaughter weight (12.8 kg/head).

The average farm size is low (29 heads/sheep farm and 11 heads/goat farm) and makes it difficult to adapt to the new performant technologies, due to the scarcity of own financial means and low access to other funding sources.

Ovine meat consumption is mainly occasional, with maximum values in the Easter period, and Romanian consumers' preferences for sheep and goat meat varies across regions, high consumptions being found in the Sud-Est region, with Greek and Turkish influences and the region Centre, with sheep grazing tradition. Self-sufficiency was over 100%, in the period 2000-2016.

Sheep export is almost fully dependent on the orders from North Africa and Middle East, Romania permanently ranking 1st in EU-28 in the export of live sheep.

The support to the sheep and goat sector under the future Common Agricultural Policy is necessary, as besides the food source there is also the secondary product – wool; at the same time, sheep and goats contribute to the cultural wealth of European landscape. The support to the sector contributes to maintaining an important number of jobs, in the great agricultural areas from the EU, vulnerable from this point of view. In the absence of support measures, many sheep farmers will have to abandon this activity, with serious consequences on jobs, social dynamics in the countryside, environment and cultural heritage.

Romania initiated and implemented two important schemes to support sheep farmers. These refer to *"De minimis aid for the implementation of the program supporting sheep farmers for selling wool"* and *"Choose the sheep"* – scheme for promoting sheep meat and meat preparations consumption. The effects of these schemes, both initiated in 2017, began to be seen in the first months of 2018, in the collection of important quantities of wool in the wool collection centers and the slight increase of meat consumption.

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INVESTMENT AS A WAY FOR THE IMPROVEMENT OF AGRICULTURE OF THE REPUBLIC OF SERBIA

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Abstract

The aim of the paper is to point out the significance of agriculture in Serbia along with the specificities that accompany it. The purpose of the paper is to show that the selection of an adequate source of funding can contribute to the improvement of agrarian production which would not only mean production for its own needs, but also export to the world market. The methodology of writing the paper is based on the use of adequate professional literature that describes and monitors the specificities of agricultural production together with the specifics of financing. The following indicators of investments were used: a) the participation of total realized investments in fixed assets in agriculture, forestry and fishing (AFF) in total; b) the participation of the total payed investments in the fixed assets in the activities of the AFF in the total; c) structure of payments for investments by sources of financing; d) investments made in the rural areas by rural inhabitants. The mentioned indicators are presented for the period 2013-2016.

Key words**:** *agriculture, investments, sources of financing*

INTRODUCTION

Investments are important for the economic development of each country as they influence the creation of economic policy. However, for the economic development of the Republic of Serbia, the most important place are investments in agriculture.

The problem of financing Serbian agriculture is rooted in the 20th century. More precisely, the issue of financing agriculture has not been resolved to this day, and the financial markets for agricultural products have not sufficiently ensured a uniform product allocation. In order to create a more efficient system of financing agriculture in the coming period it is necessary to educate staff. This implies that more financial managers need to be employed to follow the trends and jobs that are being implemented on the financial market in order to further improve the rural and agrarian production. Financial managers would assist farmers in choosing a short-term or long-term model of financing their own production and services. In this way farmers would realize that dealing with agricultural production requires their own effort and financial resources. Therefore, a more active attitude of the agrarian sector in the financing process is necessary in order for farmers to understand that no one is in charge of providing them with funds, but that they have to do this on their own. This attitude leads them to the conclusion that they have to produce commercially profitable goods or contracted by established balance sheets and quotas for domestic needs and exports.

The aforementioned facts reduce the importance and essence of agricultural production for our country. Whether agriculture is viewed in a narrows and spreads meaning, it requires technical, technological and innovation changes to develop faster with the provision of sufficient amount of food. However, the application of modern mechanization in production processes can make this activity more attractive for business.

In order to facilitate the identification of the essence of financing agriculture, this activity needs to be seen in a narrows and spreads meaning. Numerous authors dealt with the definition of agriculture, its divisions and interpretations, but their adequacy depends on the angle of observation. Agrarian expert [2] has divided agriculture on: *a) agro-technical and economic; b) Extensive and intensive. Agro-techical agriculture* implies the application of

agro-technology (farming, cattle breeding, vegetable growing, fruit growing, viticulture, etc.) and *economic agriculture* takes into account the purpose of agricultural products (cereals, vegetables, fodder, industrial and fodder plants). *Extensive agriculture* involves small roles of labor and capital that yield small yields from the arable land unit, and *intensive agriculture* implies large roles of labor and capital with large yields from the arable unit.

The author [6] cited the division of agriculture in the wider and broader sense. *Agriculture in a narrow meaning* implies dealing with agriculture for its own needs, and *agriculture in a spread meaning* implies linking economic areas and branches at the horizontal and vertical levels. The common name of such agricultural production is an *agro-industrial complex or agribusiness.*

Some agrarian experts believe that the currently bad state of the agricultural sector is due to the inadequate lending and capital policy that has been implemented over the past 30 years. Authors [1] state that agricultural loans were granted in the form of grants or under privileged terms, and the interest rate had the role of maintaining the productivity of capital in terms of demand and consumption. Since the interest rate was lower than the productivity of capital, it stimulated the demand for loans above the real level. Although such low interest rates have reduced the costs to agricultural enterprises and individuals, they have led to an increase in costs at the level of the economy, as agricultural production has become ineffective.

The essence of today's system of financing agriculture is in support of agricultural producers and the strengthening of the manufacturing sector. This is due to the fact that products at a higher level of processing are known to achieve higher market value. Consequently, even when exporting, a higher price would significantly contribute to the reduction of the foreign trade deficit. Therefore, regardless of the source of funding, it is necessary to start from the goal that is achieved, which is the development of the agrarian sector and the implementation of technical and technological innovations.

In order to create a complete picture of agriculture as a business, it is necessary to mention its specifics. Primary agrarian production is characterized by numerous biological, organic, technical-technological, social and economic specifics, and numerous problems have been addressed and emphasized by many authors. The answer is contained in the fact that agrarian production is subordinate to natural factors (climate, soil, water, etc.). In today's conditions of production, and thanks to genetics, biological phases in the development and development of plant culture can only accelerate but not skip. Thanks to more modern machinery, production processes can be made easier by making this activity to some extent more attractive for dealing and business.

All these specificities have their own causes, but from the economic point of view, the available and initial investments that are necessary for the start-up and/or expansion of the production cycle take the key place. The farmer wants to have certainty that the favorable business conditions will be maintained even in the future when the growth/yield is due as a result of his investments [2].

The data of the Census of Agricultural conducted in Serbia in 2012 show that the plots are fragmented, the farms are aging, that they have 1-2 members of the elderly, with the predominant presence of family agricultural holdings (legal persons and enterprises have about 0.5%) [10]. According to the legal form, there are 34% of companies with limited liability, 16% of entrepreneurs and 13% of agricultural cooperatives [8].

After the specificity of agricultural production, it is also necessary to mention the specificity of financing of agricultural production [6]:

-The high risk of agricultural production can be covered by production insurance;

-The slow turnover of capital requires higher financial resources, while commercial banks borrow their funds from activities where the turnover of capital is faster;

-Mismatch between production time and collection time influences the creation of a loan repayment plan that is adapted to the seasonal character of agricultural production, which will reduce the need for additional borrowing by farmers;

-Specialized production could not be developed (production of only one product) due to the necessary of the crop, which requires additional financial resources;
-The degree of utilization of agricultural machinery could not be measured because mechanization can be used only in optimal deadlines.
In the period of financing of agriculture from the primary issue of the Central Bank (National Bank of Yugoslavia), Serbian agriculture declined because the funds were short-term and used to finance current production costs. More detailed analysis of the placement of primary emission funds for individual purposes points to its insignificant position. An illustrative example of directing the means of primary emissions into the agrarian sector in Vojvodina shows that a liquidity loan for one purpose is greater than the total amount of primary emissions for agriculture. This sector has reached the bottom of all interventions carried out by the Central Bank. This conclusion points to the conclusion of the determination of the real price of the capital employed in the agrarian sector [1].
In the period 2013-2016 the highest share of realized (4%) and paid investments (3.7%) in fixed assets in the AFF in total in Serbia was recorded in 2013.
Analyzing the structure of total paid out investments in fixed assets by sources of financing in the period 2013-2016. year. The largest share is taken by own resources (from 67.3% in 2015 to 77.2% in 2013), then financial assets (from 12.5% in 2014 to 20.7% in 2015), while the rest is made up of pooled resources and resources from other funds.
Analysis of the paid-investments in the AFF per rural inhabitant of Serbia leads to the conclusion that these values are very low. From 2013 to 2015 the value is constantly decreasing, from 58.2 EUR to 43.1 EUR, in 2016 increased by 50.3 Euros per rural inhabitant, which is below the value of 2013.
Generally, Serbia has a lot of potential in the agricultural production segment, but there is no safety in investments. More precisely, in order to realize investments, there must be a stable system that would provide agricultural producers with a return on invested funds and then earnings.
These facts point to the conclusion that agricultural production is very specific, but by providing stable and continuous financing, more farmers will want to deal seriously with not only production, but also processing.

MATERIALS AND METHODS

In order to determine the significance of investments for agriculture in Serbia, the following indicators were used: share of realized and paid investments in fixed assets in the activities of the AFF; structure of payed investments in fixed assets by sources of financing; the value of paid investments in the AFF per rural inhabitant.
The analyzed indicators were presented for the period 2013-2016 by searching books, journals, statistical bases of the Statistical Office of the Republic of Serbia (SORS) and other professional publications. After the collected statistical data, the author's calculations were applied and graphically presented.

RESULTS AND DISCUSSIONS

Serbia should turn to current sources of financing for the agrarian sector if it intends to improve and modernize it to improve the living conditions in the countryside. Primarily, internal and external factors must be analyzed which enable and / or make it difficult to implement the financing of agricultural policy measures. Differences and difficulties can exist in different areas of Serbia, but applying the appropriate method and the principle of difference can be minimized. Also, Serbia is a diverse country and not all areas are suitable for dealing with all types of agricultural production (farming, vegetables, fruit growing, viticulture, cattle breeding, etc.). It is free to say that Serbia lacks investment in the agricultural sector, which will be more in continuous of paper.
Previous experiences in the field of agriculture financing have shown that it is necessary to include scientific and technical progress. Business advancement (production and processing of agricultural and food

products) determines the purpose and possible forms of future investments. In the early eighties of the 20th century in the Yugoslavia, was improved the so-called *project approach to investments*. This approach implies the existence of an appropriately prescribed methodology for the preparation and implementation of financing projects. In this process, all phases are interconnected and rely on one another. The project financing phases are as follows [1]: *identification, preparation, evaluation, realization, monitoring and evaluation of the project during exploitation.* This form of financing proved to be more acceptable because the state is able to attract funds from international funds, and may also be joined by local government units.

Distinguished economists [3] emphasize that investing is a very complex process with a large number of activities and participants. Such an investment does not necessarily mean purchasing and/or investing in new goods and services, but it can also be an investment in existing infrastructure, equipment, etc.

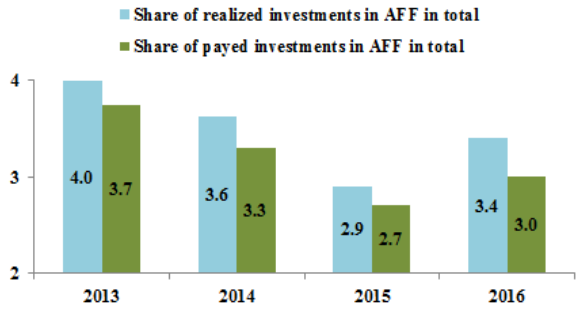

Fig. 1. The share of total realized and payments for investments in fixed assets in AFF in total in Serbia (2013-2016, in %)
Source: SORS, STAT database.

Fig.1. shows the participation of total realized and payed investments in fixed assets in AFF in Serbia during the period 2013-2016. *Realized investments in fixed assets* in the reporting year present the value of effectively finalised constructions, production or acquisition of facilities, equipment and other fixed assets, disregarding whether these investments were accomplished and whether they were paid out (excluding revaluation). *Payments for investments* are the monetary investment in fixed assets during the year in which the payments were actually made, irrespective of the time of their construction or acquisition [7].

The graphic illustration above shows that the participation of *total realized investments in fixed assets* in the AFF are ranged from 2.9% in 2015 to 4.0% in 2013, annually about 3.5%. As a possible reason for such a decrease, the fact that the economic activity of the rural population and legal entities is diminishing is decreasing, as the demolition of the village and the overcrowding of the cities is growing. Therefore, it is necessary to motivate agricultural producers to deal more intensively with this branch, which can certainly bring profit if it is approached in an adequate way.

The average annual share of *payed investments in fixed assets* in AFF in the total has an approximate value as well as the previous indicator and amounts to 3.2%. This indicator also shows a decline in the share of payed investments funds for agricultural activity, as well as the previous ones, moving in the range of 3.7% in 2013 to 2.7% in 2015. Thus, a reduction of 1.0 p.p. only indicates a decline in investments in this business. One of the solutions to stop this trend and a slight increase will also be the fact that more and more young people need to be involved in agricultural production and encourage investments. This fact is a special contribution made by the Rulebook on incentives for programs for income diversification and improvement of quality of life in rural areas through support to young farmers [5]. Article 6 of this Rulebook emphasizes that it is necessary that persons aged 18-40 years old and have settled debts to the line Ministry.

By showing the paid value of investment funds in the agrarian sector, can see how much is interested in this type of investments. However, the structure of payments for investments in fixed assets for all activities by sources of financing (Fig. 2) will be presented below in the period 2013-2016.

Based on a graphical overview, the following conclusions can be made:

-the financing of investments from own resources in 2016 will have a share of 75.3% and

1.9 p.p. are smaller compared to 2013 when they made 77.2%;
-funding from pooled resources registered a slight increase of 0.2 p.p., from 0.4% in 2013 to 0.6% in 2016;
-financing from financial assets in 2016 registered a decline of 1.2 p.p. in comparison with 2013, ie. participation was reduced from 15% to 13.8%;
-resources from other funds registered a slight increase, which increased by 2.9 p.p. during the reporting period (from 7.4% to 10.3%).

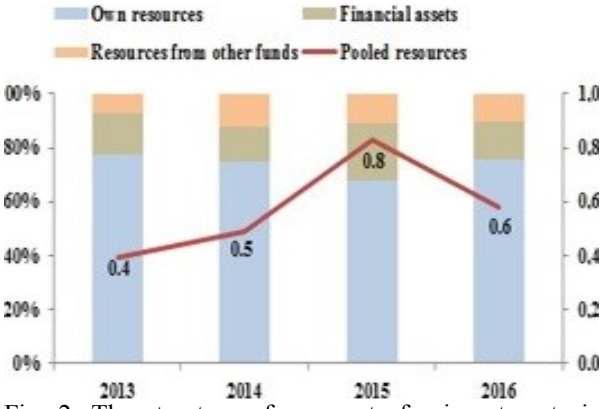

Fig. 2. The structure of payments for investments in fixed assets by financing sources (2013-2016, in %)
Source: SORS, STAT database.

Such indicators can only point to the conclusion that the decline in own funds as a source of funding, as opposed to an increase in the share of funding from pooled assets, leads to an increase in confidence in the banking and financial sectors. In favor of this fact, interest rates on borrowed capital are also being gradually reduced, making agricultural loans more accessible to more farmers.

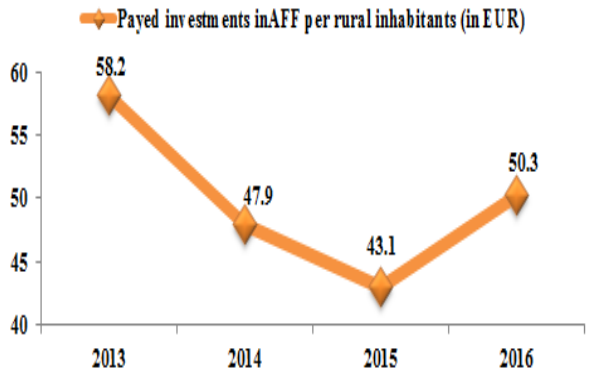

Fig. 3. Payments for investments in AFF per rual inhabitans
Source: SORS, STAT database.

After all, the value of investments in AFF by the rural inhabitant will be shown (Fig. 3). This indicator will only confirm the level of seriously of the rural population by which they approach the performance of this activity.
The graphic representation shows that there is a tendency of declining investment value in the AFF according to the rural inhabitant as a result of the reduction, on the one hand, of investments, and on the other, the number of rural inhabitant. Consequently, in a given presentation of the paid investments per rural inhabitant in 2015, they are by 15.1 EUR less than in 2013, or by 26%. However, in 2016, there is a slight increase in the value of investments by rural inhabitant by EUR 7.2 compared to 2015.
Generally, with the increase in the number of rural population, investments will increase. But in order to keep the population back or to return to the village, it is necessary to provide adequate agricultural standards to adequate living standards for farmers. Otherwise, the discharging the village it's gonna with increasing dynamics.

CONCLUSIONS

The current system of financing (primarily from the primary issue of the Central Bank) has led to a significant decline in the business functions and profitable capacity of companies in this area, which is accompanied by major problems in liquidity and the increase in the level of indebtedness.
Based on the above, it is not difficult to draw the conclusion that, if the growth of agricultural production is to accelerate, more stable conditions of business, market and export of agro-food products, special credit arrangements for agro-food products are needed. Since the financial system for the development of agriculture is underdeveloped, it is necessary to approach the elimination of all those obstacles that slow down the growth and development of the agrarian sector.
Also, the improvement of financial institutions and their successful functioning in the field of agriculture financing will yield significant results in the long run. Although agriculture is less profitable economically, including all the specificities that accompany it, and that the area on which further economic development of the

country is based, it is necessary to establish a financing system as it is represented in developed countries in Europe and the world.
It can be said that the potential chance for the development of Serbian agriculture is in fact the production of health-safe food and inclusion in international financial institutions

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CASH FLOWS FROM OPERATING ACTIVITIES AND EFFECTIVENESS OF DAIRY CATTLE FARMS IN BULGARIA

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Abstract

The aim of the research was to estimate cash flows from operating activities of dairy cattle farms in Bulgaria and to compare their effectiveness. In order to achieve the aim, in 2016, information was collected by questionnaires from 2 dairy farms located in Northern Bulgaria. The first farm had 16 cows in the main herd, and the second farm had 120 cows respectively. A number of indicators had been studied: farm size (number of animals, arable land and pasture in decares), animal feed, milk production, number of calves born and fattened, cleaning technologies used in the farms, animal health, cash flows by categories. An estimate of the cash flows from operating activities of the dairy cattle farms had been developed. The estimate was based on the collected information and on the basis of own calculations. The farm with 120 cows in the main herd achieved higher effectiveness than the farm with the smaller herd, although the farm with 16 cows managed 50 decares more arable land, achieved higher average milk yield (7,000 l vs. 6,000 l) and received subsidies. Workforce involved with cattle operations in the first farm was used less effectively compared with that in the second farm: a cattleman tended for an average of 8 cows in the main herd in the first farm and for 30 cows in the second farm.

***Key words*:** *Bulgaria, dairy cattle sector, effectiveness, cash flows*

INTRODUCTION

Dairy cattle husbandry is an irreplaceable branch in Bulgarian economy, providing 88.7% of obtained milk in 2016 [6]. The number of dairy cattle farms fell down by 13.1% at 01.11.2016 compared to 01.11.2015, particularly those having up to 9 animals in main herds, which decreased with 14.39% [5], [6]. A tendency of growth in farms' number, that had 50 or more dairy animals was observed (with 8.13% more in 2016 than in 2015). The ratio of dairy cows kept on farms having up to 9 animals also showed reduction with 12.66%, while the share of cows kept on farms with 50 or more animals had raised by 9.83% [5], [6]. Some authors [2] explained the restructuring and trend of declining cattle's number in Bulgarian farming with incremented quality control and reglaments in the livestock sector.

According to some authors [1], European dairy production is influenced by regional conditions. Milk yield per cow for EU was 6,932 kg in 2016, while that value was with 47% smaller for Bulgaria (3,653 kg) [3].

The aim of the research was to estimate cash flows from operating activities of dairy cattle farms in Bulgaria and to compare their effectiveness.

MATERIALS AND METHODS

In order to achieve the aim, in 2016, information was collected by questionnaires from 2 dairy farms located in Northern Bulgaria. The first farm had 16 cows in the main herd, and the second farm had 120 cows respectively. A number of indicators had been studied: farm size (number of animals, arable land and pasture in decares), animal feed, milk production, number of calves born and fattened, cleaning technologies used in the farms, animal health, cash flows by categories. An estimate of the cash flows from operating activities of the dairy cattle farms had been developed. The estimate was based on the collected information and on the basis of own calculations. Value Added Tax was not included in cash flows. Farms were selected because of similarities in the environmental conditions in which they

operated and because of the similar size of their arable land (the first farm managed 450 decares arable land and the second - 400 decares). The size of the pastures they managed was compliant with the needs of animals for grazing.

In the first farm, there were 16 dairy cows in the main herd, of which animals in second and third lactation were prevailing. The arable land was 450 decares and pastures - 160 decares. Cows were used 5 lactations on average; the farmer retained heifers as replacement, including them in the herd at the age of 23-24 months; calves were fattened on average of 14 months; artificial insemination of cows was practiced, natural insemination was practiced by exception; average milk yield was 7,000 l; service period was 70 days on average and the dry period was 60 days; the animals were in good health - clinical mastitis and fertility problems were observed in no more than 1 cow per year; in the summer animals grazed on the pastures, situated in more than 1 km away from the farm; cows were milked with vacuum pump; barns were cleaned manually; tie-stall housing system was used; cow beds were kept clean and comfortable with plenty of straw; the farm employed 4 workers: 2 were engaged in crop and forage production and 2 in cattle farming activities (cattleman staff). Alfalfa, wheat, barley and corn were grown on the arable land. The farm produced the predominant part of the animal feed (barley - 25 tons, corn - 20 tons and 12 tons of hay), and sold part of its crop production (wheat - 32 tons and corn - 26 tons). The farm also received subsidies. The owner of the farm had veterinary education and carried out the veterinary activities in the farm by himself.

In the second farm, 120 cows were kept. The arable land was 400 decares, pastures - 800 decares. The land was used entirely for the production of forages to feed the animals and there were no sale of excess forage. Cows were used 5 lactations on average and about 16% of cows were culled annually; the farmer retained heifers as replacement and included them in the main herd at the age of 23-26 months; artificial insemination of cows was practiced; average milk yield was 6,000 liters; calves were fattened on average of 12 months; service period was 90 days on average and the dry period was 55 days; mortality of calves up to 6 months of age was about 2% per year, and over 6 months of age - about 1%, clinical mastitis were observed in 0.5% of cows, subclinical mastitis - 1%, hoof problems - 2%, endometritis - 2%, fertility problems - 2%; during the summer period the animals grazed on pastures, situated up to 1 km away from the farm; cows were milked with a milk pipeline; tie-stall housing system was used; cow beds were covered with a thin layer of straw; mobile cleaning system was used; the farm employed 8 workers: 4 were engaged in crop and forage production and 4 in cattle farming activities. Cash inflows of the farm were from the sale of cattle production. According to the gathered information from the questionnairy, the farmer didn't receive subsidies. The farm produced the biggest part of the needed forages for the animals: lucerne hay, corn grain and about 40 tons of hay from the pastures.

RESULTS AND DISCUSSIONS

The two dairy farms' studied indicators (cash flows and effectiveness) were presented in Table 1.

Both farms bought a part of feeds needed for foraging the animals and produced the rest of it. According to some authors [4], forage cost has statistically significant effect on efficiency in dairy farms.

While in both farms the biggest share of inflows took those from milk sales, the first farm also realized incomings from calve and forage sales and from subsidies; the second – from calve, heifer and cow sales.

Cash flow structures of both farms were represented in Figures 1, 2, 3 and 4.

Figure 1 showed that 62.93% of the inflows of the first farm came from cattle production sales (cow milk – 50.53% and calves – 12.40%), wheat and corn sales occupied 19.03% and subsidies took 18.04%.

Table 1. Cash flows and effectiveness indicators

№	Indicators:	First farm (16 cows in the main herd)	Second farm (120 cows in the main herd)
1	**Cash inflows (BGN) (2+5+9+13+18)**	**88,680.00**	**351,375.00**
2	**From the sale of cow milk (BGN) (3*4)**	**44,800.00**	**288,000.00**
3	milk (l)	112,000,00	720,000.00
4	sale price per 1 l cow milk (BGN)	0.40	0.40
5	**From the sale of calves (BGN) (6*7*8)**	**11,000.00**	**52,650.00**
6	number of calves sold	10.00	45.00
7	live weight of calves sold - kg	440.00	450.00
8	sale price per 1 kg live weight of calves (BGN)	2.50	2.60
9	**From the sale of cows and heifers (BGN) (10*11*12)**	**0.00**	**10,725.00**
10	number of cows and heifers sold	0.00	13.00
11	live weight of cows and heifers sold - kg		550.00
12	sale price of 1 kg live weight of cows and heifers (BGN)		1.50
13	**From the sale of crop and forage production (BGN) (14*15*1000+16*17*1000)**	**16,880.00**	**0.00**
14	wheat (tons)	32.00	
15	sale price per 1 kg of wheat (BGN)	0.30	
16	corn (tons)	26.00	
17	sale price per 1 kg of corn (BGN)	0.28	
18	**From subsidies (BGN)**	**16,000.00**	**0.00**
19	**Cash outflows (20+21+22+23+29+30+31+32+33+34+35+36)**	**86,390.00**	**305,100.00**
20	**Medicaments (BGN)**	**500.00**	**800.00**
21	**Purchased forages (BGN)**	**4,000.00**	**40,000.00**
22	**Labour costs - salaries and social securities (BGN)**	**33,000.00**	**65,000.00**
23	**Services (BGN), including: (24+25+26+27+28):**	**3,200.00**	**11,500.00**
24	- insemination	600.00	1,500.00
25	- accounting	2,400.00	3,600.00
26	- veterinary		3,600.00
27	- for selection	200.00	2,300.00
28	- consulting		500.00
29	**Electricity (BGN)**	**300.00**	**4,000.00**
30	**Water (BGN)**	**360.00**	**18,000.00**
31	**Disinfectants (BGN)**	**100.00**	**800.00**
32	**Rent /arable land/ (BGN)**	**20,000.00**	**40,000.00**
33	**Rent /pastures/ (BGN)**	**930.00**	**2,000.00**
34	**Spare parts for agricultural machinery (BGN)**	**1,000.00**	**4,000.00**
35	**Fertilizers, seeds, plant protection products and fuels (BGN)**	**21,000.00**	**42,000.00**
36	**Other payments (BGN)**	**2,000.00**	**77,000.00**
37	**Net cash flow (BGN) (1-19)**	**2,290.00**	**46,275.00**
38	**Effectiveness indicators**		
39	**Rate of return on cash inflows (%) ((37/1)*100)**	**2.58**	**13.17**
40	**Rate of return on cash outflows (%) ((37/19)*100)**	**2.65**	**15.17**
41	**Number of cows per 1 cattleman**	**8**	**30**

Source: data, collected from dairy farms and own calculations.

In the second farm (Figure 2) selling of cow milk took 81.97%, which was similar to the established 88.28% of some authors [7]; calve sales occupied 14.98% and those from heifers and cows – 3.05%.

Figure 3 showed that labour costs (salaries and social securities) occupied the largest share of the sum of outflows of the first farm (38.20%), followed by the purchase of fertilizers, seeds, plant protection products and fuels (24.31%) and for rent of arable land (23.15%). The lowest were the shares of disinfectants, electricity, water, medicaments,

rent of pastures and spare parts for agricultural machinery.

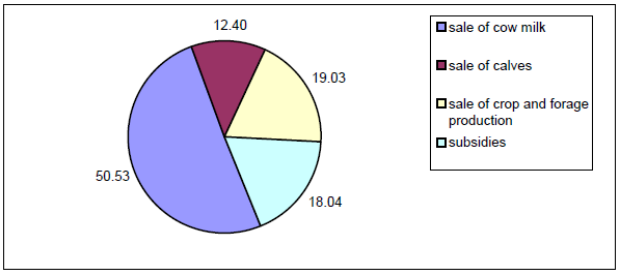

Fig. 1. Cash inflows of a farm with 16 cows in the main herd (%)
Source: data, collected from a dairy farm and own calculations

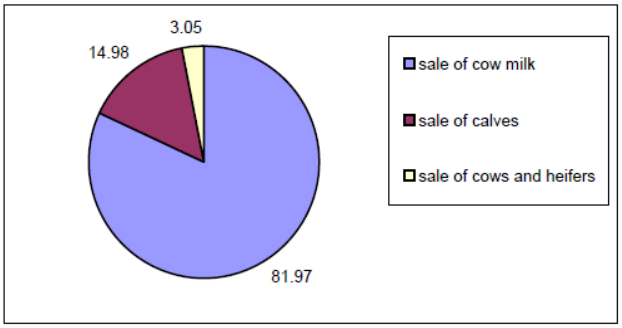

Fig. 2. Cash inflows of a farm with 120 cows in the main herd (%)
Source: data, collected from a dairy farm and own calculations

According to Figure 4 other payments occupied the largest relative share (25.24%) of the outflows' sum in the farm with 120 cows in the main herd, followed by labour associated payments (21.30%).

The purchase of fertilizers, plant protection products, seeds and fuels occupied 13.77%, followed by the purchase of forages (13.11%) and rent of arable land (13.11%). The shares of disinfectants, medicaments, pasture rent, electricity and spare parts for agricultural machinery were the lowest.

The first farm had realized net cash flow of 2,290 BGN, which was small, but positive and if subsidies were not taken into the account, the farm's activity would have been unprofitable.

The second studied farm had realized 46,275 BGN net result, although it received no subsidy and managed less arable land than the first farm.

According to calculations the farm with 16 cows in the main herd realized 2.58% return on cash inflows and 2.65% return on cash outflows. These values for the second farm were 13.17% and 15.17% respectively. The second farm more efficiently used labour engaged in cattle operations, which could be seen from the indicator "Number of cows per 1 cattleman": one cattleman tended for 8 cows in the main herd in the first farm and for 30 cows in the second farm.

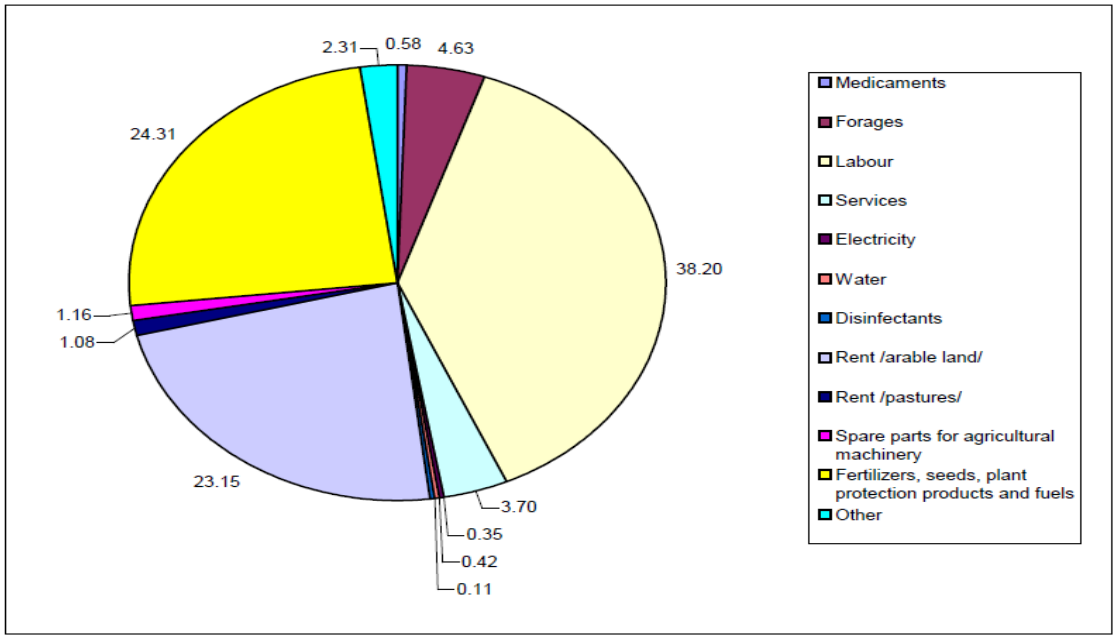

Fig. 3. Cash outflows of a farm with 16 cows in the main herd (%)
Source: data, collected from a dairy farm and own calculations

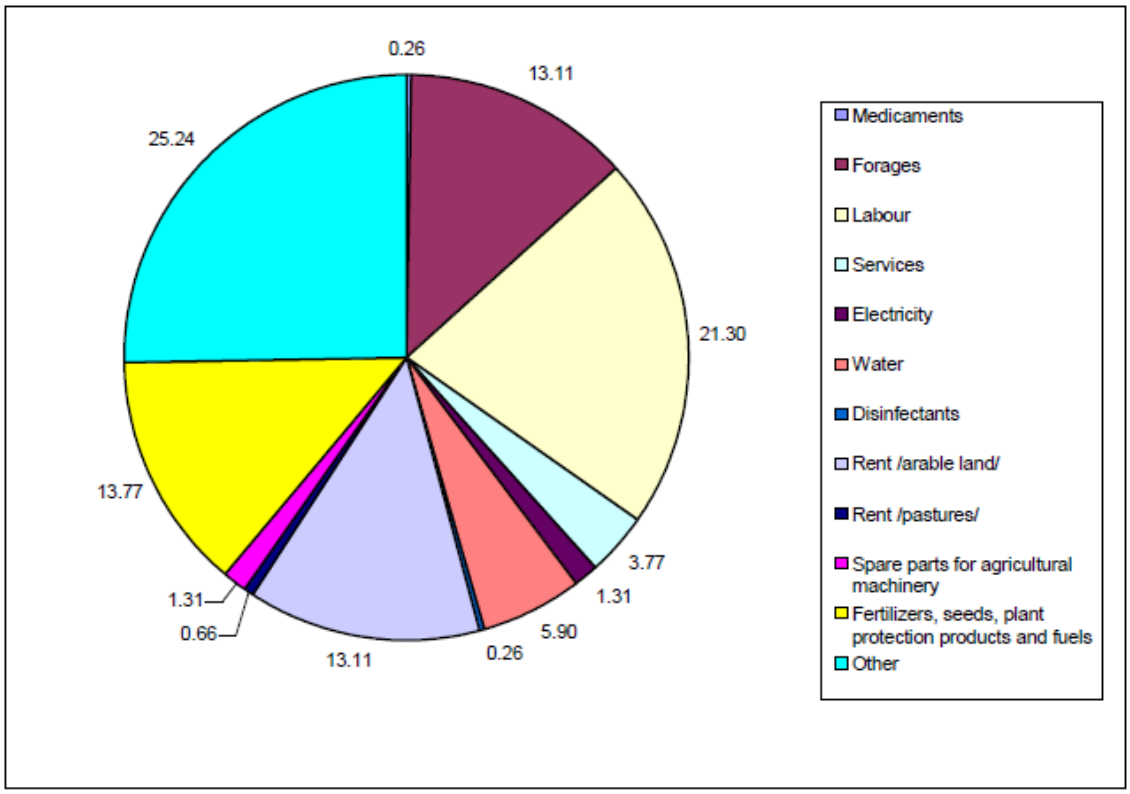

Fig. 4. Cash outflows of a farm with 120 cows in the main herd (%)
Source: data, collected from a dairy farm and own calculations

CONCLUSIONS

The farm with 120 cows in the main herd achieved higher effectiveness than the farm with the smaller herd, although the farm with 16 cows managed 50 decares more arable land, achieved higher average milk yield (7,000 l vs. 6,000 l) and received subsidies.
Workforce involved with cattle operations in the first farm was used less effectively compared with that in the second farm: a cattleman tended for an average of 8 cows in the main herd in the first farm and for 30 cows in the second farm.

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THE IMPORTANCE OF LOCAL DEVELOPMENT THROUGH THE EXPANSION OF AGROTOURISM IN PRAHOVA COUNTY

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Abstract

An article entitled "The importance of local development through the expansion of agrotourism in Prahova" it refers to the existing agro-tourism potential. The paper presents a synthesis of the technical material related to the specific infrastructure of the area and an analysis of the tourist traffic. Conclusions reveal the need to develop local government to raise the community's living standards with the help of quality services by promoting traditional values.

Key words**:** *traditions, potential, agritourism, local development, Prahova County*

INTRODUCTION

The advent of the tourist trips is recorded in antiquity, and tourist activities in rural areas found their beginning in the same period. In Romania, "country life was a theme often addressed in the literature of the end of the 19th century, having the forefront of the village as a symbol of famous works. Remarkable authors of the Roman literature, considered promoters of the development of rural tourism, have praised these areas. The special place occupied by the agro-touristic farm for leisure is derived from the natural quality offered by the geographic space offered to the tourists alongside the traditional meals offered in the peasant farms where the tourists can participate alongside the hosts in making cans, preparing dairy products or to take part in holidays or various holy fests, fishing or hunting events.

Foreign tourists who love agritourism are interested to know the history and traditions of Romania, for visiting scenic areas, admiring the architecture of peasant houses and folk crafts, traditional knowledge and tasting the gastronomic specialties.

From a financial standpoint, these people fall into the category of those with medium and small materials, whereas this type of tourism calls for less money compared with accommodation in hotel system but there are upper-income vacationers who prefer agritourism out of curiosity or for rest.

MATERIALS AND METHODS

The scientific approach achieved by this paper is based on the knowledge of the factors that can lead to support efficiency strategies and development of agro-tourism in the County of Prahova. For this they were addressed issues related to economic development, infrastructure development, social issues and cultural and touristic potential existing in the area studied.

Agritourism as a form of rural tourism has emerged as an alternative to the classic tourism being defined as "*a narrower concept and considered that it uses for accommodations and dining only tourism and agro-farming landlords, is a picturesque and unpolluted environment, natural attractions and cultural-historical values, traditions and customs are present in rural areas*". [9].

The literature identifies many different concepts that characterize the agritourism. Some of these are given in the paper "the Romanian village: tradition, contemporaneousness and hopes for the future" and follow: securing the base material as "*an activity that was able to capitalize on*

the existing surplus of peasant farm accommodation, prepared and arranged specifically for the reception of guests" [3].
Activities that revolve around the peasant household as "*a set of goods and services provided by the household consumption toward the country of persons who, for a certain fixed period, coming into rural areas for relaxation, rest, recreation, therapeutic cures, or business transactions, as well as many other activities*" [3].
Entertainment, through which the agritourism is considered "*a form of tourism with great variety and uniqueness in accomplishing what gives people who love nature, art and culture of the country*" [3].
The development of tourism at European level, is growing good of allowing tourist resources in rural areas. Agritourism is considered "*a promising option for the future whereas it can achieve economic growth of communities with predominantly agricultural and forest, with the dire consequences of attracting and maintaining favourable over the population in rural areas, to encourage agricultural activity in disadvantaged regions of auteurs of natural resources and social and cultural development*" [6].
Its evolution is represented by numerous international associations find examples in this case: World Association for professional training in tourism (AMFORT), Association for rural tourism development (ATRAC) to encourage rural and cultural tourism programme EXPERT (rural tourism development in the participating countries: Belgium, Germany, Hungary, Luxembourg, United Kingdom, Cyprus, the Czech Republic, Slovakia, Poland, France, Russia and Sweden.
The basic principles being innovation, transferability, sustainability, profitability and Environmental Management Institute), and "EDEN", "EUROTER" (has as main objective the promotion of agro-products), "CLECOMFORT" (France), "EUROGITES" ANTREC member ('EUROPEAN RURAL TOURISM NETWORK') National Federation of Tourist Offices and labour initiative (FNOTSI), Association ECOVAST (the objective of rural tourism as a means of developing local and national economy, with implications for ecological and socio-economic). CELTIC INTERREGIONAL COOPERATION ' (program of strengthening ties between the networks established between 8 of Spain's agricultural regions, France, Ireland, Great Britain, with a common cultural past for the promotion of rural tourism and cultural heritage and the creation of a common Celtic identities, along with environmental awareness throughout the tourist season).
The program TRANSNATIONAL AGRI-TOURISM INFORMATION CENTRE, organized by the 'Bishop Burton College of Agriculture, (aims to create educational services in the field of green tourism and protecting the environment for visitors to the region in which lies the Bishop Burton Agricultural College).

RESULTS AND DISCUSSIONS

Prahova was always a basic pillar in the history of the Romanian nation in the Carpatian-Danubian-pontic. The natural backdrop of the Prahova valley and Bucegi Mountains, Teleajen, numerous tourist resorts and facilities they have, along with a number of other factors have determined that this county ranked No. 3 on the country (after the County of Constanta and Bucharest) in terms of the number of tourists. Natural tourism potential is defined on the short existence of mountain chains as: Bucegi, Baiu, Scree, Ciuas. Stands and sub-Ploieşti that was Plain. The main waters are: Teleajan Doftana Prahova, Cricovul Dulce Salted. The County's climate is a temperate continental, in the North, the mountains present a tougher character with winds from the North and why bat northeast [2, 1, 4].
The vegetation is influenced by altitude, standing out like this: alpine vegetation, forests of conifers and broadleaves (Beech, common oak, Fir, Hornbeam, Oak). The vegetation in the Southeast area of the County has features of a silvo-stepe with grassy xerophyte plants. The plateaus are covered with meadows, forests and orchards of fruit trees.

In the area there vineyards, and sessile oak forests which alternate with large orchards of apple and plum trees. The fauna is varied and specific for steps relief. In the upper floors are found: red deer, bear, wolves, wild boars, ferrets, cats, squirrels, chamois. The specific territorial birds are: Blackbird, chaffinch, Golden Eagle, goshawk, Eagle. Among reptiles there are viper and lizard. The aquatic fauna is represented by trout, and in the rivers mrene Hill Pikes, carp and predatory.

Prahova is among the counties with the most numerous natural reserves, which include geologic complexes and floristic habitats, and also fauna [5].

Human potential of the county is given the existence of: archaeological, architectural and art ensembles of civil and religious memorial houses, tourist resources of cultural, ethno-folkloric manifestations [9].

Among the most important cultural attractions in the area, specific for rural tourism and agrotourism, there are: Princely House Museum-Village Brebu, ethnography and local history Collection, Museum of the Orthodox Monastery Ghighiu and Suzana, the Princely House the permanent exhibition, the Teleajen River Valley Museum, Vălenii de Munte- Museum "flowers of mine"and "Casa Rainer", Key, mountain resort; The Slănic Salt Museum, "Land Museum" from Plopeni.

The villages of County represent important centres of cultural heritage (preservation of traditions, customs, crafts, art ensembles of churches, archaeological sites, historic centres, etc.) and host a rich traditional culture, diverse architecture and a way of life based on traditional values [8].

Preservation and conservation of the rural heritage are essential to the development of rural tourism, representing an opportunity with positive effect on tourists and local population [8].

The administrative structure of the Prahova County consists of 104 localities with 2 municipalities, 12 towns, 90 common and 405 villages. Rural areas are predominantly agricultural activities, industrial and predominantly tourist: Valea Doftanei, Telega, Măneciu mountain resort; mixed with agricultural activities-tertiary; in common with industrial-agricultural activities-tertiary: Filipeştii de Pădure, Măneciu, Valea Călugărească etc, agricultural pools: Large fruit production areas in the area until Voila Băicoi, Măgurele, Valea Calugarească Susie area; wine production concentrated in the Dealu Mare Vineyard with famous pools: Valea Călugărească cu zona Seciu – Boldeşti Scăieni – Urlaţi, Ceptura, Tohani – Gura Vadului; the production of vegetables in field crops (Filipeştii de Târg, Târgşoru Vechi, Blejoi, Bucov), under crops (Puchenii Mari, Balta Doamnei) [11].

The network of county roads include: 6 national roads routes: 1 the european road-route E60; 5 main national roads; 70 County roads; 207 communal roads.

Length of public roads classified from Prahova County is 2,189 km, representing 2.8% of the total public roads from Romania. The density of roads in the County of Prahova is 46.4 km/100 km^2 what County ranks second in the country, over which the average density is of 33.5 km/100 km^2 and South Muntenia region density of 34.8 km/100 km^2.

Prahova County is located in an area where vegetable growing, fruit growing, viticulture and livestock represent important economic activities [11].

The fundamental objective of agricultural activity is the recovery and ensure the conditions for relaunching it, depending on the potential of natural, economic and human resources available to the Prahova county, in order to ensure food security of the population and to create the cash economy. The structure of the Land Fund of the Prahova County is displaying in Table 1.

Table 1. Land Fund, Prahova County

	HA	%
Agricultural Area	275,244	58.4
forests and lands with forestry vegetation	15,436	31.9
waters and ponds	9,061	1.9
roads and railways	8,895	1.9
courtyards and building	21,692	4.6
Land	6,259	1.3
total land fund	471,587	100

Source: National Development Plan, Prahova

As you can see, the entire surface of the Prahova county farming predominates the 58.4% followed by woods and forest vegetation in the rate of 31.9%.
Prahova county agricultural area by type of use is illustrated in table 2.

Table 2. Prahova county agricultural area by type of service

	HA	%
arable land	145,088	52.7
Meadows	71,842	26.1
pasture	36,877	13.4
vineyards and wine-growing nurseries	8,829	3.2
orchards and fruit tree nurseries	12,608	4.6
total agricultural area	275,244	100

Source: National Development Plan, Prahova.

The 1st place in the total utilized agricultural area in Prahova county is occupied by land that holds a percentage of 52.7%, it is preceded by the meadows surface with a rate of 26.1%, while orchards and nurseries presents a small percentage of 4.6% and 3.2% vines.
The rest of the surface is occupied by pasture in percentage of 13.4%.The main tourist areas of the County are: Prahova valley, Hyderabad, L'autodrome, Slănic.
River Valley area and Finished-It-Starchiojd forming part of the mountain range and that; Cricovului Salty Valley belonging to the bottom of the Hill and Ploieşti [8].
The accommodation capacity available to tourists in Prahova county consists of 247 tourist structures, of which 53 hotels, motels, villas, 14, 38, 1 bungalow, camping cabins, 14 1, 2 camps for pupils, 120 pensions (86 urban hostels), 2 3 hostels, tourist stops and 1 hotel for youth who respond well to the requirements of the tourists [13].
Although traditions and habits are influenced by the geographical position of the area and the presence of natural resources, cultural identity is not defined merely by a simple location.
Number of establishments of tourist accommodation functions related with the year 2016 is presented in Table 3.

Total accommodation capacity in Prahova is represented by 306 units, of which 36 agro-guesthouses.

Table 3. Number of establishments for tourist accommodation in Prahova county on July 31, 2016

	Units
Hotels and motels	99
Tourist chalets[2)]	9
Camping sites and units type box	2
Touristic villas and bungalows	39
Camps for students and preschoolers	3
Guesthouses	110
Agrotourism	36
Hostel [3)]	-8
Total	306

Source: insse.ph.ro

The number of tourists arriving in Prahova county in the first quarter of 2016 was 222,937 people. According to the National Institute of statistics, it is growing by 14.3%, compared with the same period recorded in 2015. Depending on their nationality, tourists are divided into Romanians (188,959) and foreigners (33,978). Compared to the first half of the year 2015 the number of Romanian tourists register an increase 13.9%, while of foreign tourists with 16.7%. Most of the foreign tourists come from 74.4%, European countries 15.8% coming from Asia, 5.6% in North America, 0.4% of Central and South America, 0.3% of African countries and 3.5% of other territories. The 1st position in Prahova county is occupied by the Bulgarian tourists, followed by those from the United Kingdom, Israel, Italy, Moldova, Germany, USA and France [12].
In Prahova County, there were registered 468,420 overnight stays during the first half of the year 2016. This means an increase by 11.9% than in the same period of the year 2015. Of this figure, 386,949 overnight stays belonged to the Romanian tourists and a number of 81,471 to the foreign tourists.
The average length of stay specified (INSSE) was 2.1 overnight stays per person. 1st place in the type of accommodation occupied by tourists in hotels in the County, and the last place camping sites [14].
The index of net use of accommodation places in the County of Prahova, was according to reports INSSE by 22.0 %. It shows an

increase by 2.0 percentage points compared to the year 2015 [10].
The tourist traffic in the Prahova county is presented in Table 4.

Table 4. Movement of tourists in Prahova county, 2010-2014

Prahova County	Arrivals (thousands)	Overnight stays (thousands)	Hints for use Net operational capacity (%)
2010	318.8	799.0	22.2
2011	336.0	839.2	23.3
2012	372.4	909.6	23.2
2013	366.3	876.9	21.0
2014	371.7	898.7	21.7

Source: insse.ph.ro

Table 4 shows that in 2012, in Romania it was recorded 372.4 thousand arrivals. The trend of tourist movement in the County is a positive one from 2010 to 2014/ In the year 2013 is a decline in the number of arrivals, 366.3 thousand persons, in 2014 an increase to 371.7 thousand visitors.
The index of net use of accommodation capacity had the highest value in 2011, 23.3% almost similar with the level in 2012, 23.2%. The smallest value was recorded in the year 2013 (21%).
Among the approximately 1.2 million foreign nationals visited Romania in January-November 2015, of which 70 % they came for business or to visit their relatives, and only 25 % were real tourists.

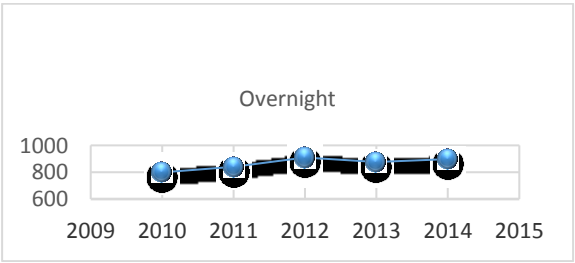

Fig.1. Tourists' night stays in Prahova county, 2010-2014
Source: author's own research.

The situation of overnight stays is similar to that of tourist movements relating to the arrivals of tourists in the Prahova county. On the 1st position is the year 2012 with 909.6 thousands night stays, followed by 2014 when its was recorded 898.7 thousand. In 2013 it was registered 876.9 thousand. As you can see, the overnight stays trend is an ascending one up in 2012, followed by a slight decline in 2013 and a significant increase in 2014.
The main resorts of national interest in the agritourism of the Prahova valley are: Valea Doftanei, Brebu and Şotrile, starting on the road of fruit: Breaza, Câmpina and Cornu. These resorts present a rich and varied natural landscape, flora and fauna as well as a number of outstanding architectural monuments, museums and exhibitions of folk art, being considered a whole complex for relaxation, cultural and economic development.
The main types of accommodation units in the County Prahova are given in Table 5.

Table 5. Complexes in the area around Valea Doftanei

Name	WTO Classification	No. rooms	No. beds
Pension Iliev	3 stars	17	34
Pension Valea Negrasului	3 stars	14	28
Pension Crăiţa	3 stars	13	26
Cottage Guest House Sibiu	four stars	5	12
Total	4	49	100

Source: author's own research

The number of bed-places in the guesthouses of the area is 100, distributed in 4 locations, which summarizes 49 rooms.

Table 6. Guesthouses in Valea Doftanei

Name	WTO Classification	No. rooms	No. beds
Pension Perla Doftanei	3 stars	8	20
Pension Loussiana	2 stars	7	17
Pension Paradise	2 stars	10	25
Casa Emanuel	1 star	5	10
Pension Atra Doftana	5 stars	8	21
Total	5	38	93

Source: author's own research

It is a real competition between double and twin room in the area of. A number of 5 pensions are able to put at the disposal of tourists 38 rooms and 93 places.
The accommodation in Villas in the area is possible in 8 units, which have 64 rooms and

131 places. The classification of the villas varies from 2 to 4 stars.

In the Slănic Prahova there are 4 touristic pensions, with 29 rooms. They classified from 3 to 4 stars. The total number of bed places is 70. In Slănic Prahova its is a goats farm of 400 heads. It is named The Forest House and was built using SAPARD funds and is included in the tourist traffic since 2008 (Table 8).

Table 7. Accommodation at guesthouses in Valea Doftanei

Name	WTO Classification	No. rooms	No. beds
Vila Predelus	2 stars	10	20
Vila Negras	4 stars	3	9
Black Valley Tourist Complex-Apollo	2 stars	10	20
Villa Monica	2 stars	9	18
Breeze House	3 stars	5	10
Villa Karina	3 stars	7	14
Squirrel Cottage	3 stars	10	20
Three Bears Resort Chalets	2 stars	10	20
Total	8	64	131

Source: author's own research.

Table 8. Slănic Prahova complexes from

Name	WTO Classification	No. rooms	No. beds
Pension Forest House	four stars	10	20
Pension Portaş	3 stars	8	16
Pension Miss Alunis	3 stars	7	18
PensiuneaMuntele Green	four stars	4	16
Total	4	29	70

Source: author's own research

Table 9. Hostels in Slănic Prahova

Name	WTO Classification	No. rooms	No. beds
Top Pension Demac	3 stars	8	16
Pension St. Nikolai	3 stars	7	20
Casa Bella	3 stars	5	12
Total	3	20	48

Source: author's own research

Table 9 presents the structures of accommodation classified by stars in Slănic Prahova area. It is about 3 urban hostels which offer 20 rooms and 48 rooms.

Table 10. Other forms of accommodation in Slănic Prahova

Name	WTO Classification	No. rooms	No. beds
Baia Rosie Resort	3 stars	48	96
Complex Apolodor	3 stars	5	9
Pension Orange Complex	3 stars	10	21
Hotel Coop	1 star	23	46
Hotel Roberto	3 stars	15	30
Hotel Horizon	2 stars	22	45
Hotel Slanic	2 stars	90	224
Rose Vila Darling	3 stars	4	14
Villa La Grand Caprice	4 stars	4	12
Slănic Villa	2 stars	5	10
House D	3 stars	3	7
Casa Teo	3 stars	6	12
Guest House	2 stars	4	8
Total	14	238	536

Source: author's own research

Other forms of accommodation in Slanic Prahova is represented hotels, villas and houses with local characteristics. They summarize 14 units, 238 rooms and 536 beds.

Table 11. Complexes from Văleni de Munte

Name	WTO Classification	Nr. rooms	No. beds
Casa Tennis	2 stars	3	9
Total	1	3	9

Source: author's own research.

Vălenii de Munte has only one agrotouristic what house, having 3 rooms and 9 places for a two-star comfort.

Table 12. Hostels of Văleni de Munte

Name	WTO Classification	Nr. rooms	No. beds
Pension Teba-Cios	0	7	16
Pension Vera and Livia	2 stars	60	150
Total	2	67	166

Source: author's own research

In competition with the guesthouses from Vălenii de Munte ther are the ones from the urban areas. It is about 2 units with 67 rooms and 166 places.

Table 13. Other establishments of Vălenii de Munte

Name	WTO Classification	Nr. rooms	No. beds
Hotel Capitol	3 stars	30	76
Villa Helen	-	8	16
Total	2	38	92

Source: author's own research

Other establishments in the area, are represented by a 3 stars hotel and a tourist Villa, all together having 38 rooms and 92 beds. Touristic accommodation structures, the resulting table 14.

Table 14. Agrotourist Complexes in Prahova county

Area	No. agrotourism	Rooms	Beds
Valea Doftanei	4	49	100
Slanic Prahova	4	49	100
Valenii de Munte	1	3	9
Total	9	101	209

Source: author's own research.

In the total number of touristic pensions in Prahova county, the largest share is kept by Valea Doftanei, 45% and Slănic Prahova 43%, and on the 3rd postion comes Valenii de Munte with 11%.

CONCLUSIONS

In general, in Prahova county, agritourism is not developed in accordance with the market demand of the domestic and international tourists.

Despite that accommodation in agroturism responds to existing requirements in terms of quantity and quality of units and places, it is facing with various difficulties. First regarding the training level, then the technical aspects of the development and in the last it is about the promotion of the local values.

But, the best pints of the Prahova valley are given to the beauty of the landscape, the possibility of practicing trekking, winter sports, but also the get knowledge on traditional folk customs. Here has grown lately agritourism in the form of thematic roads known as large scale projects in Romania: the wine road, and the sheepfold Doftana.

Agritourism activity must be is geared towards rural areas with tourism potential, the opportunities for local development through the promotion of local activities, recreational sports, walks outdoors, resting, watching traditional events and participation in the local celebrations.

Supporting infrastructure and agro services is particularly necessary and promoting a competitive tourism in rural areas but also for the establishment of local networks promotion and touristic services, with the active involvement of the population in rural areas.

The European experience in the field of tourism, as well as conducting studies and research in this field in the developed countries of Europe, constitute an important source of models that can be applied in areas with high potential for practicing agrotourism in Prahova county.

Statistical data showed the evolution of the main indicators that characterize the activity of Agrotourism and how the accommodation structures have worked in Prahova county in the period 2010-2016.

The projects destined to promote rural tourism could have a significant contribution to the economic development of the region.

The optimization of the agro-tourist activities needs new strategies based on the development of projects which could be implemented starting from promoting a destination of the historical, geographical and touristic areas in the existing administrative-territorial and socio-economic profile.

For the creation of development strategies and optimisation of agritourism in Prahova County, it is necessary to set up a SWOT analysis.

For the development of the touristic resorts in the area, it is needed to build a larger number of agro-tourism pensions.

The development of local agroturism shlub be based on projects destined to valorize the local capacity and promote handicrafts and local customs..

The existing tourist resorts from the North of the County Prahova could be included in circle sheepfold Road to develop this concept in the mountain areas.

The development of horse farms has allowed tourists to practice horse riding and walking in nature with a horse in the mountain and hilly areas.

Grace to the existence of lakes and dams, fishing could be an invitation to another sort of tour: Fish tour.

The development of touristic cottages has had the purpose to host guests for sport and hunting events.

Agritourism could become an important source of income for residents of both areas who wish to transform its structures function in households with accommodation and meals, as well as for those who want to invest in the construction of new complexes. These activities would have earned local community by collecting taxes and taxes paid annually, but also local producers by developing markets for traditional products. An important element is the creation of jobs and diminishing unemployment, which would solve one of the biggest problems faced by our society during this period.

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LATEST TRENDS IN THE EVOLUTION OF PEFC CERTIFICATION

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Abstract

Worldwide, PEFC™ represents the most spread certification scheme in forestry. The goal of this paper was to highlight the evolution of the number of Chain of Custody (CoC) certificates and the PEFC™ certified area worldwide between 2013 and 2017, by analyzing the public data provided by the official website. Currently, the total PEFC™ certified forest area accounts for approximately 313 million hectares, out of which 55% are located in North America. As for the largest forest areas certified by PEFC™ the top three places are held by Canada, The United States of America and Australia. At the end of 2017, in Europe the PEFC™ scheme had certified forests from a total number of twenty four countries, with the highest areas being shared by Finland, Russian Federation and Sweden. According to the most recent statistics, around 82% of the total CoC certificates issued worldwide were recorded in Europe, France, Germany and United Kingdom being the countries with the highest shares. Currently, in Romania only twenty three CoC certificates were issued and no forest area was yet certified.

Key words**:** *Chain of Custody, CoC, Europe, forest certification, PEFC™*

INTRODUCTION

In general, forest certification represents a mechanism aimed to promote a sustainable forest management through preserving the functions of the forests and to provide economic benefits at the same time [21].
The certification schemes are voluntary, being regarded as an useful instrument of Corporate Social Responsibility (CSR) in the case of the wood industry [17].
Worldwide, several forest certification systems exist [20], such as Forest Stewardship Council (FSC®) and Pan-European Forest Certification (PEFC™) that represent the most common ones [7], [18].
PEFC™ was set up twenty years ago by a group of European stakeholders [8], mainly forest owners, being a non-profit organization which assesses, endorses and recognizes the national certification schemes [28].
PEFC™ was criticized right from the beginning for the fact that it is mainly focused on the economic income and very little attention is given to the ecological functions and services provided by the forest ecosystems [16].
Starting from its birth, PEFC™ was seen as an alternative to FSC® aimed at preventing the spread of the latter one across European countries [25]. From the point of view of forest companies, this certification scheme is perceived as one that has fewer requirements regarding sustainable forest management standards [30].
Like in the case of FSC® certification scheme, PEFC™ promotes also the concept of Chain of Custody (CoC), which guarantees that the wood or wood-based products came from properly managed forests [10], [12].
Starting from 2013, PEFC™ aligned its Chain of Custody standard in the case of imported wood and wood products with the requirements of the European Timber Regulation (EU-TR), especially as regards the due diligence system (DDS) [15].

The special attention which is paid to the management of the artificial regeneration of the forests by using certified forest seeds [29] and the reduction or even the elimination of the pesticides [23] represent ones of the most important provisions of the PEFC™.

In some countries, PEFC™ standard takes into account the management of the non-timber forest products (NTFPs). An example is the aromatic essence extracted from mugo pine (*Pinus mugo* Turra) in Italy [27].

The total number of certified forests had grown exponentially since the release of the PEFC™ scheme. Five years after its appearance, the total area of the certified PEFC™ forests worldwide accounted for more than 46 million hectares [9]. After two years, the total certified area reached more than 187 million hectares [11], expanding to 202 million hectares in 2008 [2], 220 million hectares in January 2010 [1] and 232 million hectares at the end of 2010 [3].

In 2005, the PEFC™ certified forest area from Western Europe accounted for around four-fifths of the European certified forest lands [19]. After another six years, the total area of PEFC™ certified forests in EU countries was around 48 million hectares, being almost double in comparison with the FSC® certified area [5].

According to the latest available statistics, it is estimated that nowadays the total certified forest area (mainly PEFC™ and FSC®) represents around 10% of the globally forest area [14], [22].

As concern the situation in Romania, where the forests account for more than 27% of its area [24], only FSC® and PEFC™ certification standards were present at the time of this study [6]. As regards the FSC®, nowadays there are more than 2,7 million hectares certified, the vast majority of them bellowing to the state and being managed by the National Forest Administration ROMSILVA. Instead, until recently little attention was given to PEFC™. In 2014, a meeting of the representatives of the private forest owners and wood industry took place in Brașov and the opportunity to implement the PEFC™ certification scheme was debated [13]. After several other meetings that took place in the last years, the national standard was adopted, being currently under revision by the international PEFC™ structure.

The purpose of this paper was to point out the evolution of the number of the Chain of Custody certificates and of the certified forest area in the timeframe 2013 - 2017.

MATERIALS AND METHODS

All the data regarding the number of released Chain of Custody certificates and the certified forest area for the timeframe 2013-2017 was gathered from the official website of PEFC™, from Facts & Figures section [26].

RESULTS AND DISCUSSIONS

In the case of the certified forest lands, their area increased from 253 million hectares, in 2013, to 313 million hectares, in 2017 (Fig. 1).

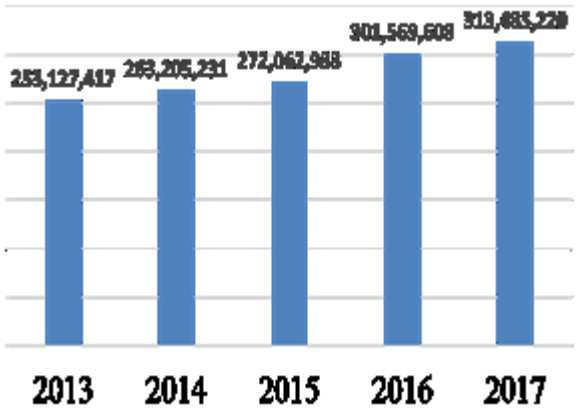

Fig. 1. The evolution of PEFC™ certified forest area worldwide
Source: PEFC™, https://www.pefc.org/about-pefc/who-we-are/facts-a-figures

In 2017, the highest share (55%) of the certified forests was recorded in North America, followed by Europe (30%) and Oceania (almost 8%), while the smallest share was hold by Central and South America.

Across Europe, countries such as Finland, Russian Federation and Sweden were the ones with the highest certified PEFC™ areas, while the Netherlands, Luxembourg and Switzerland ranked in the last positions (Fig. 2).

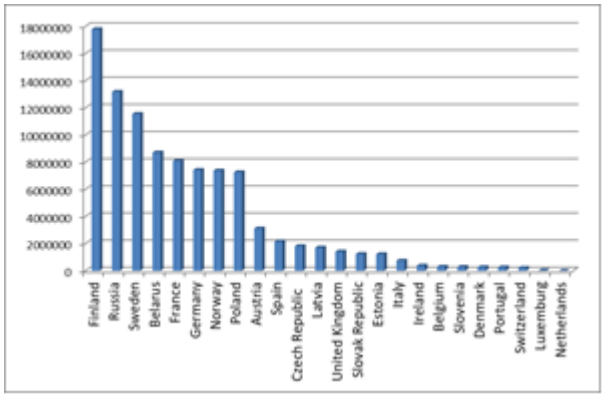

Fig. 2. The top of the European countries as regards the PEFC™ certified forest area
Source: PEFC™, https://www.pefc.org/about-pefc/who-we-are/facts-a-figures

In the last five years, the number of CoC certificates increased with approximately 1,500 (Fig. 3).

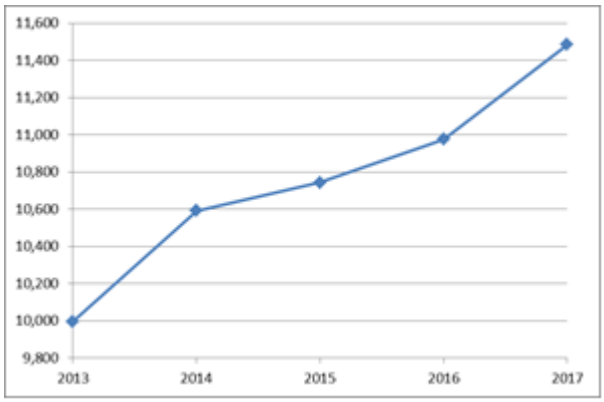

Fig. 3. The evolution of the CoC certificates worldwide
Source: PEFC™, https://www.pefc.org/about-pefc/who-we-are/facts-a-figures

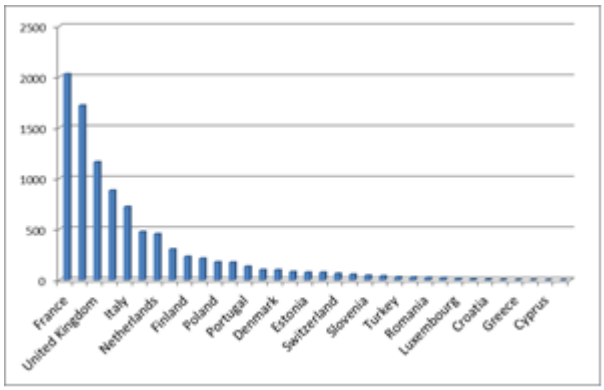

Fig. 4. The top of the European countries regarding the number of CoC certificates
Source: PEFC™, https://www.pefc.org/about-pefc/who-we-are/facts-a-figures

In 2017, around four-fifths of the total CoC certificates were recorded in Europe, France, Germany and United Kingdom being the countries with the highest shares, with 21%, 18% and 12%, respectively, while in Cyprus, Greece and Croatia the fewest numbers were recorded (Fig. 4).
According to the data available in 2017, twenty three Chain of Custody certificates were valid in Romania (Fig. 4), the situation being more or less similar with the one from Turkey.

CONCLUSIONS

North America holds the highest area of PEFC™ certified forests, while in Europe the highest number of CoC certificates was recorded.
Given the current situation regarding the area of certified forests worldwide (more than 313 million hectares PEFC™ certified and around 200 million hectares FSC® certified) and the market demands, it is expected that soon after the approval of the national PEFC™ standard, several small private owners from Romania will certify their forests and more companies from the wood industry will get their CoC certificates.
Last but not least, PEFC™ could play an important role in Romania as regards the certification of the NTFPs, being well known that the country has a great potential in marketing of these forest products [4].

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BLOCKCHAIN TECHNOLOGY IN FOOD - CHAIN MANAGEMENT - AN INSTITUTIONAL ECONOMIC PERSPECTIVE

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Abstract

Blockchain became known as the technology underlying the cryptocurrency bitcoin. While here this technology has received quite controversial attention, its proponents expect much more promising applications in other fields. One of these concerns food-chain management, where it is said to have the potential to revolutionise it. This paper looks at this case from an institutional economic perspective. For this, it first clarifies how a straight application of this technology matches basic microeconomic thinking, as restricted to private goods and prices, and thus also the market optimism associated with it. The paper then analyses the role of institutions in the food system as it has so far been organised and how this institutional setting might be changed in order to incorporate this new technology while safeguarding the objective of an overall economic optimum. In order to sketch out some ways in which these conceptual considerations might actually be put to the test, a cursory introduction is given to some options relating to the situation in Romania. Some orientation might thereby be provided for further work.

Key words**:** *blockchain, food chain management, institutional economics*

INTRODUCTION

Blockchain technology (BCT) mostly became known as underlying the cryptocurrency bitcoin. While controversially discussed for its technical features, and also for its implications for monetary policy, BCT offers options for the supply chain, and thus for food-chain management (FCM) as well. What is new about this is the concept of distributed data management. Its organisation contrasts with the hierarchical structures of centralised databases typically used by companies, or public authorities so far. Contrary to what one may associate with "distributed" or "decentralised" IT structures, namely the disadvantages of all too fragmented food chains, BCT is said to offer an insight into production and delivery at any part of the chain. Final consumers are promised access to all information from primary production, processing and distribution, and thus indeed make their decisions on the basis of complete information. So market failures due to information asymmetries, possibly occurring in older food-chain architectures, are excluded by design. Full transparency is also expected to prevent fraud, which is also a major issue for food safety, as it would otherwise have called for stricter control mechanisms ultimately enforced by some leviathan state. Middlemen, in their function of controlling information and possibly exerting undue market power, or third-party institutions safeguarding rules, are no longer needed. Traceability would practically be given as an intrinsic feature of this technology; for this reason, efforts for the development of the respective food laws as well as the establishment of public authorities applying them may well be rendered redundant. On the whole, direct consumer sovereignty is expected to be realised at last, while transaction costs would decrease dramatically. In this sense, Casey and Wong [5] promise the evolution of "*dynamic* demand chains in place of *rigid* supply chains." BCT is said to be the game changer of the coming years. Will future developments indeed live up these expectations?

After all, there has so far been a lot of work and effort on improvement of FCM as well.

Food safety – as mentioned above, supposedly no real problem anymore with BCT – was essentially considered a public concern.

Current EU food safety policy

In contrast to what BCT proponents suggest, the EU's current policy on food safety does not rely on the collection of all information of all stages of a food chain. Instead, the policy is based on the one hand simply on postal addresses for traceability, but on the other hand ubiquitously applicable quality standards (Regulation (EC) No 178/2002): Traceability (article 18), according to this regulation, is restricted to the ability to identify the origin (i.e. the trading partner) of all individual charges of inputs used for food production. It does not include any further information on the product delivered (as BCT would suggest). As all products (including those imported) have to comply with all EU food-safety criteria. Adding information from any or each production stage to traded charges would simply be redundant as long as the case is just for food safety. If it was for more information, beyond safety of food, like on organic character of production or geographic indications, the respective certification could be added, supported by the respective EU legislation and international trade agreements. By referring to the importance of risk assessment and communication, the regulation makes clear that it is meant to cover 100% of production, but that it can do so only on the basis of drawing samples only. (cf. points (15) to (22), article 3, points 9-13, and article 6, but also other parts of the regulation. The word "risk" is used 105 times in this regulation.) At the same time, the optional application of the precautionary principle allows for restrictive measures before proven evidence of any risk is given.

Retailers were consistently on alert, trying to avoid any kind food scandal, as the media would prominently highlight any violation of food regulations.

The development of globally applicable food standards, while not calling regional cultural habits into question, was key to this. Furthermore, incentive alignment, i.e. fair prices, in the sense that prices reflect marginal cost, were an objective promoted by anti-trust policies.

Mergers and acquisitions were an option for business in a globalising market, used mainly by processors and retailers. Vertical mergers were less common, as the downstream end of the chain would rather seek to take advantage of its position as principal and of competitive pressure between its suppliers. Linear programming over the whole food chain could principally be a standard helping to avoid technical and economic inefficiencies. The BSE crises of the 1990s added another requirement; while ideally the market would reside in the sufficiency of checks of quality on each level of the chain, keeping transaction costs low, major policy action had to be taken to establish traceability (from fork-, or a least trough-to-plate) as a standard. Technically, at the time, this called for centralised data management – precisely opposed to what BCT promises. After all, it is not only BCT that pushes for further digitisation all along the supply chain, down to primary production; e.g. SAP offers cloud-based *rural sourcing management* solutions, following its own standards, even integrating smallholders all over the world with mobile communications, tracking produce from farm to factory and organising complementing financial service infrastructure. [27]

Others again would call for a shortening of supply chains in the first place; this is either for ecological reasons or to avoid middlemen and superfluous processing and packaging. This may happen via regular farmers' markets or other forms of direct marketing. Modern logistics and marketing via the internet may lead the way, following the success stories of e-bay, Amazon, Alibaba et al., but this was not what Lorenz in a series of articles pointed to as *digital shortening* of the supply chain. [24]

This paper will ask whether BCT can indeed improve the working of the food chain. The criteria will be whether the situation of consumers can be improved, ultimately measured by higher welfare, and/or whether producers achieve higher levels of income.

This will be elaborated on the basis of transaction-cost theory and corresponding institutional arrangements. Special attention will be given to the issue of food safety. For an outlook, this paper will offer an outline of the situation in Romania. So what has been elaborated here in general terms should also be applicable considering the specificities of Romanian farmers, processors, retailers and ultimate consumers. Further work may empirically test whether supporting BCT would be appropriate.

Blockchain technology in recent publications

FCM has been a prominent topic in research since the 1980s. It could be categorised as part of industrial organisation, while game theory, transaction-cost analysis, and mathematical programming have also played an important role. While primarily developed only from a company perspective, issues like the alignment of incentives, Pareto-efficiency and options of collaborative supply chains are raised in some of the literature. [3] Research and policies on food safety are also concerned with the food chain. With a long history this had always been a matter of public concern, not only for private business. While the beginnings of food safety policies were largely designed as prescriptions and proscriptions, in recent decades, incentive structures have been incorporated more explicitly, harnessing business interests for the achievement of policy goals. However, food safety has remained a public good, a matter of public health. [11] [2]

Nevertheless, in practical terms, it was largely standards for product quality and respective prices, contractually agreed that were important for FCM. These were and are set by governmental regulation as far as food safety is concerned (with the FAO *codex alimentarius* offering an international reference) or privately by company prescriptions. Observing and controlling the chain in real time and thus reducing storage requirements became ever more widespread, requiring suitable computational capacities. The task for managers therefore goes beyond a firm's boundaries, covering complete value-added chains, thus also beyond the boundaries of the theory of the firm. Market failures due to information asymmetries and monopolisation became issues that were addressed by considering jointly designed formal or informal rules. The development of interfaces between firms, overall contractual arrangements and the evolution of attitudes towards informal cooperation also became important, alongside simple production decisions and pricing policies.

Considering this integrated management of the food chain, it may be argued that its organisational task could be more easily handled within a single hierarchical framework, keeping direct control of transaction cost and pricing as an internal matter.

Obviously, there has always been a certain tension between the option of centralised and de-centralised organisation of the food chain. A single hierarchical framework may show advantages in keeping direct control of transaction cost and pricing as an internal matter. The disadvantage from the perspective of the overall economy would be a lack of competition. [4] Realistically, even if companies exist independently along the chain, collaboration between peers or settlement of prices may be dominated by prescriptions imposed by one leading company. With all this, imbalances and monopoly pressure in the supply chain are high on the research agenda. Restricting negative outcomes is often considered a public task, namely a task for appropriate anti-trust laws. With respect to policies focusing on sustainability or working conditions, monitoring will be called for. Interestingly, *public* standards for quality of products, fairness and working conditions are hardly addressed in the business literature on the supply chain, while they have remained key to the literature on food safety (cf. [11] and [2] again).

Just in recent months it was BCT as applicable to supply-chain management that has also entered the stage for food. Companies like Deloitte [20], [28] and IBM [16] [17],[23] have picked up on it and are presenting it as game changer. Food Logistics, an information provider, is similarly euphoric about it [33].

The *New Food Magazine*, another business-intelligence service provider, offers 28 hits when selected for "blockchain" [25], *Food Safety News* [19]] offers nine hits, all of them with an optimistic stance towards this technology, namely with respect to traceability and fraud. In a paper by Reyna et al. [15], published in a scientific journal, the terms "revolution" or "revolutionise" are used no less than nine times; the fact that BCT is a "disruptive" technology is mentioned six times. In October 2017 Ahmed and ten Broek brought a comment on the issue into *Nature*, one of the most prestigious scientific journals [1]. Specifically, it is presented as a new option for small-scale farmers in developing countries, along with micro-credit systems. [26] A clear signal of business interests in the issue is the publication of straightforward commercials. (Walmart and IBM, August 2017 [32]; IBM on apples, coffee, March 2018 [21], April 2018 [22]). To put it briefly, all the problems of FCM, that had been so diligently addressed over the last 30 years in research, business administration, and respective public policies are now supposed to be overcome with this supposedly cutting-edge technology. The realisation of the textbook ideal of consumer sovereignty, with consumer preferences immediately steering production decisions, is promised without any impediment. Those preferring other technologies, in differing institutional settings, have to see themselves categorised as die-hards, possible luddites, unable to face some disruptive, but in a Schumpeterian sense creative, forward-looking technology.

Wageningen University and Research (WUR) pushes the case as well: "Blockchain technology is now on the radar of all major players in the food chain." WUR says it is necessary to recognise BCT not only as a powerful enabler, but also as a challenge and potential threat. There is a business model and a challenge to governance to be observed: organising the trust ecosystem. WUR is thus not only going into it with research and observation, but is actively organising events ("cases") called "Food Integrity Blockchained" at which they discuss BCT publicly and support start-ups in the field. (e.g. case 4 [31])

For all that, it is not only a mix of business administration, engineering, or some entrenched computer nerds trying not to miss this envisioned bandwagon of technological progress. The BCT principle of decentralisation also seems to be attractive from some political perspectives. On the one hand there is the libertarian stance, as often found with IT pioneers, favouring BCT just for its anti-hierarchical thrust. On the other hand, *New Food Magazine* also sees the anti-globalisation political activist and sharing protagonist Rachel Botsman as being on board: "According to Botsman, we are beginning to move from an institutional system of trust to a distributed system, a natural progression in her eyes as 'institutional trust is not designed for the digital age'." [7] So, there is considerable preference for BCT from what may be grouped as technological modernisers of business relations. This also finds some support from political groups critical of hierarchal structures, whether they are encountered with the classical nation state or any hierarchically dominated developments of globalisation, including the respective firms. In the context of the development of the internet, this kind optimism, in particular the preference for lean structures and an emphasis of open peer-to-peer communication has occasionally been criticised as technological solutionism, showing too narrow a view of social developments. [35] However, despite notice being taken of this lacuna, there has been hardly any specific social science work with regard to filling it. From this research environment, only some judgements of principle can be derived from work on digitisation. Following the introductory texts and tables of contents of two handbooks on BCT that have been published [13], [14] the term is introduced here mainly as an option to overcome bureaucratic hindrances in national governance, or banking systems. However, a social-science approach to the issue has not been applied. A combination of "socioeconomic" and "blockchain" offers no more than 26 hits in sciencedirect.com of

which only eight are research articles. Most of these are again concerned primarily with technical aspects of BCT. Hinings et al. (cf. [10] are the only ones exploring the issue with respect to changes in institutional settings.

Tracing an epidemic outbreak

In 2011 an epidemic outbreak of a food-borne illness, caused by EHEC (Escherichia coli O104:H4), affected no less than 3,950 people, of which 53 died. 800 were in danger of permanent kidney damage. The main region affected was Hamburg and its surrounding area, but also other parts northern Germany and neighbouring countries. The search for the origin of the pathogenic bacteria first led to presumption that cucumber imported from Andalusia may have carried it. However, no supporting evidence was found in greenhouses that the cucumbers were supposed to have come from. Cross-contamination during transport could not be excluded, but was not supported by evidence either. After that, sprouting seeds, added to cucumber dishes, pointed to a restaurant in Lübeck (60 km from Hamburg) as the starting point of the epidemic. Sprouting seeds were indeed found to have carried the bacteria. A relative hotspot of an outbreak (15 cases) was Bordeaux, to which no connection could be identified whatsoever. An organic farm close to Lüneburg (roughly 60 km from Lübeck and Hamburg) was served with an official closure order, as it was growing sprouts, even though no bacteria were found there. Only finally were sprouts imported from Egypt named as the most likely source. While the death toll and human suffering remain the most deplorable part of these events, the economic damage should not go unmentioned either. Even in Austria large parts of cucumber and other vegetable production was disposed of as demand collapsed. (cf. Wikipedia on 2011 Germany E. coli O104:H4 outbreak, Elga [40], ORF [34], AZ [36] all retrieved 5 July 2018)
The case of this epidemic outbreak shows what "traceability" may actually call for. It should not be considered as a matter that could be handled in an all too, easy way. It is rather something that has to rely on highly developed probabilistic studies, tenacious searching and cooperative communication. If traceability is thought of as serving a marketing strategy, the case will of course look easier, but should not be mistaken for a complete answer to the problems of food safety.

According to its proponents referred to above, two areas will be disrupted by this new technology. Firstly, in a technical sense it is information management based on central databases, secondly, concerning institutions, it is the bureaucratic effort of certification of origin and of quality that will have to face major changes, if not complete redundancy.
While they are not explicitly mentioned, one may also envisage that not only would state-run bureaucracies be concerned, but also those in bigger companies, multinationals with their sometimes considerable overheads. In another respect, but without elaborating on it any further, Kshetri [12] also states that "NGOs and others that monitor the fair-trade use 'antiquated' techniques." For this he refers to 25 million coffee growers worldwide, and the positive effects BCT could have in social and economic terms. The extent to which and in what way BCT in FCM will be disruptive for agricultural industry remains to be seen.

MATERIALS AND METHODS

Approaches to analysis

As mentioned above, most papers on BCT applied to FCM introduce it as a given option, showing relative advantages from a technical point of view. Those explicitly addressing economic criteria mention cost, quality, speed, dependability, risk reduction and/or flexibility as criteria (cf. Kshetri [12]). The paper presented here will go beyond company perspectives and call for the achievement of Pareto optimality. With Pareto optimality as a criterion in mind, the work done with this paper will analyse transaction cost in the context of differing institutional settings, primarily based on standard microeconomic theory, but embedded in the more comprehensive approach of New Institutional Economics (NIE). The paper approaches the case only analytically, with some concrete examples to illustrate the case rather than indicating any quantitative proof.
An alternative to the economic approach used here is offered by Kshetri [12] in that it develops a theory on the basis of a number of case studies available for current BCT in supply-chain management. Yet another approach is used by Hinings et al. [10], who approach the issue explicitly from an institutional perspective as well, but based rather on management than on standard microeconomic theories. Most other available

publications (introduced above) do not use theory or methods used for testing hypotheses, but present well developed IT architectures and considerations for possible applications, typically supported by reference to pioneering activities. A strictly micro-institutional economic approach to the analysis of BCT in FCM, as selected for this paper, has not previously been available.

Using welfare economic categories for this paper may expose it to the criticism of being normative. However, careful reading would make it possible to separate the part in which the analysis remains purely positive and the point from which conclusions are indeed normative in the way that welfare economics and utilitarianism are indeed normative. An open discussion of implicitly or explicitly normative content is further supported by Hinings et al., indicating that also the development of – only at first sight purely – technical infrastructure is orchestrated by private actors according to their values. "Creators of digital infrastructures seek to infuse their norms, values, or institutional logics, into the infrastructure" [10].

RESULTS AND DISCUSSIONS

Micro- and institutional economic theory for analysis of BCT

Orthodox economic theory is just a price theory: it is prices, that explain quantities supplied and demanded in the framework of functional relationships. In that prices mirror relative scarcities, they steer human activities and thus the allocation of resources to their optimal use, i.e. maximum utility, which everybody is assumed to seek. Ultimately, all human activity is explained on the basis of prices (reflecting scarcities) and preferences. So according to this theory – natural conditions and available technology assumed to be given – no further factors are needed to coordinate human activity, striving for well-conceived, long-term maximum of utility, i.e. life as good as it can possibly be. Further factors interfering with this mechanism, even if well-intended, would only and necessarily lead to lower levels of welfare.

BCT, as put forward by its proponents, fully matches the described ideal of this price theory. For both BCT and fundamental micro-economics, there are uniquely measurable and tradeable items, namely land, commodities, products, services or property rights. All their characteristics, as well as their current, earlier or later ownership can be well captured in blocks, just like they are captured in a system of price/quantity relations. All communication and mutual agreements required for the smooth working of markets are guaranteed by BCT. Thus BCT is the ideal technical complement to the principle of market exchange as captured by pure price theory.

What is more, BCT may claim to maintain the notional world of microeconomics, when microeconomists themselves begin to struggle with possible violations of the axiomatic foundations of their theory. Violations, first of all of the axiom of complete, and particularly of asymmetric information, are said to be overcome by BCT. The problem of incomplete contracts could thereby also be solved, in that "smart" contracts are generated in a food chain accompanied by BCT. However, this kind of solution to the problem only reflects the fact that the problem itself is essentially seen as merely technical: former communication systems (based on paper, e-mail communication, centralised databases with restricted accessibility, etc.) would simply be too slow and too rigid to serve their purpose as well as BCT could. (The problem of "unknown unknowns" is not addressed in the literature on BCT). The axiom concerning rationality and thus limitations of cognitive capacities of individuals is hardly addressed by BCT, probably because the availability of information and IT tools for rational optimisation make this appear a less important problem. The axiom of well-defined property rights in items processed, traded etc. is implicitly seen as taken for granted, as they are easily documented in the blockchain. Concerning property rights in information and access to blockchains, some of its proponents (cf. interview partners of Sommer [35]) push for solutions following an open-access philosophy. In theoretical terms, this again actually matches basic microeconomics, typically found in later chapters of textbooks, where the categories of club or public goods are introduced. However, BCT proponents thereby rather skip the intricacies of forms of governance as discussed by institutional

economics, in that their radical solutions seem to cut through such Gordian knots. In a similar way, the role of economies of scale is either neglected or seen as a matter only of the "disruptive" period of the introduction of any new technology, ultimately leading to new, stable, and welfare-enhanced equilibria. Thus the axiomatically important role of convexity of production and consumption functions (i.e. essentially, of substitutability), or the way in which more advanced microeconomics, namely industrial organisation, deals with violations of it, seems rather negligible from the perspective of BCT proponents in the first place.

What may help to recognise the joint pattern of thinking that underlies BCT and basic micro-economics, is a look at a third concept, namely of the internet of things (IoT), as it also follows just this pattern. (A look at the papers of Kshetri cf. [12] or Chen and Xu [6] and the literature quoted there in fact proves a considerable ancestry of BCT in work on the IoT.) Here again, and here most explicitly, it is revealed that clearly identifiable and measurable *things* form the ontological basis of this concept. In that the pure price theory of microeconomics, BCT and the IoT do so, they avoid any confrontation with complexities of the real world that cannot be captured by this atomistic thinking. Atomistic thinking as it underlies the methodological individualism of microeconomics may often help analysing real world phenomena, but it cannot always be re-transferred as such to the real world for policy design. Institutions – which may themselves be captured as public goods – are a case in point. The IoT, by definition, cannot comprehend public goods.

Of course, any scientific approach will have to reduce the complexity of the real world. However, while the respective limitations of pure price theory can well be made explicit when teaching economics by checking for possible violations of its axioms, and in that different optional forms of governance are introduced, BCT proponents implicitly take this problem for null and void in that they either claim that BCT overcomes these limitations, or in that they simply ignore them.

To what extent can this notional world underlying BCT claim validity? For economics. a violation of its axiomatic foundations will call for institutions (rules of behaviour), offsetting the failure that accompanies the violation. But for BCT? To explain the issue, firstly an institution that seems in any case to be taken for granted is discussed here: well-defined property rights. It is an institution that – at least for introductory microeconomics – has itself achieved the status of an axiom. Of course it is not given by itself, but a hard-fought issue of what is called a *social contract*, i.e. a matter, political economics was concerned with from its beginnings. Unfortunately, for today's economists this issue was somehow lost when economic and political sciences separated as academic disciplines.

If well-defined property rights are not given or violated, the respective resource may run the danger of being overused, or it may not be created in the first place. So the way it can possibly be established and enforced deserves the utmost scrutiny (which it is not given in standard introductory courses). Such scrutiny will include the option that this kind of institution does not offer the best choice for a social contract, but that other forms of governance may be superior.

Enforceability of the institution of property rights presupposes, that the resource in question can indeed be identified as a fungible, and thereby directly measurable item. If this precondition is not given in the first place, the resource may possibly be transformed ("commodified") to make it meet this requirement. Examples where this process has proved possible are land, or radio bandwidth. The distributive effects of such a transformation can be problematic but are in principle resolvable. In other cases, an attempted commodification may in fact destroy the very characteristics of the resource concerned, namely in the case of essentially social resources. One example of such a resource is culture, as it cannot sensibly be reduced to commodities to e.g. visits at a theatre, pictures in a gallery or the like, as some parts of the existing literature suggest. [9] Similarly, security can hardly be

commodified into security services or the enhanced barring of windows, let alone in a welfare-maximising way. Institutions themselves, relying on political agreements or at least grudging acceptance, offer other examples of essentially social resources. For all these cases more complex institutional settings or – in other words – more complex forms of governance have to be established. A concrete example is provided by the various forms of governance of water supply and sewage systems. Mobility schemes, which include not only private but also public transport, are another example; here, aspects from convenience to the death toll resulting from different mobility schemes indicate the challenge that comes with the respective social decision-making. The establishment of complex institutional settings – whether socially emerging or consciously designed – are discussed by institutional economics. Neoclassical microeconomics with its axiomatic basis remains a cornerstone of all this, if not reduced to the typical introductory course content of pure price theory. The conclusion up to this point is that as axioms are violated more or less complex sets of institutions may be observed (if given already – e.g. in the case of traditional alpine pastures), or they may have to be developed in a given social context, possibly leading to an overall optimum, or – if not well designed – to a politically biased outcome. In general terms, these aspects are presented in introductory textbooks as the problem of open-access goods. Important contributions, now enjoying the status of milestones in history of economic thinking, came from Harold Demsetz (on property rights), Garret Hardin (on the "tragedy of the commons"), Ronald Coase (trying to re-direct economists' attention to the role of transaction cost and thus to the law and forms of governance, not – as a reduced view went – to their principle containment) and at later stage Elinor Ostrom (observing and analysing the functionality of institutional settings for the management of natural resources.) In recent years it is the author trio of Acemoglu, D., Johnson, S., Robinson, J. A. who became known for working on systematically biased outcomes, such as colonial structures, leading to comprehensive questions like "Why do nations fail?"

As it is presented by its proponents, BCT is largely restricted to what microeconomics offers in its basic form, as if its axioms could not be violated. Promising to overcome all problems linked to information asymmetries etc. must seem overstretched, considering real-world situations. Other limitations (violation of convexity assumptions, actor rationality etc.) of a concept reducing the real world to one of *things* are not even addressed by BCT proponents. However, this does not mean that BCT might not prove to be a tool supporting efficiency of FCM in some forms of implementation.

Limits of blockchains applicability

For BCT, with its ontology of *things*, the degree of granulation of these produced and consumed things is considered critical. The size of a unit consumed would of course be critical in that the promise to consumers is that they could trace products back to their origins. In most cases it will be part of a batch of produce that can be traced back to a previous stage of the food chain, where again batches purchased as inputs will be traced back to the next previous stage and so on. Depending on the kind of processing, the size and composition of batches may change. The information that will have to be made available will multiply with the variety of inputs used and the number of their suppliers. The number of stages (and thus blocks) in the chain as such will possibly add less to the volume of information but rather to the effort needed to represent the respective contracts electronically within the blocks. Apart from this, the mining (generating and adding) of blocks is computationally a rather intensive matter, calling not least for considerable energy input. The issue or energy requirement of bitcoin has been raised by the blog digiconomist.net and recent research [8] on the topic found widespread attention also in the media. Whether or not the energy requirements of a blockchain application to supply chains will depend on its specific design, it still seems safe to assume that this problem will not be as serious as with the

bitcoin system. So the mining of blocks will not have to refer to numbers of blocks as large in the bitcoin system and it may not be made up of as many nodes. It is to be expected that new and different designs of blockchains will offer new and more energy-efficient options.

A look at Chen and Xu [6], presenting a computational design of a platform and its application for traceability and supervision of broiler production, may give an idea of what is to be expected. All the details of feeding and feedstuffs, veterinary applications, of death rates etc. all along the respective time line of the fattening process of the herd are covered here as a protocol of real-time operation. All this will have to be continued for slaughtering, packaging, refrigerating, storing, shipping etc. until it reaches the shelves of the retailer. For all of these stages, detailed information is supposed to be measured in real time and documented in the blockchain.

Neither conceptually nor technically would such a procedure have to be considered an insurmountable problem in principle. There is no restriction to the volume of information in the blocks. The question is rather whether it indeed leads to an optimal solution. For the case of broilers as described by Chen and Xu [6], data to be fed into the blockchain are readily available, as the whole production process is computerised in the first place. So considering blockchain technology as a standard presupposes "smart" (i.e. computerised) farming, possibly using drones, detailed soil analysis and the corresponding application of fertiliser, the use of GPS-navigated self-driving equipment for this application and also for tillage, broadcasting seed etc. To really live up to the expectations stipulated by proponents of BCT in FCM, the same level of information would have to be available for the inputs used (namely seed, pesticides etc.). Animal husbandry, crop or vegetable production etc. will all have their own specificities to be captured. Without questioning the possibility of such computerisation in principle, it will still be a long way to realising it. Besides the fact that some ultimate limit to the information gathered will have to be accepted anyhow, the question may be whether this is indeed the best way to go.

Of course, the critical point here is not the fact that the digitised handling of information offers considerable advantages compared to paper- or e-mail-based communication. Nor is it the question of whether a system that is coherent by design (as is BCT) might technically be superior to one that is only made coherent by extra efforts organising respective data exchange between differing company databases. The question is whether the problem of asymmetric information can indeed be solved in this way. Indeed, a nominal lack of information may be overcome, but the information available may not be useful for the two sides of a market to the same extent. What is more, the enormous amount of information promised by this may actually lead to a self-defeating overflow; the cognitive capacity as well as the willingness of people to make use of information is limited. So far, BCT proponents have hardly addressed these questions.

As introduced in section, at this point in the real-world economy it is institutions that come into play, offsetting the violation of the axioms of complete information and rationality. This time the violation may not be due to a lack or a lopsided distribution of information, but due to an overflow of difficult to qualify information. Though not discussed – essentially not wanted – by its proponents, a workable application of BCT will nevertheless have to resort to institutions beyond private property. What is needed for well-informed and not too irrational decisions is consolidated and reliable information. Information is thereby not to be understood as an individual appendage linked to individually traded items, not as almost intrinsically given with this specific good, but as something generated as such and subsequently shared by traded items. Information can be made subject to quality-management programmes, with appropriate institutional settings allowing for the use of decreasing marginal costs. Information can thus be provided as a club or as a public good: certificates, norms, the use of a specific language, or information requirements imposed by food laws are

examples. Brand names in principle fulfil a similar purpose, while they are typically owned by private companies, which can be categorised as specific kinds of clubs. Product warranties – in substance legally enforceable compensation schemes for problems resulting from false information – set incentives for safeguarding announced quality standards.

Communicating information in a sensible way thus relies to a large extent on essentially social agreements, beginning with the establishment of generally accepted metrics in which the quality of a product can be described, all the way to third party intervention that can be called for conflict resolution. There is no way that BCT could be made workable without taking account of the essentially social foundations of efficient communication. Of course, ways may be found to reduce the cost of these systems, but it is obvious that many existing institutionalised information systems are more cost-efficient than strict peer-to-peer information systems. To borrow from Coase's famous paper on the nature of the firm: why, otherwise, would they have emerged as such? Measurability of products and peer-to-peer ways of communication as such may be given in principle, but practically be unrealistic, too cumbersome or simply too expensive.

Food safety is another issue to be addressed here, as it cannot be captured sensibly as matter individual importance. Food regulations are among the oldest institutions of human civilisation; many religious prescriptions relate to this. With food traded between increasingly anonymous partners, it became all too obvious that trust can be a rather fragile and possibly even a deceitfully used resource. Historically, first it was severe penalties that were intended to deter violations of food laws; this deterrence was gradually complemented – which may be recognised as the progress of civilisation – partly substituted by an ever closer system of administrative measures, building up trust in food safety of an impersonal, general character. Food safety became a public good.

Would BCT offer another step in this progress of civilisation? From the BCT proponents' perspective, food safety would actually no longer be such a problematic issue. Complete transparency would automatically lead to food safety, as unsafe food would no longer be marketable. The consumer, and all those participating in the food chain would have the respective information available. Traceability would be an inbuilt feature of the system. So the supply side would provide for the necessary trust in its own interest; suppliers themselves will make sure they are trusted.

Following purely economic criteria, it would simply be a decision between two competing systems. If the BCT system (including all kinds transaction cost) was indeed cheaper than current legislation and its respective enforcement, legislation could switch to enforcing the use of BCT as an obligatory tool for food chains. There is no doubt that the current system is an expensive one, but even if BCT were to be the economically preferable solution, its comprehensive implementation would remain a major challenge. For this, the situation in Romania would have to be scrutinised. A long-term plan could be developed.

Apart from the purely economic approach to decision making, one might reconsider what fundamental a switch to a BCT-based system would be like: food safety (a public good) would be replaced by safe food (private goods). As explained above in the theoretical part of this paper – along with the concept the IoT, or some introductory microeconomics – BCT is essentially concerned with and restricted to private goods. If what used to be food safety is left to BCT, it would no longer be a matter of public responsibility. Access to safe food would become a matter of individual purchasing power. Those unable to afford it would drop out. For now, cheap meat counters (in German it used to be called the *Freibank*), offering meat not matching the criteria of the official – with BCT private – veterinary post-mortem inspection, may seem to be a matter of the past in the developed countries. It is to be expected that this marketing option – not only for meat – would find its place again under a BCT system of only private goods. Keeping both systems going in order to avoid such a development

would not be Pareto optimal, and should thus not be considered as an option.

Considering all this, a caveat may be added: the social capacity to create and maintain institutions such as fairness, honesty, social cohesion and their concrete and modern expressions in the form of the respective policies may gradually erode as they are declared to be inefficient and better replaced by systems like BCT or the IoT. Such an erosion of what may be classified as the institutional capital of society will have effects going beyond FCM.

A place for blockchain technology in the food chain

In order not to waste the undoubtedly given potential of this technology, interfaces will have to be developed between the IoT world of BCT and the real world, being – as a matter of fact – full of cognitive incapacities and currently still underdeveloped digitisation. Thus the critical point is how, in what format and under what conditions information is fed into and released from BCT-supported food chains. The following paragraphs will be dedicated to this more concrete, but still theoretical cases.

To begin with a straightforward example: For the broiler production described by Chen and Xu [6], feeding data into the system should indeed be no problem. The problems begin with production processes that are less easily measurable, even more complex or cannot be considered as appropriate starting point of the chain. For the production of broilers one may thus well ask for the provenance of feedstuff, vaccines etc. One may ask for the integration of all the respective information into yet another block, prior to the block of broiler production. The farther this is taken, the more unrealistic it becomes. The "old technology" solution would instead rely on authorisation schemes, publicly negotiated and enforced, i.e. on institutions offsetting the "failure" of not having achieved perfect information. For food products this would primarily rely on the food regulations.

Of course, the impasse of an exponentially increasing volume of information has not been overlooked by the proponents of BCT. However, if solutions offered by institutions are considered at all, the existence of respective legal conditions continues to be considered rather as an additional bureaucratic nuisance than as an asset. Kshetri [12] acknowledges: "Addressing this challenge may be no small feat." At least Casey and Wong [5] give some accepting, but ultimately interest-oriented turn to the case. They see BCT as confronted with the existence of a complex array of regulations like maritime law and commercial codes governing rights of ownership in a multiplicity of jurisdictions. But instead of taking this as determined by public bodies, they propose the industry should take the lead in defining best practices and standards of technology as well as contract structures, making them applicable internationally, across jurisdictions. In brief, the design of institutions should follow business interests.

Etherum, alongside bitcoin another pioneer in BCT, soon saw the need to capture more in blocks than just information. Sample contracts should also be offered, making it possible to decide on a number of optional terms before fixing them. This corresponds to what is needed when institutions are also to be incorporated into blockchains, being constitutive for an interface. Nevertheless, when presenting its service, Etherum does not emphasise this as an institutional turn in BCT development, which would be of most interest here, but leaves it at what is typically seen as an advantage of BCT. So Etherum offers applications for "smart" contracting "that run exactly as programmed without any possibility of downtime, censorship, fraud or third-party interference." [18] While this statement discloses some of the libertarian impulse often encountered with IT specialists, matching the principle dismissal of public authority by private business, it nevertheless confirms the need for contracting. Even complex contracts can be concluded in the blockchain, with standard contracts being lodged there, serving as blueprints to be written out with specific content. In the same way, the "legal conditions" that Casey and Wong [5] refer to, i.e. laws and regulations, could be lodged in blocks, serving as building blocks for contracts. Technically, there is no

reason why the role of a third party, a public body or democratic principles underlying standards of contracts would have to be excluded from this.

While it may be no "small feat" (see above), the option of lodging laws and regulations in blocks may help to clarify the character of entrance points for block chains. Thus entrance points could be established not only for trivial cases with their easily verifiable criteria, but also for cases based on complex production processes, possibly overly complex bundles of inputs, or simply non-computerised farms, i.e. cases falling short of what blockchain technologists may presuppose as a state-of-*their*-art agriculture. In this way blockchains would not have to rely on fictional entrance points beginning seamlessly with primary, perfectly monitored production. It would rather be sufficient to begin and end with interfaces to the world of "old" technologies and institutions.

Now the critical question should no longer be whether standards (i.e. institutions) are needed at all. They are needed, as long as the world is not 100% shaped according to the ontology of BCT; and it never will be, if it is intended to persist. The critical question will rather be what guidance these standards are formulated under, which again predetermines by whom, to whom, and in what form they will be applied – or enforced if needed. Possible monopolisation of, or arbitrarily determined access to food chains, as well as lock-in situations may well occur and lead to losses of welfare. Anti-trust regulations will have to be in place to prevent this. The fact that market access may not be barred if Pareto efficiency is to be achieved is basic textbook economics. On the other hand, it is clear that only standards – which are selective and thus restrict access – can avoid adverse selection and an ultimate implosion of the respective market itself. So two opposing effects will have to be kept in productive balance. Inasmuch as standards may limit market access or lead to lock-in-situations etc. they are a matter of public concern and will have to be dealt with as such. So designing standards and thus defining entrance points to a system of food chains cannot be left to just one side of the entrance.

Beginning with a realistic entrance point – e.g. today's typical agrarian trade and warehouses – an important aspect will be the format in which data on products and production will have to be provided in order to qualify for a particular standard, possibly lodged as a certificate in the blockchain. Will it have to be most detailed information, amounting to a de facto electronic, real-time monitoring of production, or will a proven visit by a representative of a certifying organisation suffice? If it is detailed information, i.e. de facto "smart" farming, is presupposed, a potential bias towards farm size and thus enforced structural change will have to expected, calling for a prior technological impact assessment. Changing economies of scale will have to be scrutinised for each product group. Information technology might possibly be supportive for small producers, but it may also put them at a disadvantage. If standards were to be set by retailers or the processing industry ("taking the lead", as proposed by Casey and Wong [6], see also above), farmers may not have much of a choice. Farmers investing to make their products eligible for specific food chains may end up in a lock-in situation. So what will call for sober assessment is whether the cost of the expected disruption, i.e. of the sudden depreciation of earlier investments in equipment, software, training etc., can be covered otherwise. Textbook economics – following the Pareto criterion – considers compensations for farmers concerned. The question would be whether there is indeed an option to negotiate this and whether there are indeed sufficient extra profits available to compensate for losses.

Having now – at least conceptually – established defined and defining entrance points of the blockchain, additional information can be added to it, real-world-step-by-real-word-step, block-by-block. From this point onwards, advantage can be taken of the fact that these parts of the chain typically consist of industrial processing and logistics, which is much more suited to digitised organisation and documentation in the first

place. However, this part of the chain will also require critical attention. Inasmuch as the companies in the food chain rely on external service providers for the blockchain, the latter may build up a strong negotiating position vis-à-vis not only farmers, but also processors, wholesalers etc. Other than for producers of physical products, the axiomatic law of diminishing marginal productivity, safeguarding upward-sloping supply curves and thus the emergence of a market equilibrium, does not hold for IT services. The resulting tendency to monopolisation (as for farmers, queuing up at the entrance points) will call for a degree of scepticism with respect to the formation of markets under the auspices of BCT.

Finally, an interface is also needed for the exit point in the blockchain, transforming all the accumulated information into what consumers can find useful for their decisions. QR codes, just making all this information as such accessible by mobile phone apps, as envisaged by some BCT proponents, will not be up to the task.

"Old" technology solutions offer certificates, brand names, information on selected substances for consumers to base their decisions on. These systems are far from perfect. A longstanding debate on an excessive number of food labels, etc., i.e. the information overload that consumers are confronted with even in this way, makes their functionality questionable. What is more, the image, created and supported by commercials, will often override substance.

Here BCT can indeed contribute to a solution. For this, the possibly vast volume of information accumulated on the blockchain should be made available in a structured way. Based on this information, apps on a mobile phone or appropriate equipment on the retailers' shelves could check the information for compliance with any variety of seals or certification criteria. Personal profiles could be developed and used for this, but also simplified food labelling (e.g. just using "traffic lights", giving a rather rough indication for consumers to choose) could be provided in this way. (So, paradoxically, BCT might ultimately give a push to certification schemes – something that is typically regarded with contempt by its proponents.) Structured portraits could be generated for those seeking more information. In this way, one of the typical violations of neoclassical axioms – assuming the perfectly informed actor – caused by either an overload or a lack of information could be solved or at least be reduced.

A critical requirement of this is that the information available on the blockchain is indeed offered in a publicly available format. If, otherwise, access to the information remained a proprietary matter of specific wholesalers, retailers or the supporting IT companies only, the problem of asymmetric information would return, consumers would be left manipulated or possibly refrain from purchasing at all. Nothing short of general agreements on standards for public access to data will be needed to achieve the promised progress. Arguments referring to privacy policies put forward in this context will be no more than thinly camouflaged business interests. In concrete terms, consumers' organisations, fair-trade organisations, trade unions, the health ministry, anyone else, or any coalition of them, could actually "rent" a place (of some lines of code) in the final block. (How this could be organised technically should be left to experts. Possibly, the evaluation process would not be run within the last block itself, but may be triggered by providing the respective information and request to the cloud, or the evaluation would be done only once for a batch of products and stored as such in the block.) The consumer may select the preferred provider of an evaluation – possibly liable to some payment. The way in which typically private foundations or associations check and compare products for their quality may be exemplary for this: in Germany it is the Stiftung Warentest [29], in Austria the Verein für Konsumenteninformation [30], in the United Kingdom it is the Consumers' Association, known from *Which?* Magazine [39]. All of these are bipartisan organisations, meaning there are representatives of producers and consumers etc. on their boards. In any case, providing

this additional, processed information could be left to suppliers doing just that, offering this information on the retailer's shelf on the consumer's demand. With that, an additional marketplace for provision of information is created. Consumer organisations will "rent" their place there, like at a fair, like any other provider of information consumers might ask for. As one should not take the establishment of such a market for granted – the retailers will probably want to make use of their a priori given monopoly power – legislation may have to force them to do so. There is no possible argument that this would not bring the overall economy closer to its Pareto optimum.

For all that, and possibly to the disappointment of many blockchain proponents, what has been introduced above will bring BCT back into the world of private and public law, of third parties and public arbitrators. Only the careful development of institutions, i.e. in this case of appropriate standards, enforcing functionality of the interfaces as discussed, will offset the deficiencies of BCT with respect to social organisation. In a similar way, economics will have to go beyond its purely price-theory approach and incorporate into its analysis optional institutional settings in which BCT could be organised, and thus in which the price mechanism itself can indeed bring about optimal results. In very general terms, BCT and standard economics will both have to *overcome their ontology of things*. Also *institutions matter*, i.e. in this case standards for the interfaces between the real world and what may be manageable by BCT.

Situation and perspectives for Romania

Ultimately, all theoretical reasoning will have to be put to the empirical test. As developments in this field are rapid, and thus a proof of workability of BCT for FCM appears like going for a real-time experiment, this paper can only propose taking a closer look at existing efforts and actual options of the farmers and consumers concerned. For this, specific types of case can be identified here. Further work may then explore it in greater depth.

Criteria for the identification of specific types of case have been developed in the earlier parts of this paper. From the farmers' perspective, accessibility to the food chain is critical, and thus what will have to be to defined as interfaces between the blockchain and the "old" world of mostly non-digitised farming. In purely economic terms it would be the transaction cost that arises for participating in the "new" format of food chains compared to collecting and marketing via existing agricultural trade organisations, possibly supported by certification (labels organic farming, geographical indications etc.)

Table 1. Romanian farm structure 2016

	Number (000)	UAA (000)	AWU (000)	>50 hhc %
Total	3.422	12.503	1.588	2.956.380
Zero ha	80	0	25	73.720
Less than 2 ha	2.401	1.540	816	2.202.900
From 2 to 4,9 ha	660	2.049	416	539.530
From 5 to 9,9 ha	194	1.304	173	123.460
From 10 to 19,9 ha	50	666	60	15.160
From 20 to 29,9 ha	11	263	16	1.150
From 30 to 49,9 ha	8	289	13	350
From 50 to 99,9 ha	6	418	12	100
100 ha or over	12	5.973	57	10

Source: EC, Eurostat, retrieved 24 September 2018. UAA: Utilised agricultural area – '000 hectare, AWU: '000 Annual Work Units, >50 hhc: Farms whose household consumes more than 50% of the final production - number

It seems quite obvious that the upfront cost of digitisation is not affordable for most smaller farms, producing in rather traditional ways. What is more is the fact that with such anyhow limited digitisation the border with the "old", non-digitised world is shifted only by one step. Real compatibility with what makes BCT so attractive, namely for bigger investors, is provided by what is called "smart" farming, i.e. completely digitised farming. Thus the adoption of digitised farming technology is usually limited to large farms, as its high cost makes it not only unaffordable but often also just inappropriate for most smaller farmers. Elements of digitisation can especially be observed in the dairy farming, crop production and greenhouses. These techniques and technologies include GPS (global positioning systems), GIS (geographic information

systems), remote sensors to manage the use of water, fertilisers [38] and pesticides, as well as the use of drone monitoring systems. Dairy farmers in Romania (especially farms larger than 200 dairy cows) have adopted technologies for monitoring and sustaining cows' health and performance, such as positioning, precision feeding, automatic calf feeders, milk analysis and also heat detection, mastitis sensors, or temperature sensors [37]. Currently, the use of such technologies is still a matter of a number of pioneering farms, but it may shape the overall picture of commercial agriculture in Romania within just a few years.

For some farming sectors – possibly wine, some specific dairy products, and others – digitisation of their production may offer quite appreciable advantages, even if operating on a smaller scale. This option certainly deserves special attention and will have to be checked for each product group.

Another option may be given for *contract farmers*. As they are getting support for land preparation, seed, pest management, fertilisers, compound feed, etc. from agribusiness firms, to suit the requirements of BCT better than other farms. Such farming may also be dubbed "franchising", as farmers become franchisees, if only on their own land, while the franchisor can assure lower overall transaction costs. Today, the number of farmers in Romania following this pattern is relatively low. It is an option, most obviously for smaller farmers, producing eggs, poultry or pigs. For some medium and large-scale arable farms integrated into overall agribusiness in this way, the decision to do so is confirmed and reinforced by their investment strategy. Here the surplus is not used for diversification or for establishing any other value-adding activities on-farm, let alone for independent marketing activities. Instead it is typically used for to extend the current production pattern, i.e. purchasing more land and labour as the only factors this kind of farming critically contributes to the overall production process.

In any case, whether for poultry or crops, marketing and quality control of all inputs and outputs is left to the contracting partners as service providers, making use economies of scale in this area of the business. These economies are also based on technical and logistical capacities, as well as on the lower transaction costs associated with quantities much larger than individual farms could achieve, and of course also better negotiating positions. It is obvious that such an integration into a comprehensive organisation of production suits the requirements of FCM supported by BCT much more easily than any other, rather fragmented form of organisation. Whether this will also lead to an economic optimum, i.e. an alignment of resources with prices equilibrating marginal cost and productivity, will depend on the ability of farmers to select between competing contracting partners. Obviously there is a certain likelihood that the latter will be in a stronger position than the farmers.

Before the transformation began in Romania, the respective agri-business activities were under uniform state control; in Western European countries it was often dominated by cooperatives. Thus the situation for farmers will not really be new; the extent to which upstream and downstream partners could be described as efficient service providers or as all-powerful firms, squeezing farmers, is a long standing debate. The effect of digitisation will largely depend on the accessibility of a possibly larger number BCT-supported food chains. Anti-trust policies will be seen in charge of providing for competition between firms and technological options, whether centralised data management, or blockchain.

All farms that are integrated in a broader context of production and distribution, whether as contract farms or independently, will either produce only commodities, or they may – if higher value is to be achieved – opt for branded products. Typically, *brand names* (as a matter of intellectual property rights to be considered private goods) are owned and maintained not by agricultural units but rather by downstream processors or retailers. So it is to be expected that the extra margins will accrue to the latter. For farmers themselves, the situation is therefore not much different from supplying the market for commodities.

There is no reason to assume that this will change with introduction of BCT in Romania.
For farmers, the alternative to producing commodities is going for higher value-added products, which will then rely on *certification* such as *geographical indication* or *labels for organic production*. In contrast to brand names, these are classified as club goods. As long as the members of this club do not opt for a complete digitisation of their own production, which would include the option of digitised certification, they will have to strive for entrance points to BCT-supported food chains, that actually lodge the respective certificates as qualification for admission. This is where the dissimilarity between the genuine BCT world of big data on the one hand and the "old" world supported by institutions on the other calls for an interface. The BCT world relies solely on an ontology of things, whereas in the "old" world a role is attributed to institutions. The development of this interface is now a matter institution-building itself.
In Romania, there are four registered geographical indication schemes and six other designations are listed as applying. [cf. Table 2] As with all other product groups, it will have to be checked what advantages digitisation might offer for farmers in the production and the certification process. Again, this will depend on the kind of product and on the scale of production.

Table 2. Romanian designation schemes

Designation	Status	Type	Product Categrory
Salată cu icre de ştiucă de Tulcea	Applied	PGI	Fresh fish, molluscs, and crustaceans and …
Telemea de Sibiu	Applied	PGI	Cheeses
Scrumbie de Dunăre afumată	Published	PGI	Fresh fish, molluscs, and crustaceans and …
Caşcaval de Săveni	Applied	PGI	Cheeses
Novac afumat din Ţara Bârsei	Registered	PGI	Fresh fish, molluscs, and crustaceans and …
Magiun de Prune Topoloveni	Applied	PGI	Fruit, vegetables and cereals fresh or processe
Cârnaţi de Pleşcoi	Applied	PGI	Meat products (cooked, salted, smoked, etc.)
Telemea de Ibăneşti	Registered	PDO	Cheeses
Salam de Sibiu	Registered	PGI	Meat products (cooked, salted, smoked, etc.)
Magiun de prune Topoloveni	Registered	PGI	Fruit, vegetables and cereals fresh or processe

Source: EC, DOOR databank, Retrieved 18 September 2018.

Here, with trust built on institutions (certification) vs. trust built on digitised monitoring of production, the key question of the whole debate on the advantages of BCT (or SAP's and others' ways of digitised monitoring, for that matter) is clearly expressed: there are two competing trust-building mechanisms that differ from each other in principle. The degree of trust they achieve, and possibly also the differing levels of sympathy consumers will feel for them, are decisive. On the other hand, the respective cost they incur is critical to the consumers' decision. This can well be approached as typical case for transaction-cost analysis.
From an individual consumer's perspective, the critical question will be whether retailers offer information at the exit point of the food chain that indeed supports decision-making. As explained above, this final interface should not be defined in a proprietary way. Instead, the accumulated information should be accessible to all those who want to evaluate it according to any possible set of criteria that consumers may consider relevant for them. A market for this information, taking account of specific informational preferences of consumers. would be the keystone of the edifice of the whole digitisation exercise. As retailers may consider this to be interference in business affairs – which it is – legislation may be needed to enforce it. As food chains of the kind discussed here do not restrict themselves to national borders, the EU should be seen as responsible for providing a respective regulation.

CONCLUSIONS

Over the last two years, blockchain technology (BCT) has been presented by its proponents as a game changer not only for the finance industry, where it originated, but also for supply-chain management and – as considered in this paper – explicitly also for food-chain management (FCM). Indeed, only with respect to these new applications, would BCT be able to unfold its real strength.
In fact, BCT very much complies with the world of standard microeconomic textbooks, i.e. pure price theory. The expectations raised by its proponents, that BCT might generally help to overcome the need for institutions, third-party interventions etc., may find some reason in that institutions are often perceived as allowing only second-best solutions compared to an economy driven by price

alone. Information asymmetries as a recurrent violation of one of the microeconomic axioms would namely be overcome practically by design. Ultimately, it could indeed be left to prices to equilibrate individual utilities and resource scarcities.

In this sense BCT can claim to offer the ideal technical complement to market-economy optimism. However, when delving deeper into it and trying to apply it to more concrete and complex cases, the violation of micro-economic axioms and thus failures to achieve Pareto-optima turn out to be inescapable. The proposition that such failures could be overcome by BCT is clearly overstretched. Information asymmetries will continue to be a problem, if only in different forms; violations of the axioms of rationality, convexity etc. will also remain a matter of concern, while they are not even addressed by BCT proponents.

While recognising overshooting technological solutionism in what its proponents put forward, BCT may nevertheless find a productive place in FCM. This may be brought about by replacing the presupposition of fictional entrance points by clearly defined ones, serving as interfaces between a BCT-supported part of the food chain and the "old" world of primary production, limited cognitive capacities of consumers, foodregulations, certificates and other institutions. In order to optimise this, these interfaces should be based – like other institutions – on commonly agreed (or at least agreeable) standards. Accessibility is thereby guaranteed in principle, lock-in situations are to be avoided etc. As IT services show the characteristics of natural monopolies, anti-trust regulation will have to be put in place. Information accumulated at the very end of the food chain may not be proprietary. Instead, evaluation schemes would be lodged in the final block as an additional service, directly left to what consumers – possibly liable to payment – select as the preferred criteria for decision-making.

Some parts of the Romanian food and agribusiness may prove to be early adopters of BCT. This is mainly due to that fact that this sector is still in the process of reconstituting itself after the changes since 1989. Namely with respect to the production of agricultural commodities the new technology encounters favourable conditions, as large-scale farming also shaped large parts of the sector before 1989. On the other hand, it is the large number of small-scale farmers who may experience growing pressure from these changes. Their integration into digitised food chains will call for a set of appropriate institutions: agreed food standards, access to the food chain and anti-trust regulations will have to provide for options to safeguard their potential. While digitised food chains may indeed offer a wealth of information in support of consumer decision-making, it is again only food standards and appropriate evaluations that will really benefit consumers. Considering the integration of European food markets, there will need to be appropriate EU regulations to take account of this. More than in other countries, the public matter of food safety maybe overrun by an ill-considered approval of blockchain as a determining technology.

Summarising all this, the analysis conducted here suggests that *changing* technology may call for *changing* institutional settings, but that institutions will *not be made redundant* altogether. BCT will call for new institutional settings precisely to the extent that new kinds of market failures are to be observed. In some cases, the new settings may offer more leeway for the price mechanism to allocate resources, in others an optimal outcome will call for a more closely knit set of institutions defining the space in which the price mechanism can be put to full use. Contrary to what proponents of BCT suggest, this technology does not live up to the expectations they have raised, in just the same way – as has been shown –introductory microeconomics does not live up real-world problems. Institutions – i.e. contracts, certificates, anti-trust regulations etc. – and their enforcement by third-party intervention *matter*. Stated quite generally, developments of relative scarcity of resources, of technology, and of institutions always have to be well synchronised if harm is to be avoided. A food chain without an appropriate institutional framework will rather

leave the outcome biased in – possibly only relative – favour of the group pushing for it. On the other side of the spectrum, those relying existentially on food safety as public good would suffer most.

The Economist, 1 September 2018, dedicated a whole series of articles to BCT. It concluded that most attempts to make use of this technology remained tentative, if not disappointing. So "managing expectations" is said to be essential in continuing work on it, namely as much of what has surfaced so far has shown all characteristics of just another hype. Some proponents are quoted as saying: "We are but a few bright-eyed technologists with a special hammer, looking for the right nail." So, first of all, some sober expectation-management is needed. Whether BCT will ultimately find its proper place in FCM, whether it may possibly cause more disruption than create added value, or whether it will fade without trace remains to be seen. This paper has merely sought to contribute some consideration from the perspective of institutional economics.

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THE CORRELATION OF NUTRITION KNOWLEDGE AND JUNK FOOD CONSUMPTION FREQUENCY TOWARDS BODY MASS INDEX

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Abstract

Nutrition knowledge is one of the factors that lead to a change in behavior toward a modern lifestyle in choosing food. Changes in behavior toward the modern direction make consumers choose foods that are easy to find and processing is relatively short, such as consuming junk food. Good nutrition knowledge is expected to affect the consumption of good food so that it can lead to good nutrition status as well. The purpose of this research is to know the correlation between nutrition knowledge and frequency of junk food consumption towards the nutritional status of Unpad Faculty of Law students. The data collecting by using a questionnaire that is adapted to the aims of research and refers to the framework of concepts and theories that have been made. Data analysis through 2 stages that is univariate and bivariate analysis. Univariate analysis to describe the characteristics of the respondent, knowledge, and consumption habits of junk food. Bivariate analysis was done to determine the correlation of knowledge and junk food consumption frequency towards nutritional status. The knowledge aspect of junk food is 94% with good category and 3% who understand the nutrition knowledge of junk food. Based on the frequency of junk food consumption, obtained 46% respondent that often consume junk food, 8% normal and 46% rare. There is no significant influence towards nutritional knowledge with the Body Mass Index. Meanwhile, other result shows that there is no significant influence between the frequencies of junk food consumption with the Body Mass Index.

Key words**:** *body mass index, junk food, knowledge, nutrition*

INTRODUCTION

Rapid progress in the era of globalization has led to an increase in the level and quality of life of people living in urban and rural areas, resulting in a change in behaviour towards a modern lifestyle, such as in food scope, among others, high calorie, high fat, high cholesterol, high salt, low fibre, smoking, drinking alcohol and so on [4]. The development of-of the knowledge of nutrition is one of the factors that lead to behavioral changes toward a modern lifestyle in choosing food. The high nutritional knowledge of a person determines the attitude and behavior of choosing food, which determines whether or not one can understand the nutritional benefits of the food consumed.

Nutrition knowledge affects attitude and behavior in choosing food. Good nutrition knowledge is expected to affect the consumption of good food so that it can lead to good nutrition status as well. Inadequate knowledge of nutrition and errors in choosing food will affect the nutritional status [11]. Changes in behavior toward the modern, making consumers choose foods that are easy to find and food processing is relatively short, such as junk food. Consuming junk food especially in urban areas is certainly not a strange thing anymore, especially seen from the activity of the urban community is solid course choosing junk food as one of the promising choices to fill the stomach.

About 84% of teenagers have lunch or dinner in restaurants and some of which are in restaurants are girls and teenagers prefer junk food including in Indonesia. This happens due to technological and socio-economic developments that result in changes in the consumption patterns of junk food. Basically, people know the side effects of consuming junk food in excess, it's just that they often ignore it and do not pay attention to the

content that is in it. Junk food contains lots of fat and high cholesterol. In addition, it contains chemicals such as preservatives and artificial sweeteners that cause the accumulation of foreign substances in the body. Junk food does not contain vitamins, minerals, and nutrients and has an addictive substance as a flavor enhancer that can make the eaters become addicted when eating it [3]. The higher the contribution of junk food so there are high risk towards nutritional status.
Therefore, the correlation of knowledge and junk food consumption frequency towards the nutritional status which represented by the body mass index of the student are need to determined. Hopefully, the consumption of junk food and the disease risk can be minimize in the future. Data collection used in this study in the form of questionnaires given to respondents. Respondents in this study are The Law Faculty students of Universitas Padjajaran aged 20 to 23 years that located in the middle of the Bandung city. The environment around the campus certainly is a promising place for business in fulfilling daily life, such as the number of restaurants that are widespread in the environment. From snack foods to heavy meals and fast food are contained therein.

MATERIALS AND METHODS

The research has been done quantitatively, data obtained by using a cross-sectional design that is research is done where independent variable and dependent variable are taken at one time simultaneously [10]. Population in this research is a student of Faculty of Law Universitas Padjajaran Bandung. The research is done by a simple random sampling method through online questionnaire as many as 50 respondents.
The data collected by a questionnaire that is adapted to the aims of research and refers to the framework of concepts and theories that have been made. Closed questions given are concern weight, height, some questions about junk food knowledge, and the frequency of junk food consumption by respondents. Data were analyzed by univariate and bivariate analysis. Univariate analysis is an analysis that is done to analyze each variable from the result of research. Univariate analysis to describe the characteristics of the respondent, knowledge, and the habits in consumption of junk food. Bivariate analysis also done to determine the relationship of knowledge and junk food consumption frequency towards the nutritional status.

RESULTS AND DISCUSSIONS

This study used the knowledge and frequency of junk food consumption as comparison towards body mass index of the Faculty of Law students. From 50 respondents it can be known gender as follows:

Table 1. Respondents' distribution by gender

Gender	Frequency(n)	Percentage (%)
Female	30	60
Male	20	40
Total	50	100

Source: Own results.

The table above shows that the number of male respondents is 20 respondents (40%) and female respondents amounted to 30 respondents (60%). This is because the survey is done randomly so there are no restrictions based on gender.

Distribution of Respondents by Size of Anthropometry

-*Weight.* Based on the survey results on body weight measurement obtained average respondents is 57.81 kg, with a minimum value of 42 kg and a maximum value of 89 kg.

-*Height.* Based on survey results on height measurement obtained the average height of respondents is 163.96 cm, with a minimum value of 146 cm and a maximum value of 178 cm.

Junk Food Knowledge

Knowledge of junk food is something that is known about junk food, whether it is about the definition of junk food itself or its relationship with individuals who consume such health effects or anything else. Knowledge of junk food includes knowledge

about the selection and consumption of junk food well and provides all the nutrients needed for normal body function.

Table 2. Respondents' distribution based on junk food knowledge

Knowledge	Frequency (n)	Percentage (%)
Good (4-6)	47	94
Enough (3-4)	3	6
Less (1-2)	0	0

Source: Own results.

Based on Table 2, it can be seen that most of the respondents have good knowledge about Junk food (94%), knowledge of Junk food is enough (6%), and knowledge of Junk food is less (0%). This shows that most students have a good knowledge of Junk food. Good knowledge of students about Junk food, which means they understand what they consume. This is related to the notion of Junk food itself, examples of Junk food, and also the negative impact of Junk food itself.

The frequency of Junk Food Consumption

The frequency of junk food consumption is how often more and more nutritional examples and consumed junk food during the last 1 month consumed by students.

Table 3. Respondents' distribution based on Junk food consumption

Consumption	Frequency (n)	Percentage (%)
Often	23	46
Normal	4	8
Rare	23	46
Total	50	100

Source: Own results.

Based on table 3, it is seen that all respondents who often consume junk food by 8%, while the normal junk food consumes by 46%, and rarely consume junk food by 46%. The categories of junk food frequencies we provide have the option of 0, 1-2 times/month, 3-4 times/month, and 2-7 times/week and have 6 types of junk food i.e. Kentucky fried chicken, burger, pizza, pasta, fries, and nuggets.

This happens because most of them live in very strategic urban areas with junk food sales centers and easily accessible. In addition, junk food is a food that is well known if the layers of society, both urban or village society though. With tasty taste, tasty, cheap and practical causes most people, especially students of Law Faculty, Universitas Padjadjaran consume these foods to meet their basic needs of eating. While the remaining 46% (23) students answered rarely consume junk food, this is possible because they realize the dangers of junk food what if consumed continuously which can cause various diseases. Junk food contains addictive substances that can make the consumer can be addicted to what when it tasted. Therefore, a minority of the students never consume food that is rampant in circulation that is junk food.

Body Mass Index (BMI) Status

A person's Body Mass Index can be determined by comparing the results obtained from the examination with the existing standard values. In addition to the determination of nutritional status can also use the results of BMI calculations. BMI is one of the simplest anthropometric indices to monitor an adult body mass index over the age of 18, especially those associated with deficiency and overweight [12]. BMI is a measurement that compares weight with height. Although it is called an "index", the BMI is actually a ratio or ratio expressed as weight (in kilograms) divided by the square of the height (in meters) [9].

Table 4. Respondents' distribution based on Body Mass Index (BMI) Status

BMI Status	Frequency (n)	Percentage (%)
Skinny	7	14
Normal	37	74
Fat	4	8
Total	50	100

Source: Own results.

Based on Table 4, the results of the survey can be found out that the BMI status of the students of the Faculty of Law Unpad has various BMI status based on high relationship and weight. Where can be seen BMI status of skinny person counted 7 respondents (14%), normal person BMI status counted 37 respondents (74%), and status of fat BMI counted 4 respondents (8%). This indicates

that the students of Faculty of Law Unpad have an average of normal BMI status.

Knowledge and Frequency Relation with BMI

BMI is the state of the body which is the end result of the balance between the nutrients that enter the body and its use [6]. According to [2], BMI is a measure of a person's body condition that can be seen from the food consumed and the use of nutrients in the body. BMI is divided into three categories, namely the Body Mass Index is less, normal nutrition and more nutrition. Knowledge plays an important role in the formation of attitudes and actions. Knowledge of balanced nutrition is useful in determining what is consumed every day. Given the knowledge of balanced nutrition, the nutritional needs can be tailored to the needs that should, so as to achieve optimal health. The level of knowledge about a person's nutrients will affect his habits in choosing food.

The behavior of food consumption in adults needs to be considered. Because the food consumed will affect the Body Mass Index. Body Mass Index is formed from what foods are consumed. Deficiency and excess nutrients consumed will affect the metabolic processes in the body. If the intake of nutrients is consumed less then it will cause the body weakness due to lack of energy, decreased body resistance so easily sick and can experience less nutrition. Conversely, if the intake of nutrients consumed in excess will cause the build-up of energy that can trigger more nutrients.

Table 5. The correlation of knowledge towards BMI

Knowledge	BMI (%)			Total (%)
	Skinny	Normal	Fat	
Less	12.8	78.7	8.5	100
Enough	33.3	0	66.7	100
Good	14.0	74.0	12.0	100

Source: Own results.

Based on Table 5, it shows that of 47 respondents who have good nutrition knowledge has normal BMI of 35 respondents (74.0%), skinny BMI of 7 respondents (14.0%), and fat BMI of 5 respondents (12, 0%). The respondents who have enough nutritional knowledge have normal BMI of 0 respondents (0%), 1 person BMI skinny (33.3%), and fat BMI as much as 2 respondents (66.6%).

Table 6. Summary Output of correlation of junk food knowledge towards BMI

Regression Statistics	
Multiple R	0.328408
R Square	0.107852
Adjusted R Square	0.089265
Standard Error	0.565737
Observations	50

Source: Own results.

Based on the result of research, got the value of multiple R equal to 0.328 which mean level of correlation of linear relationship between knowledge of junk food to BMI equal to 32.8% and got value of r^2 equal to 0.108 which mean 10.8% Y value (junk food knowledge) influenced by X variable (BMI) or junk food knowledge relation factor to BMI is only 10.8%. This value is less than 1 so it can be concluded that is small influence between knowledge of nutrition with BMI respondent. Based on table 7, can be stated that knowledge junk food affects BMI.

Table 7. The knowledge correlation of junk food towards BMI

	df	*SS*	*MS*	*F*	***Sig. F***
Regression	1	1.857206	1.857206	5.802714	0.019888
Residual	48	15.36279	0,320058		
Total	49	17.22			

Source: Own results.

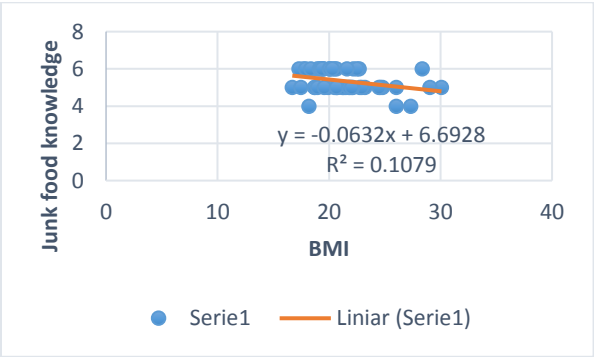

Fig 1. The knowledge correlation of junk food towards BMI
Source: Own results.

Based on the Fig.1, obtained regression equation y = -0.0632x + 6.6928 and seen that the distribution of respondents' knowledge of junk food to BMI is not linear. It is seen that the Body Mass Index is not only influenced by knowledge alone which is an indirect factor but also influenced by direct factors like infection and food consumption.

In general, a BMI assessment can be done directly and indirectly [1]. Assessment of Body Mass Index is directly divided into four methods, namely: anthropometry, biochemistry, biophysical and clinical. While indirectly divided into three methods, namely: food consumption survey, vital statistics and ecological factors.

Anthropometry is one way of direct assessment of Body Mass Index which is more often used because it is simple, practical and its implementation is relatively cheap and can be done on many people with a relatively short time. The use of anthropometry was conducted by the general public who received prior training [12].

Table 8. The correlation of consumption frequency towards BMI

Consumption	BMI (%)			Total (%)
	Skinny	Normal	Fat	
Rare	8.7	82.6	8.7	100
Normal	25.0	75.0	0	100
Often	8.7	78.3	13	100

Source: Own results.

Based on Table 8, it can be seen that from 23 respondents who frequently consume junk food has found 18 respondents (78.3%) have normal BMI, 2 respondents (8.7%) have skinny BMI, and fat BMI as many as 3 respondents (13%). There are 4 respondents whose frequency is normal in consuming junk food have normal BMI as much as 3 respondents (75.0%), BMI thin as much as 1 person (25.0%), and fat BMI 0 person. Of the 23 respondents whose frequency was rare in junk food consumption had normal BMI of 19 respondents (82.6%), fat BMI as many as 2 respondents (8.7%), and skinny BMI of 2 respondents (8.7%).

Based on the result of research, the value of multiple R equal to 0.068 which mean level of correlation of linear relationship between junk food knowledge towards BMI of 6.8% and the regression value of 0.0047 which mean 0.47% the frequency of junk food consumption (Y value) is determined by the value of the variable X (Body Mass Index). This value is less than 1 so it can be concluded that small influence between the frequency with BMI respondent.

Table 9. Summary Output of the junk food consumption correlation towards BMI

Regression Statistics	
Multiple R	0.068414
R Square	0.00468
Adjusted R Square	-0.01606
Standard Error	0.504464
Observations	50

Source: Own results.

Tabel 10. The junk food consumption correlation towards BMI

	df	*SS*	*MS*	*F*	*Sig. F*
Regression	1	0.057441	0.057441	0.225716	0.63687334
Residual	48	12.21522	0.254484		
Total	49	12.27266			

Source: Own results.

Based on Table 10, can be stated that the frequency of junk food consumption has no effect on BMI. The lack of correlation between the frequency of junk food consumption and BMI is due to many other factors affecting BMI such as infection, income, food availability, nutrition education, nutrition knowledge, social culture and physical activity.

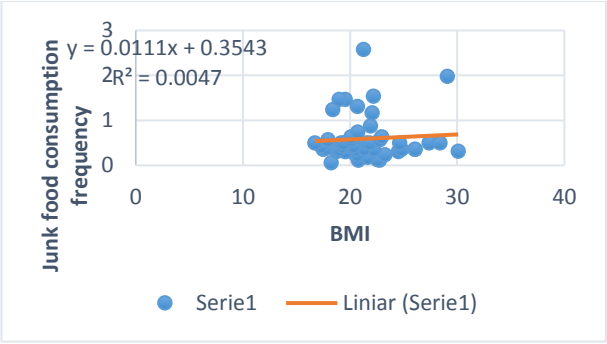

Fig. 2. Correlation of junk food consumption frequency towards BMI
Source: Own results.

Based on the graph above, obtained regression equation y = 0.0111x + 0.3543 and it appears that the distribution of respondents' knowledge of junk food to BMI is not linear. It is seen that BMI is not only influenced by knowledge alone which is an indirect factor but also influenced by direct factors like infection and food consumption.

Although the results of the frequency of consumption of junk food are not too big on BMI in students due to the wrong diet and also the influence of the surrounding environment, such as ease of access to buy junk food. In a study conducted by Darvishi et al in 2013, more nutritional percentages were found in adolescents who consumed junk food at least 6 times per day [7]. The high frequency of junk food consumption such as drinks and snacks (> 1x per day) can cause more nutrition. Opportunities for increased nutrition can reach up to 20.3% [13]. Another thing is also mentioned in research conducted by Bashkar in India in 2012, that in addition to junk food type of drinks and snacks, types of sweet foods such as cakes, biscuits, and syrups can also cause more nutrition. With a delicious taste, tasty, cheap and practical cause most people, especially students of Law Faculty, Universitas Padjadjaran consume these meals to meet the basic needs of eating. The tendency of students to eat junk food one of them because of the addictive substances contained in junk food can cause dependence. This addictive substance can cause over-eating and will increase the risk of more nutrients in children [5].

BMI in adults is influenced by many factors, one of which is the habit of consuming daily food. Eating habits are not influenced by the nutrients contained in food. But many factors that influence the formation of eating habits, one of which is the environment. Adults tend to pay less attention to food intake. Generally, adults prefer to consume fatty foods, energy savory and sweet. While fiber-rich foods such as vegetables and fruits are ignored. As a result, energy intake (calories) that enter into the excess body [8]. Yet at this age is recommended to consume foods high in fiber but low in fat, this is because growth and development are no longer happening and should fulfillment of nutrients centered for health maintenance in order to form a good BMI.

To reduce the danger of junk food can be done the following steps:

(i)Get used to breakfast and eat at home, because the home food is healthier and more nutritious. So before leaving for school or sightseeing, especially to the mall, try breakfast. Guaranteed, full stomach pocket intake was reduced.

(ii)If unable to stem the desire to eat junk food, buy the smallest portion. For example, in a frugal package, there are two pieces of chicken, better divided into two with friends. When buying ice cream, sodas or other menus, choose a small or regular size. Do not be tempted by additional toppings or spices. Because it can increase the content of calories in food.

(iii)For those who find it difficult to escape from junk food, drink water as much as possible. Although according to the recommendation is 8 glasses per day, drink more the better. Because water helps the disposal of all toxins in the body. Includes substances contained in junk food. Do not forget also to exercise regularly. At least three times a week, half to one hour a day. With exercise, the calories in the body will burn. The type of exercise that is done does not have to be heavy. Walk half an hour, better than hanging out in front of the tv.

Also, take advantage of junk food by eating vegetables and fruits. These two foods are high in fiber. Choose fruit that is easy to carry such as apples, pears, tomatoes, bananas, oranges, grapes, or strawberries. As soon as the hunger strikes, the fruit is full. This way will gradually become a positive habit. If it is already entrenched, junk food intake is reduced by itself. After successfully reducing junk food, increase the consumption of fiber contained in vegetables, fruits, and grains.

CONCLUSIONS

Of the 50 respondents consisting of 30 women and 20 men who came from students and students Faculty of Law, Universitas

Padjadjaran. Respondents had an average body weight of 57.81 kg, while the mean height was 163.96 cm. There are 94% of respondents that have good category know general definition of junk food and 6% are quite understand about the knowledge of junk food.

Based on junk food consumption frequency there are 46% who often consume junk food, normal 8% and 46% rarely eat junk food. Many who eat junk food because it is available in their location and rarely consume because the respondents have good junk food knowledge

BMI of 50 respondents is 74% normal, 8% fat and 14% thin. There are no significance influence on nutritional knowledge towards Body Mass Index of respondents because the results of the regression value are only 0.1. Meanwhile, the value of regression of frequency relationship with Body Mass Index of 0.06 where this value is very less than the number 1 so it can be concluded that not too big influence the relationship between the frequency with the Body Mass Index of respondents. Not influential junk food is caused because in analyzing the BMI must be taken into account all aspects of both the activity, the food consumed every day, the speed of metabolism and genetics in order to get a valid conclusion.

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FARMS COMPETITIVENESS IN SELECTED COUNTRIES OF CENTRAL AND EASTERN EUROPE

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Abstract

In the conditions of the modern economy, competitiveness is one of the most important components of the assessment of the position of a business in the market. Depending on the sector or industry, competition can take place on many levels, can have different character and varying severity. The problem of farm competition, which was defined as the farm's ability to grow, was addressed in the paper. This capacity was measured using the value of agricultural income generated by the agricultural holding. The competitiveness index (CI) by W. Kleinhans was used in the work. The index measures the real value of agricultural income to the value of own costs of production factors. The purpose of the research was to evaluate the competitiveness of farms from chosen countries of Central and Eastern Europe and to find out the determinants of competitiveness correlated to the production potential of farms, management efficiency and an investment activity. It was discovered that the competitiveness level of agricultural farms in the chosen countries of Central and Eastern Europe was characterized by a considerable diversity. The highest level of competitiveness characterized agricultural farms from the Czech Republic, and the lowest was achieved by agricultural farms in Slovakia. When analyze the impact of selected factors characterizing the production potential, management efficiency and investment activity of agricultural farms on the level of competitiveness, their varied impact resulting from the specificity of agriculture in a given country was found. The attention was also paid to the need to look for determinants of the competitiveness of farms in their surroundings.

Key words**:** *competitiveness, Competitiveness Index, efficiency, production potential, investments*

INTRODUCTION

Competitiveness is a term used in relation to enterprises, sectors, regions, countries, as well as supranational organizations. In the realities of the contemporary global economy, competitiveness becomes one of the main factors in an appraisal of the functioning of an enterprise in the market and determines its development opportunities.

The competitiveness of an enterprise is treated as a multidimensional category, defined by a set of factors such as: market share, share in basic market segments, an impact on the market, scale of operations, technologies used, resources possessed, skills and adaptability. The competitiveness of an enterprise is a multidimensional feature resulting from its internal conditions, but it is also shaped to a large extent by a set of environmental factors [6].

Measuring the competitiveness of an agricultural farm is often simplified and boils down to determining its competitive position by comparing its economic results with other farms under certain economic conditions. Taking into account the chain of causality and positive feedback in the form of long-term ability to affect of the competitive rank on future competitive potential and development opportunities, such simplification is justified.

In the work it has been assumed that the level of generated agricultural income determines the competitiveness of the farm. This narrowing of competitiveness is connected to the importance of agricultural income in shaping sustainable foundations for long-term growth and development. It is savings level that determines the agricultural income, which again largely determines the investments of farms. Subsequently, an increase in investment induces a rise in the value of tangible fixed assets, which in turn enhances

the production potential, volume of output, changes the relations of factors of production, and in particular improves the relation of capital to work, which induces increase in labour productivity, which is a condition for the increase of value agricultural income, which then it can transform into savings and successive investments outlays. Therefore, the amount of agricultural income generated not only ensures satisfaction with running a farm, but also guarantees the maintenance of competitiveness and is fundamental to the developmental capacity and growth, as well as the agriculture modernization.

MATERIALS AND METHODS

The purpose of the research was an evaluation of competitiveness of farms from chosen countries of Central and Eastern Europe (the Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria) and the determination of competitiveness determinants related to the production potential of farms, management efficiency and an investment activity.

The object of the research was agricultural farms embraced by the FADN (*Farm Accountancy Data Network*) monitoring system. The analysis period covered the years 2011-2015.

In order to determine the competitiveness of farms, the competitiveness index (*CI*) was used following W. Kleinhans [1].

The following formula is applied to measure competitiveness:

$$CI = \frac{FNI_c}{OC_{fw} + OC_{ol} + OC_{oc}}$$

where:

- *CI* – Competitiveness Index of farms from a given country,
- FNI_c – average value of Farm Net Income (*FNI*) of farms from a given country (*c*),
- *OC* – opportunity costs for own factors of production held at a farms in a given country: OC_{fw} work of family members (*fw*), own agricultural land (*ol*) and own capital (*oc*).

The value of $CI \geq 1$ points to at least full coverage of the opportunity costs of factors of production, while $CI < 1$ features their incomplete coverage.

The analysis adopts further classification of the Competitiveness Index (*CI*) value which differentiates the following classes:

- *CI* (-) value in case of negative *FNI* index (*CI*),
- $0 \leq CI < 1$ partial coverage (*CI*),
- $1 \leq CI < 2$ full coverage: 100% or more (*CI*),
- $CI \geq 2$ coverage of 200% and more % (*CI*).

The *FNI* index is taken directly from FADN data, while opportunity costs (*OC*) come from the costs of external factors and are aggregated by countries:

- OC_{ol} (opportunity costs of own land) based on the rent on leased land,
- OC_{fw} (opportunity costs of family labour) calculated based on the costs of work of paid employees,
- OC_{oc} (opportunity costs of own capital) based on the interest rates (apart from lands).

The study assumes that competitiveness is a capacity of a farm to growth and development. Such a farm's ability is achieved when its agricultural income (*FNI*) is twice as large as the costs of its own production factors. This approach differs from the traditional definition of competitiveness as achieving an advantage (cost, price, market share, etc.) in relation to competitors. The traditional approach to define competitiveness for farms may raise certain reservations, as agricultural farms do not compete in the global, European market. Other companies from other agribusiness chains (commercial and production companies) compete in these markets. For this reason, determining competitiveness as the ability to sustainably develop in a market economy seems reasonable [7].

RESULTS AND DISCUSSIONS

The data on the competitiveness of farms from selected Central and Eastern European countries is featured in Table 1. The data shows that the highest level of competitiveness (*CI*) was recorded in

agricultural farms in the Czech Republic, where competitiveness ratios in the analyzed period took values in the range $1 \leq CI < 2$ (*CI*). Also for Hungary the average value of the competitiveness index (*CI*) in period 2011-2015 was in the scope of $1 \leq CI < 2$ (table 1). However, for Hungary, the competitiveness index in 2012 and 2013 only allowed partial coverage of the opportunity cost of production factors ($0 \leq CI < 1$). Competitiveness Index (*CI*) for Bulgarian farms in the analyzed period assumed values close to 1, which also indicated a significant competitive potential. In turn, the competitiveness (Competitiveness Index – *CI*) of farms in Poland (*CI*=0.69) and Romania (*CI*=0.65) was at a similar level. The obtained farm net income (*FNI*) in these two countries allowed only the partial covering of the opportunity costs of own production factors (*OC*). The lowest level of competitiveness was characterized by agricultural management in Slovakia. In this case, agricultural income (*FNI*) allowed only partial coverage of own production costs (*OC*), while the Competitiveness Index (*CI*) in 2012 and 2013 assumed negative values.

Table 1. Competitiveness Index (*CI*)

Country	Year					Average
	2011	2012	2013	2014	2015	
Czech Republic	1.38	1.28	1.27	1.59	1.06	1.32
Slovakia	0.38	-0.19	-0.15	0.64	0.76	0.29
Hungary	1.59	0.31	0.35	1.56	1.23	1.01
Poland	0.83	0.81	0.70	0.57	0.52	0.69
Romania	0.67	0.68	0.70	0.67	0.51	0.65
Bulgaria	0.95	0.88	1.02	1.05	0.92	0.96

Source: Own calculation on the basis of data from FADN

The group of factors of an exogenous and endogenous nature decides about the level of competitiveness of farms. Among the exogenous factors, the most important factors will be economic ones (such as: an economic growth rate, an income level of the population, inflation, prices of the available factors of production and their relations, unemployment, economic situation, interest rates, tax rates, exchange rates, international trade, the situation of public finances, etc.) and institutional conditions (organizations, standards, regulations, agricultural policy). In turn, among endogenous factors, the attention is paid to the volume of agriculture output generated by farm, the relations of production factors (techniques of production) and the economics effectiveness. In the paper the focus was paid to endogenous factors, being aware that a large part of endogenous factors depend on exogenous ones (e.g. the effectiveness of farming depends not only on the farmer's skills, but as well depends on the level of prices of food and agricultural products and goods purchased by farms; relations of production factors are not only conditioned by the method of organizing the farm, but they are primarily the resultant of the price relations of the available production factors).

A study of the farms production potential in selected countries indicates their considerable variation (Table 2). The farms from Slovakia and the Czech Republic were characterized by a particularly large production potential (expressed in the economic size, total utilized agricultural of area and total labour input). The differences between the analyzed countries were significant. In the analyzed period (2011-2015), the average utilised agricultural area in Slovakia was 52.28 ha U.A.A., in the Czech Republic it was 207.2 ha U.A.A. (Table 2). In other countries, the average utilised agricultural area was significantly smaller. In Hungary, 49.8 ha U.A.A., in Bulgaria 38.4 ha U.A.A., in Poland 18.6 ha U.A.A. and in Romania only 9.6 ha U.A.A. The effect of differences in the average utilised agricultural area were also significant distance between farms from analyzed countries in the production potential assessed by the economic size. The highest value of the economic size was noted for agricultural holdings in Slovakia and the Czech Republic, and the smallest values in Romania and Poland. In addition, there was a different level of use of external factors of production. The smallest percentage of rented U.A.A. occurred in Poland (26.5%), in other countries it ranged from 54.9% to 93.7%. The share of hired employees in labour resources was also the least important in Poland and Romania. The agricultural farms in Slovakia were characterized by a particularly high level of involvement of waged labour. Similarly,

the involvement of foreign capital in the financing of agricultural farms was the smallest in Poland and Romania. In addition to the production potential expressed in a quantitative and valuable sense, the mutual relations of production factors are very important, because they define the applied production technique, but also the value and structure of production costs and profitability of agriculture output [2, 3, 4]. For agriculture, two kinds of relationships are very significant: (i) labour and capital inputs in ratio to the utilised agricultural area; (ii) utilised agricultural area and capital in ratio to the labour. The first type of dependence is used to evaluation the so-called intensity of agricultural production or technical equipment of agricultural land. The second type of indicator is, in turn, the estimate of work equipment (employed in agriculture) in the ground (utilised agricultural area) and other means of production, especially technical ones (tangible fixed assets).

Table 2. Production potential of farms (average for 2011–2015)

Variables	Country					
	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Economic size	245.4	432.8	54.0	27.1	9.6	31.3
Total Utilised Agricultural Area [ha]	207.2	527.8	49.8	18.6	9.4	38.4
Rented U.A.A. [%]	80.3	93.7	62.1	26.5	54.9	87.5
Total labour input [AWU]	5.8	13.1	1.6	1.7	1.2	2.4
Share of hired work in total work [%]	77.4	93.3	59.2	13.0	10.9	51.7
Number of employees AWU/100 ha U.A.A.	2.8	2.5	3.3	9.1	12.7	6.4
The value of fixed assets per one employee [thous. EURO/AWU]	93.4	44.7	68.8	84.8	23.1	25.8
The value of fixed assets per 1 ha of U.A.A. [thous. EURO]	2.6	1.1	2.2	7.7	2.9	1.7
Share of total debts in liabilities [%]	25.6	22.8	17.4	6.0	2.6	20.0

Source: Own calculation on the basis of data from FADN

The highest employment level per 100 ha U.A.A. farms in Romania, Poland and Bulgaria were characterized (Table 2). In turn, the highest value of fixed assets per one employed person was found in agricultural holdings in the Czech Republic and Poland.
The lowest level of these ratios was recorded in Romania and Bulgaria. Similar diversification related to the level of fixed assets in thousand euro per 1 ha of U.A.A. The highest level of this ratio was recorded in Poland, while in other countries this ratio was much lower. This diversification of the farm equipment level in production factors and their mutual relations may also, as a consequence, determine the competitiveness level. In the further part of the analysis, the attention was paid to the effectiveness of farms in individual countries. The results of calculations are shown in Table 3. The efficiency of management and the level of cost-consuming production (Total specific costs/Total output and Total specific costs per 1 ha U.A.A) was diversified between the analyzed countries. It is worth taking notice the importance of the balance of subsidies and taxes for operating activities in shaping farm income. This was presented by the share of subsidies and taxes in Farm Net Value Added (Table 3).

Table 3. Economic efficiency of farms (average for 2011–2015)

Variables	Country					
	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Profitability of production (Total output/Total input) [%]	0.89	0.80	1.04	1.17	1.44	0.99
Total specific costs per 1 ha U.A.A.	647.5	517.8	621.5	681.7	398.5	381.6
Total specific costs/Total output	0.44	0.48	0.43	0.43	0.32	0.37
Total output/AWU [thous. EURO]	52.2	43.3	44.1	17.4	9.9	16.4
Total output/1 ha U.A.A. [thous. EURO]	1.49	1.12	1.51	1.53	1.21	1.01
Total output/Total assets [EURO/100 EURO]	40.6	55.2	40.3	18.3	32.4	43.7
Family Farm Income/FWU	18.4	16.5	22.9	6.3	4.1	4.4
Farm Net Income /1 ha U.A.A	231.3	22.8	392.5	517.2	543.6	227.8
Farm Net Income /Net worth [%]	8.7	1.6	13.3	6.4	14.4	12.1
Share of balance current subsidies & taxes in Farm Net Value Added	66.5	86.2	49.2	45.9	23.4	43.1

Source: Own calculation on the basis of data from FADN

It is noticeable that agricultural support instruments applied under the common EU agricultural policy are of great importance in shaping agricultural income, especially in Slovakia and the Czech Republic.

Despite the fact that farms from these two countries present much greater production potential, their ability to create income without public aid is much smaller than in other countries. The smallest share of subsidies in the net value added farm took place in Romania. This institutional factor also seems to be an important element shaping the level of competitiveness of farms.

The analysis also drew attention to the investment activity of farms (Table 4). This activity, as well as the previously analyzed production potential and efficiency of management, varied. The smallest scale of completed investments was characterized by agricultural management in Romania, in particular a low investment level per one employee and per 1 ha of U.A.A. Important information about the development possibilities of a farm is also the renewal rate of fixed assets, computed as the ratio of gross investment outlay to the fixed assets [5].

Table 4. Investment activity of farms (average for 2011–2015)

Variables	Country					
	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Gross Investment [EURO]	53,057.4	98,914.8	8,683.8	4,153.2	484.8	8,228.0
Net Investment [EURO]	18,010.4	9,951.2	2,477.0	-463.8	-741	3,200.4
Gross Investment/Total labour input [EURO/AWU]	9,096.2	7,547.4	5,349.3	2,454.7	406.5	3,390.2
Gross Investment /U.A.A. [EURO/ha]	256.5	186.8	174.6	223.2	51.9	214.0
Fixed assets renewal ratio [%]	9.9	17.5	7.8	2.9	1.7	13.9

Source: Own calculation on the basis of data from FADN

Same to the previously evaluated investment activity (investment level per one employee and per 1 ha of U.A.A), the value of this ratio in farms in Romania was definitely lower than in other countries. Differentiation of farmers' investment activity may in the future decide not only about the production capacity, but also the efficiency of management, the level of modernity of the production workshop, the quality of manufactured products, which in turn may lead to further diversification of competitiveness of agricultural in the analyzed countries and to deepen development differences.

In order to determine the relationship between the competitiveness ratios of farms, their production potential, economic efficiency and investment activity, a statistical analysis was made. As for the interdependencies between the competitiveness index (*CI*) and the production potential, it was found that the statistically significant production potential determined the competitiveness of agricultural farms in Poland.

Table 5. R – Spearman correlation coefficients between variables Competitiveness Index (*CI*) and variables characterizing production potential of farms

Variables	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Economic size	-0.645	0.589	-0.230	-0.659	0.313	0.056
Total Utilised Agricultural Area	0.119	0.347	0.705	0.687*	0.429	0.586
Rented U.A.A.	0.297	-0.740	-0.286	0.944*	-0.727	-0.147
Total labour input	0.111	-0.150	0.757	0.978*	0.550	-0.309
Share of hired work in total work	0.059	0.838	-0.507	0.918*	0.530	0.477
Number of employees AWU/100 ha U.A.A.	-0.004	-0.625	0.609	0.895*	0.639	-0.555
The value of fixed assets per one employee	-0.175	0.837	-0.277	-0.99*	-0.771	-0.751
The value of fixed assets per 1 ha of U.A.A.	-0.157	0.862	-0.227	-0.988*	-0.729	-0.759
Share of total debts in liabilities	0.026	0.887*	0.536	0.857	-0.924*	0.790

* significant for $p<0,05$

Source: Own calculation on the basis of data from FADN

Along with an increase in the production potential expressed in terms of total utilized

agricultural area (R - Spearman = 0.687), increased importance of land lease (R - Spearman = 0.944), a growth in labour resources (R - Spearman = 0.978) and the share of hired employees in labour inputs (R - Spearman = 0.918), the level of employees per 100 ha of U.A.A. (R - Spearman = 0.895) the competitiveness index was significantly higher (Table 5).

In turn, the increase in technical equipment of labor in agriculture (R - Spearman=-0.99) and technical equipment of agricultural land (R - Spearman = -0.988) was negatively correlated with the index of competitiveness of farms (*CI*) in Poland. For Romania and Slovakia, only the share of total liabilities in financing the assets of farms statistically significantly influenced on the farms competitiveness level. In Romania, this relationship was negative (R - Spearman = -0.924), while in Slovakia it was positive (R - Spearman = 0.887).

Table 6. R – Spearman correlation coefficients between variables Competitiveness Index (*CI*) and variables characterizing economic efficiency of farms

Variables	Country					
	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Profitability of production	0.915*	0.927*	0.225	0.972*	0.980*	-0.505
Total specific costs per 1 ha U.A.A.	-0.297	0.871	0.136	-0.667	0.051	0.258
Total specific costs/Total output	-0.440	0.734	0.102	-0.943*	-0.428	0.523
Total output/AWU	0.135	0.872	0.028	0.099	-0.243	0.366
Total output/1 ha U.A.A.	0.246	0.929*	0.179	0.685	0.497	-0.632
Total output/Total assets	0.246	-0.560	0.570	0.995*	0.412	0.768
Family Farm Income/FWU	0.820	0.793	-0.083	0.995*	0.562*	0.222
Farm Net Income /1 ha U.A.A	0.932*	0.999*	0.327	0.992*	0.993*	-0.820
Farm Net Income /Net worth	0.675	0.997*	0.502	0.996*	0.960	0.684
Share of balance current subsidies & taxes in Farm Net Value Added	-0.751	-0.896*	-0.173	-0.851	0.628	0.481

* significant for $p<0,05$

Source: Own calculation on the basis of data from FADN

For Bulgaria, Hungary and the Czech Republic, there were no statistically significant relationships between the production potential and the farms competitiveness level (Table 5).

A further analysis of the competitiveness (Competitiveness Index) determinants concerned its relation to the economic efficiency (Table 6). For Bulgaria, Hungary there were no statistically significant relationships between the economic efficiency and the competitiveness of farms. For the Czech Republic, the profitability (R - Spearman = 0.915) and profitability land ratio (R - Spearman = 0.932) positively influenced on the competitiveness ratios. Similarly, in the case of farms in Romania, the profitability of agricultural production (R - Spearman = 0.980), the profitability of land (R - Spearman = 0.993), and the level of family farm income/FWU (R - Spearman = 0.562) had a positive influence on the farms competitiveness (*CI*). For Poland and Slovakia, there was a greater number of determinants showing the competitiveness level of agricultural enterprises. For Poland, statistically significant positive dependences were found between the competitiveness index (*CI*) and profitability of agricultural production (Total output/Total input) (R - Spearman = 0.972), productivity of fixed assets (R - Spearman = 0.995), family work profitability (FWU - Family Work Unit) (R - Spearman = 0.995), profitability of land (R - Spearman = 0.992) and return on equity (Farm Net Income /Net worth) (R - Spearman = 0.996). A significantly negative statistical dependence in Poland was noted for the relationship between competitiveness (*CI*) and cost-efficiency of production (Total specific costs/Total output) (R - Spearman = -0.943). In turn, in Slovakia, the farms competitiveness was shaped by a different set of factors. The statistically significant positive influence on the level of competitiveness was the profitability of agricultural production (R - Spearman = 0.915), land productivity (R - Spearman = 0.929) and land profitability (R - Spearman = 0.999). For Slovakia, the share of the balance of subsidies and taxes in the net value added farm (R - Spearman = -0.896) in

shaping the competitiveness index was negative. There was no statistically significant impact of investment activity on the competitiveness index of farms (*CI*) in the analyzed countries.

In the case of interdependencies between the competitiveness index (*CI*) and investment activity, it was not found that the statistically significant correlation (Table 7).

The analysis carried out shows a varied degree of impact of endogenous factors on the competitiveness index (*CI*) of farms. This diversification may result from regional disproportions in the level of agricultural development between the analyzed countries, as well as result from differences in the institutional environment of agriculture and the economic situation concerning the economies of individual countries.

Table 7. R – Spearman correlation coefficients between variables Competitiveness Index (*CI*) and variables characterizing investment activity of farms

Variables	Country					
	The Czech Republic	Slovakia	Hungary	Poland	Romania	Bulgaria
Gross Investment	0.242	0.530	0.435	0.464	-0.345	0.410
Net Investment	0.398	0.178	0.383	0.719	-0.187	0.029
Gross Investment/Total labour input	0.168	0.635	0.271	0.380	-0.456	0.398
Gross Investment /U.A.A.	0.136	0.510	0.293	0.442	-0.389	0.050
Fixed assets renewal ratio	0.329	-0.486	0.444	0.669	-0.312	0.645

* significant for $p<0,05$

Source: Own calculation on the basis of data from FADN

CONCLUSIONS

The competitiveness level (*CI* - Competitiveness Index) of agricultural holdings in the examined countries of Central and Eastern Europe was characterized by a considerable diversity. The highest level of competitiveness was characteristic for agricultural farms from the Czech Republic (where competitiveness ratios in the analyzed period took values in the range $1\leq CI <2$). In turn, the lowest competitiveness level was observed in agricultural farms in Slovakia (where average Competitiveness Index took values in the range $0\leq CI <1$). In these two countries agricultural farms were characterized by a much larger production potential than in other countries. Despite this, the agricultural management in Slovakia could not achieve high competitiveness ratios. It may be related to the existence of the optimal size of a farm. The desire to increase the scale of production has its limits resulting from the limitations of management.

While analyzing the impact of selected factors characterizing the production potential, management efficiency and investment outlay of farms on the level of competitiveness, their varied impact resulting from the specificity of agriculture in a given country was found. In Bulgaria and Hungary, there was no statistically significant influence of selected factors that characterize agricultural farms on their competitiveness level (Competitiveness Index). The highest number of endogenous factors connected with production potential and farms organization that determined the competitiveness level was recorded in Poland. The diversity and the lack of statistically significant impact of the analyzed determinants on the competitiveness (*CI* - Competitiveness Index) of the surveyed farms indicate the need to identify them in the surroundings of farms, but also the necessity to pay attention to aspects related to the farms organization.

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ECONOMIC AND MATHEMATICAL RESEARCH OF THE RURAL TERRITORIES DEVELOPMENT IN RUSSIA

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Abstract

In the article the works of Russian and international scientists devoted to the solution of problems of the countryside territories development are being analyzed. The conducted research made it possible to identify the main trends in development of Russia's rural areas and in the leading countries of the world as well. The article analyzes the prevailing support level needed for Russia's rural development. Also it presents the dynamism of main indicators of Russia's countryside evolution. The authors identify regions of Russia with low and high rates of rural evolvement. Influencing factors are being revealed. The study offers a mathematical model for the rural areas advance in both medium- and long-term perspectives. The authors make a forecast for Russia's rural areas progress until 2050. The article concludes that it is necessary to concentrate processing industries in rural areas, as well as to create new jobs, to reduce people outflow from rural areas, and to stimulate the development of efficient production in the agricultural sector of the Russian economy.

Key words**:** *rural areas, economic development, agriculture, land use, agricultural economics, institutional reform*

INTRODUCTION

Russia's land area is the largest in the world. The total area of the country is more than 17 million square kilometers, including agricultural land of 191.3 million hectares [12]. The great length of the country and its size predetermined the specifics of the rural areas progress. The current state of the Russian economy and its level also affects the rural advance dynamics. Throughout the history of the Russian state, the government has paid special attention to the well-being of the countryside. Rural territories are the basic units of the agrarian segment of the country's economy, its central link. The extent to which rural areas are developed depends on the overall degree of agriculture. As a rule, the higher the scale of economy, the higher the scale of the countryside progress. In most countries of the world, including Russia, the problem of sustainable progress of the countryside is given the highest priority. This, first of all, is due to the fact that in rural areas there live a significant number of Russia's residents - about 38 million people. It is more than 25% of the country's total population. 6.2 million people are directly employed in agricultural production [12]. Various programs are being developed and adopted for the rural areas at all the levels including federal, regional and local. In rural areas, the production capacities of agriculture are concentrated, as well as large processing industries in many countries of the world. Another task of the countryside is the provision of manpower for agricultural production. Another equally important problem in the development of areas under study is the maintenance and development of the existing ecological systems. The changes taking place in Russia's economy are due to the natural processes of the world economy development, primarily the cyclical development [9, 14], as well as factors related to political processes. They pointed out the

importance of the problem being studied, both for the Russian economy and for the world economy.

MATERIALS AND METHODS

The conceptual basis of the study is the work of prominent scientists of Russian and international science [1-10, 13-15, 18, 20]. The study uses elements of the theory of spatial development, the theory of effective development, mathematical modeling of socio-economic processes, probability theory. The main research methods in the economic part are the abstract-logical method, computational-constructive, graphic, monographic, economic-statistical methods.

In the mathematical part of the study, when constructing the economic-mathematical model and calculating the predicted values of the studied indicators, we applied mathematical methods of modelling and forecasting, such as the method of growth curve models, a graphical method for selecting a regression equation describing a model based on empirical data, estimating the accuracy of the forecast by correlation and regression analysis. The relationship between the empirical items in the study was checked for linear or nonlinear dependencies (polynomial, exponential, logarithmic, hyperbolic). Choice of the approximating function was determined by the highest correlation index, and accuracy of prediction was determined by the smallest approximation error. To eliminate the error from the point estimate of the forecast of the calculated indicators we used the confidence interval.

RESULTS AND DISCUSSIONS

The twenty-first century world economy shows a tendency of slowdown in the pace of its development [19], which was especially evident during the periods of the world economic crises of 1998 and 2008. Analysis of the leading foreign countries development in the agrarian sector made it possible to identify a number of basic trends. Thus, studies [2, 5, 13] stress the importance of accelerated development of the countryside on the basis of small family farms formation (USA, England, France). Many countries (China, Brazil, India) give preference to the development of large-scale industries and, at the expense of this, stimulating the rural areas growth [4, 20]. In many developing countries (Africa, Southeast Asia), preference is given to the rural areas progress through cooperation and the division of labor [1, 3, 7, 8]. In Russia, the progress of the countryside has its own specifics, due to the specifics of the country's general political and economic development [15].

The main objective of the Russia's rural areas development is to create comfortable conditions for agricultural activities, reduce the outflow of rural population from rural areas, develop engineering, production and social infrastructure in rural areas, increase rural incomes and longevity, and stimulate rural business activity on the basis of the peasant farms progress.

Total amount of funds allocated for the countryside development of Russia in 2015 amounted to 540.91 million US dollars (Fig. 1), while the increase in resources allocated for the same goal by 2020 which is twice as much as before (to 1,157.06 mln US dollars). In the structure of funds, the largest share is taken by the regional budgets, their share varies from 43 to 53 percent.

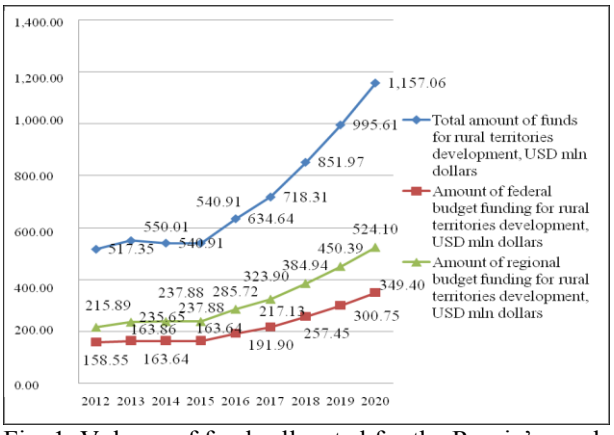

Fig. 1. Volume of funds allocated for the Russia's rural areas development, US $ million, calculated by the authors on the data basis [16]

In the structure of allocated funds for the Russia's rural areas (Fig. 2), the largest share is taken by measures to improve the living

conditions of more than 46% and the extension of a network of highways about 22 percent. Other equally important areas of spending are financing for further gasification, water supply, building of rural schools.

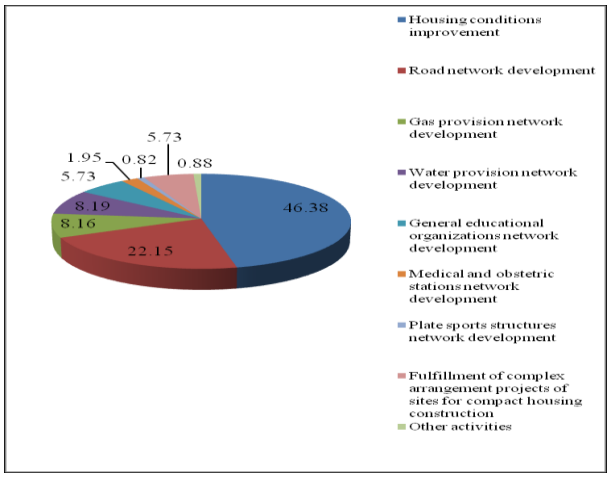

Fig. 2. Structure of the funds for Russia's rural areas in 2015, %, calculated by the authors on the data basis [11]

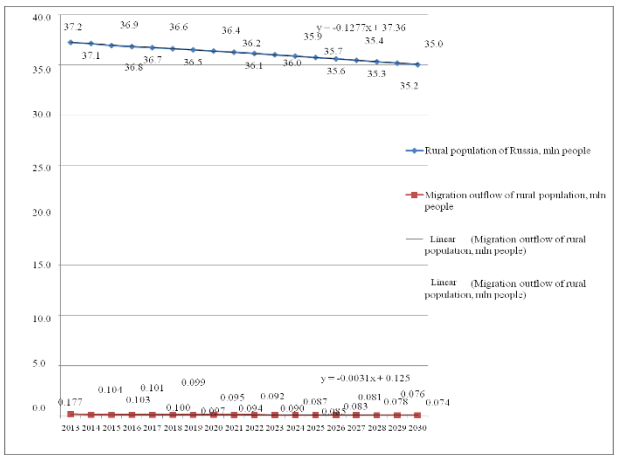

Fig. 3. Number of people and migration outflow out of rural areas in Russia in 2013-2030, mln people, calculated by the authors on the data basis [17]

Meanwhile, in Russia, as in many leading foreign countries [3; 5], there is a movement of people away from rural areas (Fig. 3). This is probably the most important reason for the need for a radical change in approaches to Russia's rural growth. In the adopted «Strategy for Development of Rural Territories of the Russian Federation for the period up to 2030» [17], the outflow parameters of the population from rural areas have been determined (Fig. 3). These measures allow to concentrate a large part of the country's human resources of about 35 million people in the countryside and significantly reduce the rural population outflow.

Table 1 presents main indicators of the areas under study development, the criterion indicators are the housing commissioning, general education organizations, medical and obstetric stations, gas networks and water pipes. In the Russian Federation, despite the reduction in the funding of some programs, the financing of rural development has remained virtually unchanged. That allowed to save volumes of housing commissioning in rural areas and other key areas of further progress of rural areas.

The conducted research has allowed to allocate regions of Russia with low and high rates of development of non-urban territories (Fig. 4).

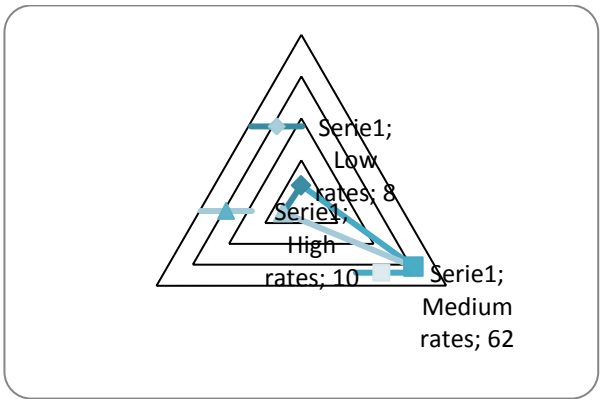

Fig. 4. Number of Russia's regions in terms of the countryside territories progress rate, units, calculated by the authors on the data basis [12]

Table 1. Main indicators of countryside development in Russia in 2010-2015

Indicators	2010	2011	2012	2013	2014	2015
Housing commissioning for citizens residing in rural areas, thousand m2	1,267.33	1,289.89	1,343.21	1,260.89	1,298.68	709.78
Including those for young families and young professionals	633.37	616.12	681.75	611.08	645.53	453.57
Commissioning of general education organizations, thousand student places	4.59	4.81	4.1	5.7	5.16	2.82
Commissioning of medical and obstetric stations, units	43	94	115	175	174	146
Commissioning of gas distribution networks, thousand km	5.16	4.44	4.22	3.83	3.07	1.84
Commissioning of local water supply, thousand km	2.87	2.21	2.31	1.98	2.37	1.24

Source: Compiled by the authors on the basis of data [11].

There are 10 regions with high rates of the rural progress, among them are the Belgorod Region, the Krasnodar Krai, the Lipetsk Region, the Republic of Tatarstan, and the Saratov Region.

The regions with low rates of development are 8 in number. Among which the authors single out the Jewish Autonomous Region, the Karachaevo-Cherkess Republic and the Sakhalin Region.

The remaining regions of Russia are included in the group with an average level of development, which does not mean the prosperity of these regions in the rural development and the creation of good conditions for the effective management of modern agriculture.

Our research has allowed us to identify the main factors affecting the level of the countryside elaboration in Russia's regions. First of all, they are: the rate of agriculture progress, natural and climatic conditions, the rate of concentration of the rural population, traditions and created social and living conditions in the countryside.

In the study, based on actual data, we calculate and justify the forecast of main indicators affecting rural development in Russia up to the years of 2020, 2030 and 2050.

The projections, due to the nature of the empirical data relationship ambiguities, checked linear and nonlinear function (polynomial, exponential, logarithmic, a hyperbolic).

Non-zero linear autocorrelation coefficients indicated a nonlinear trend. The choice of the approximation function determined by the highest index of correlation, forecast accuracy - the smallest approximation error. Since any forecast is based on a limited number of raw data obtained curve does not display all the events and trends, and describes a number of mid-level movement dynamics. So, any forecast seems to be approximate.

Therefore, to eliminate the error, we moved from the point estimate of the forecast to the interval one, and indicated the so-called confidence interval.

Table 2 presents the forecast for the Russia's rural development up to 2050 which was calculated using mathematical prediction methods.

To check the series for the presence of a nonlinear trend, linear autocorrelation coefficients were calculated for a time series consisting of logarithms of the original levels. Non-zero values of autocorrelation coefficients indicated a non-linear trend for all indicators, therefore, to predict the values of the selected indicators, we used:

Exponential regression $Y_t = Y_0 \cdot EXP(k;t)$ (1),

Indicative regression $Y_t = a \cdot b^t$ (2),

Logarithmic regression $Y_t = a + b \cdot \ln(t)$ (3).

The choice of the approximating function was determined by the highest correlation index and the smallest approximation error for time series smoothed by the moving average method. The coefficients of regression equations were selected by the method of least squares.

As an interval estimate with reliability $\alpha = 0{,}05$, a confidence interval was:

$$\hat{Y}_{t+p} = \overline{Y}_{t+p} \pm \delta \quad (4),$$

where: $\hat{Y}_{t+p}$ - interval value of forecasting characteristic in (t+p) period ,

$\overline{Y}_{t+p}$ - pointwise value of forecasting characteristic (forecast) in (t+p) period,

$\delta = t_\alpha \cdot \sigma$ (5)

probable error of forecast,

$t_\alpha = t_\alpha(\alpha;k)$ (6)

tabulated point of Student criterion.

Quality of the forecast is determined by its accuracy (%), equal to the difference of 100% and possible forecast error, (%). In this case, the forecast error in general is understood as the difference between the actual and predicted values of the studied quantity.

Table 2. Forecast of Russia's Rural Areas Development

Factor	Model	Forecast 2020	2030 Confidence interval (if $\alpha = 0.05$)	2050	Forecast evaluation: Approximation error, (MAPE, %)	Forecast evaluation: Forecast error, (ME)
Rural population, mln people	$y_t = EXP(3.6648 - 0.0033 \cdot t)$ (exponential)	36.55 (36.00; 37.11)	35.37 (34.81; 35.92)	33.11 (32.55; 33.67)	0.52	-0.022
Land area (farming area), mln hectares	$y_t = 221.1854 \cdot 0.9997^t$ (indicative)	219.8 (219.7; 219.9)	219.1 (219.04; 219.23)	217.8 (217.73; 217.92)	0.02	-0.003
Average yearly number of people involved in rural activities, (farming, hunting, forestry), thousand people	$y_t = 8,439.72 - 770.72 \cdot \ln t$ (logarithmic)	6,125.81 (5,829.54; 6,422.08)	5,832.65 (5,536.38; 6,128.92)	5,457.91 (5,161.64; 5,754.17)	1.59	-0.00005
Ratio of people involved in rural activities to total number of people, %	$y_t = 13.1102 - 1.3987 \cdot \ln t$ (logarithmic)	8.9 (8.41; 9.30)	8.3 (7.86; 8.75)	7.6 (7.17; 8.05)	1.58	-0.00002
Commissioning of general education organizations, thousand student places	$y_t = 48.2655 - 11.0961 \cdot \ln t$ (levelled logarithmic)	15.02 (11.1; 18.95)	10.53 (6.6; 14.45)	4.86 (0.93; 8.78)	5.98	-0.0008

Source: Compiled by the authors on the basis of data [12].

Absolute, relative and comparative indicators are used to analyze the accuracy of quantitative forecasts. These are of practical significance for the research:

$$ME = \frac{\sum_{t=1}^{n}(Y_t - \overline{Y_t})}{n} \quad (7),$$

$$\sigma = MSE = \sqrt{\frac{\sum_{t=1}^{n}(Y_t - \overline{Y_t})^2}{n}} \quad (8),$$

$$MAPE = \frac{1}{n} \cdot \sum_{t=1}^{n} \frac{\left|Y_t - \overline{Y_t}\right|}{Y_t} \cdot 100\% \quad (9).$$

If $0 < MAPE(\%) < 10$ - high forecast accuracy and model can be used for forecasting.

The work of many scientists in Russia and abroad are dedicated to the study of rural development.

The conceptual basis and the main goal of the studies on this scientific problem is the theoretical justification and use of the identified and developed directions in practice for the effective exploitation of rural territories.

Thus, having analyzed a large number of scientific works on this topic, it is necessary to highlight the study of Bruce L. Gardner[5]. In his opinion, the main feature of effective progress of territories in the rural areas is the need of establishing a relationship between the level of agricultural production and the creation of an appropriate infrastructure in the countryside, ensuring the necessary growth of production and contributing to the flow of population to the countryside.

According to M. Banse and S. Tangermann [2], when determining the directions for further development of these territories, special attention should be paid to technological factors, the ability to modernize production processes, social, engineering and production infrastructure. An important aspect of the issue is the ability of the government to support the countryside, by providing targeted support to agricultural producers, as well as channeling available financial resources for improving social facilities, reducing differences in living conditions between the village and urban areas.

In Russia, a group of scientists under the academic supervision of A.V. Glotko [6] proposed a scientific hypothesis that the identification and solution of methodological and theoretical issues which affect the effective extension of rural areas develops the system of principles, models and directions for improving economically feasible, socially desirable and environmentally sound management impacts on rural areas. It is made with the purpose of their comprehensive development and implementation of a system of measures aimed at improving both the level and the quality of the village population life.

In research by a group of scientists guided by A.Y. Trotskovsky [18], the rural areas extension is considered in conjunction with the patterns of the settlement system, and primarily urban resettlement. The most important role in ensuring the countryside progress belongs to the regions, which should not only react to the proposals of enterprises, but should themselves organize the economic

process, producing integrated urban and rural environments, and individual areas specially designed for commercial activities.

In the scientific works of I.N. Merenkova and V.N. Pertsev et al. [10] the most interesting idea is the approach to the research of the rural development basing on the definition of the main contradictions, laws and principles of moving forward, definition of a system of criteria and indicators, substantiation of signs and assumptions. These indicators include production and economic and financial factors characterizing the development and level of sustainability of reproductive processes in agriculture, as well as socio-demographic indicators that determine the quality of village population life, and the state of rural social and engineering infrastructures, indicators reflecting changes in ecosystems of the territory. Also, there are indicators reflecting the degree of interaction between the government and local authorities.

CONCLUSIONS

Rural territories represented by land resources are the basis of the agricultural production process, and the territories themselves are home for a significant part of the population. Throughout the world, the evolvement of rural territories is paid a great attention. The level of the peasant areas and the effectiveness of their use, both from the social-economic and environmental sides, shows the level of the country's economy and its agricultural segment.

The research conducted by the authors made it possible to identify the existence of significant problems in Russia's village. These problems in Russia's economy require an early solution, since the existing level of the countryside, contributes only to reducing the outflow of the population from the village and into towns, and its stabilization, which, in our view, is clearly not enough.

The forecast for the extension of non-urban areas in Russia, using mathematical modelling and forecasting methods with a high degree of reliability, presented in this article, indicates that the trend continues for a further reduction in the number of the village population, agricultural land area and other indicators.

In Russia, as the economic and mathematical study shows, rural development should be based on the concentration of production in the countryside, and on the transfer of large processing industries to production sites. In those regions of Russia, where agriculture is of secondary importance (due to the specific nature-climatic conditions) it is advisable to develop small-scale family farms in villages.

For the effective rural development in Russia's economy, we consider it necessary to increase the amount of financial resources directed to the qualitative growth of the engineering, industrial and social infrastructure of peasant areas, to increase the level of incomes of the country population, and improve the life quality in the countryside.

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ECONOMIC RESEARCH OF BIOTECHNOLOGIES TRANSFER IN RUSSIA'S AGRICULTURE

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Abstract

The authors consider the mechanism of technologies transfer for the production of high-tech products in modern agriculture in Russia. The peculiarities of biotechnological clusters construction in Russia's economy and the leading countries of the world economy are considered. The features of interaction and principles of biotechnological clusters creation in modern conditions are shown. For example, the transfer of technologies that use integrated biological plant protection systems is based on the possibilities of modern biotechnology that contribute to reducing environmental pollution and increasing the production of environmentally friendly agricultural products. In the article, the authors substantiate that the principle of close interaction between 1) the scientific environment, 2) educational institutions, 3) experimental farms and 4) agricultural organizations, is the basis for the transfer of technologies for the production of high-tech products in modern agriculture. The article shows the peculiarities of technology transfer with the activity of large high-tech companies (including transnational companies) as initiators of the development and mass use of new technologies in agriculture. In the article, using the example of the use of biological plant protection systems, the experience of transferring technologies for the production of high-tech products in agriculture in the Saratov region and other regions of Russia was examined. The research made it possible to form a unified technology transfer system that uses biological plant protection systems in the production of high-tech products, based on business structures, research centres and the necessary infrastructure. In their study, the authors come to the conclusion that the introduction and mass use of new technologies for the production of high-tech agricultural products will contribute to the effective development of the agrarian sector of the Russian economy, increasing the competitiveness of Russian agricultural products in world markets.

Key words**:** *development economics, bio-technology, bio-economics, bio-clusters, plant protection, technology transfer, biological systems*

INTRODUCTION

The current level of development of agrarian science in Russia and in the world makes it possible to use the opportunities of the newest methods of agricultural biotechnology, which make it possible to significantly reduce the cost of manufactured products, and also successfully test them in practice, promoting mass use.

New technologies of cultivation of agricultural crops allow to minimize negative influence of a person on the environment. However, not all agricultural producers use these technologies for various reasons. One of the main reasons is high production costs, low economic effect, and lack of technical and technological opportunities for production.

The requirements of the world's leading agrarian countries are aimed at increasing the production of environmentally friendly products, reducing the use of chemicals and their impact on the environment. For example, in the European Union, the directive No. 1907/2006, which is the basis of the REACH program, was adopted and is being actively applied [13]. This directive is aimed at reducing the use of chemicals in the production of agricultural products. At the same time, organic agricultural products must have a low cost and compete on an equal

footing with the products produced using chemicals.

In recent years, agriculture has been actively developing biological plant protection products, which are an alternative to the use of chemical plant protection products. From an economic point of view, the use of chemical protection should be more beneficial than the use of biological protection. However, the damage they cause to the environment is more significant and will require considerable restoration costs in the future.

Theoretical and methodological basis of the research was the works of scientists of Russian and world agrarian science. In the economic part of the study, the works of many scientists of modern economic science, such as Kozakova [7], Krochmal-Marczak [8], Sessa [15], Dyrdonova [4], Kovalenko [6]. The scientific works of prominent Russian scientists of agrarian science are devoted to the development of the biological methods use and plant protection systems, such as the works of Kandibin [5], Pavlyushin [11, 12], Shternshis [16] and other scientists.

MATERIALS AND METHODS

The methodology of the study included the formulation and conduct of an economic study of the transfer of technologies for the production of high-tech products in Russia, using integrated biological plant protection systems. The study was conducted in accordance with traditional methods of conducting economic research, as well as using special methods to assess the effectiveness of agro-ecosystems.

The main methods of investigation were the following ones: dialectical method, analysis and synthesis methods, graphical method, computational-constructive method, economic-statistical method and others.

The conceptual basis of the research is the adopted Strategy of scientific and technological development of the Russian Federation [3]. This Strategy provides for the transition to a highly productive and environmentally friendly agriculture, the development and implementation of systems for the rational use of chemical and biological protection of agricultural plants. As well as the Federal Scientific and Technical Program for the Development of Agriculture for the years 2017-2025 [14], the State Program for the Development of Agriculture and Regulation of the Agricultural Products, Raw Materials and Food Markets for 2013-2020 [17] and the Comprehensive Program for the Development of Biotechnology in The Russian Federation for the period up to 2020 [2].

RESULTS AND DISCUSSIONS

At the heart of the transfer of technologies for the production of high-tech products in modern agriculture lies the principle of close interaction between 1) the scientific environment provided by research centres of the appropriate profile, 2) educational institutions training and retraining specialists, 3) pilot farms, where new technologies are tested and 4) agricultural organizations, where mass introduction of production technologies is carried out.

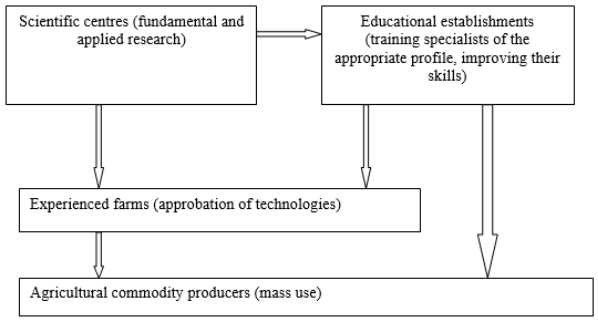

Fig.1. Mechanism of new technologies transfer in agriculture.
Legend: the arrows on the diagram show the transfer of technology.
Source: Authors' design.

Technology transfer in Russia's agriculture can be represented in the form of a scheme (Fig.1). The existing mechanism of technology transfer allows successfully and efficiently introduce new technologies from the stage of development of technology to mass use by agricultural commodity producers.

At the same time, large holding companies of the agrarian sector of the economy, as a rule,

have scientific subdivisions and experimental production, which allow them to develop and introduce new technologies into mass production within the company. This technology transfer option provides competitive advantages for large companies in comparison with medium and small organizations, and also improves the efficiency of their activities.

Small agricultural organizations (farmers) are trying to use new technologies to minimize costs and to be able to compete with large companies. From their point of view, the additional costs for the maintenance of scientific units are almost impossible, and therefore cooperation is most effective for them within the framework of associations or directly with large scientific institutions. For example, the association of peasant farms and production cooperatives "Vozrozhdenie", created in the Saratov region, facilitates the adaptation of small farms to the changing conditions of economic activity, the introduction of new technologies into mass production. And the activities of the Association "Agrarian Education and Science", within which the leading scientific and research institutions of the agrarian profile of the region are concentrated, ensures the development of new technologies and their approbation.

Another way of transferring technologies in agriculture is the activity of high-tech companies (including transnational) producers of biological products that have experimental production. The major producers of biologics in Russia are FGBU "Russian Agricultural Centre", "Sibbiofarm" LLC, "Vedabio" LLC and others. For mass introduction of the developed technologies, they conclude direct contracts with agricultural commodity producers for the supply of necessary drugs or equipment (Fig.2) or use distribution companies.

In modern agriculture, in our opinion, the most effective way of transferring technologies is to use the cluster approach and on this basis to build clusters that include scientific and educational institutions, financial and credit institutions, organizations that provide information and consulting services, enterprises of production infrastructure, trade and intermediary organizations, resource providers, producers of products [10].

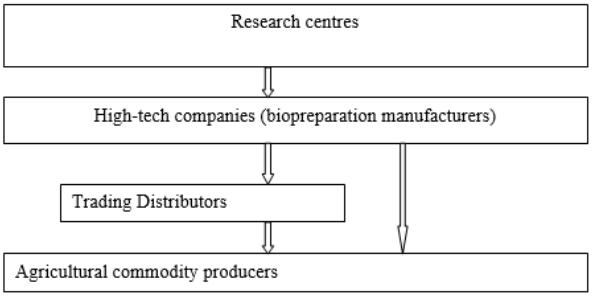

Fig.2. Mechanism of technology transfer in agriculture on the basis of high-tech companies (on the example of development and use of biological products for the production of environmentally friendly agricultural products)
Legend: the arrows on the diagram show the transfer of technology.
Source: Authors' design.

The cluster approach for technology transfer is actively used in Germany, which is most clearly manifested in the biotechnological direction. Germany is actively developing biotechnology. In Germany there are well-known and promising biotechnological clusters. Munich and Berlin-Brandenburg belong to the leading biotechnological clusters of Europe [4].

In Russia there are also examples of successful construction of biotechnological clusters. The biotechnological cluster has certain principles and specifics of creation, the main ones are (Fig.3):

1.Self-organization of clusters. The development of the cluster, as a rule, occurs as a self-organizing system, which dynamically develops and changes.

2.Corporatism. All the arising disagreements in the cluster are expedient to be solved taking into account the opinion of all cluster members based on trust and reciprocity.

3.Long-term cooperation. This principle is based on the long-term cooperation of all cluster members in order to achieve the most effective use of available resources and opportunities.

4.Geographical principle. In order to maximize profits, all participants in the cluster must be geographically close to each other.

5.Dynamism of a cluster. This principle is largely based on the fact that the flexibility of the cluster is its one of the main advantages and it allows the cluster to change depending on changes in the market.

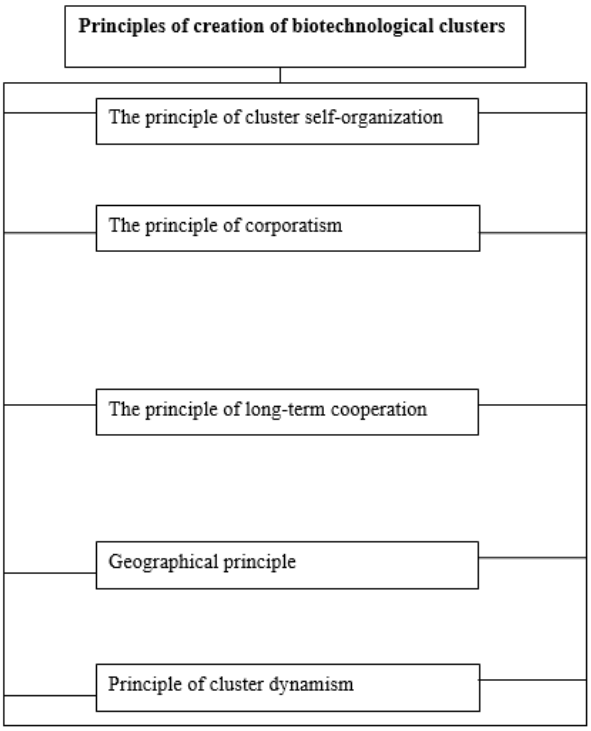

Fig.3. Basic principles of biotechnological clusters creation
Source: Authors' design.

An example of the successful construction of biotechnological clusters in Russian regions is the biotechnological cluster of the Kirov region [1] created in 2008 in the form of a non-profit partnership. This cluster includes various enterprises and organizations united by a technological process and a unified economic development strategy.

In the agriculture of the Saratov region, the Agrarian University has an active role, which includes a number of scientific laboratories in which fundamental and applied research in the field of biotechnology is conducted, and two large structural divisions in which the approbation of new technologies is being carried out: the Agrocentre and the UNPO "The Volga region". So, scientists of the Agrarian University successfully tested a number of biologics: Gamair was used from spot on leaves, black leg, late blight, alternaria, bacterial decay, scab, moniliosis, bacterial cancer, vascular bacteriosis, tracheomycosis wilt. It also restored useful microflora in the soil and in plants; Bitoksibatsillin has not only insecticidal properties, but repellent, that is, a repellent effect. Due to its odour, the drug repels pests from the treated area, thereby reducing the number of oviposition; Lepidocid - used to combat silkworm caterpillars, scoops and other butterflies - pests; Averesectin was introduced against mites, nematodes and the Colorado beetle. These drugs are successfully used in agricultural enterprises and farms in the region.

In the Saratov region, integrated biological systems of plant protection in vegetable growing of protected soil are actively used. Such enterprises as OJSC Volga, JSC Sovkhoz-Vesna use biological plant protection systems based on the use of existing biological laboratories. Widely produced bioagents: phytoselius for fighting against a spider mites, enkarziya against a greenhouse whitefly in the production of tomatoes and other products of the vegetable-growing industry.

Saratov Agrarian University is the leader of agrarian education in Russia, which allows to train highly qualified specialists of the appropriate profile, providing the needs not only of the Saratov region, but also of other regions of Russia. The educational activity of the Agrarian University is an integral part of the technology transfer mechanism in the regional agro-industrial complex and facilitates the transfer of technologies for the production of high-tech products.

Large companies of biopreparation manufacturers actively cooperate with scientists from leading scientific institutions and organizations of the agricultural profile, which allows them to successfully develop their business by providing technology transfer at the level of a research institution - a high-tech company. So, the company "Sengenta", which is one of the leaders of the Russian segment of the plant protection products market, has an active development of biologics as its development priority. Successfully applied modern biopreparations in plant growing are preparations Vertimec

and Isabion. Vertimek is a preparation of a group of insecticacaricides of biological origin, has an intestinal-contact effect. It is used when it is necessary to protect almost all types of garden, berry and flower crops from a wide range of pests, especially from ticks, thrips and miner insects. Isabion is a biological fertilizer of the latest generation, of wide application, consists of a complete set of amino acids.

The branch of the Federal State Unitary Enterprise "Rosselkhozentr" in the Saratov region has a bio-factory and a production plant for the production of biological plant protection products. The products are intended for pre-seed treatment of seeds, as well as protection of crops against pests, fungal and bacterial diseases in the open and closed ground. Such drugs as Rizotorfin, Risoplan, Rizoagrin and Flavobacterin show high efficiency in the cultivation of crops. With their use, the yield of agricultural crops is increasing by 10-40 percent. For example, the cost of processing 1 hectare of a biological fungicide Risoplan is 3.5 - 5 US dollars (depending on the rate of consumption 0.5-1 l / ha), and treatment with an average of 16.7 USD / ha and more.

Currently, an integrated plant protection system should be understood as a system of management measures for intra- and interpopulation relations within the agroecological system and its constituent agrobiocenoses. In this case, the use of active plant protection products is regulated by the stage distribution of harmful objects, by the time and method of their most safe application to useful bio-objects. This method is most suitable from the point of view of environmental protection. First of all, it became clear that the problems of combating harmful species can not be solved without taking into account the connection of these species with other organisms, that any impact on agrobiocenosis leads to a change in the number of all, including useful, organisms. Integrated methods of plant protection include the selection of such means of suppressing pests that would not only preserve but also activate the activities of beneficial organisms. In other words, the integrated method of plant protection is a system of management measures for intrapopulation and interpopulation relations within a particular agrobiocenosis. This is its fundamental difference from previous systems.

The growth of the use of biological plant protection products and microbiological fertilizers in the crop sector of Russian agriculture should reach 32 percent by 2020 (Fig.4).

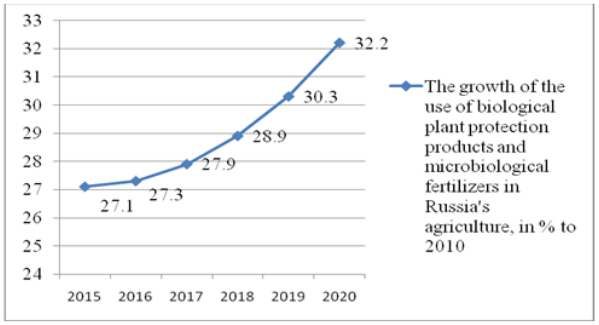

Fig.4. The diagram of the growth in application of biological plant protection products and microbiological fertilizers in Russia's agriculture, in % to 2010.

Source: Compiled by the authors on the basis of research data [17].

All of the above enumerated allows us to form a unified technology transfer system that uses biological plant protection systems in the production of high-tech products. The basis of this technology transfer system will be 1) business structures, 2) research centres represented by universities and research institutes, 3) administrative, production and social infrastructure.

In the studies by C. Sessa and A. Ricci [15] the importance of the process of exchanging technologies for the production of high-tech products for the development of the world economy was stressed out. The scenario of development of the world economy predicted by them is characterized by a high level of cooperation and use of new production technologies.

In the study by Ja. Kozakova [7], she presents the experience of developing organic farming in Slovakia. The development of production of ecologically clean products allowed to enlarge the area occupied by this product since 1991 by more than 12 times. And also

significantly increase the export of these products outside the country.

Another aspect of the development of environmentally friendly production is the introduction of quality control in the production of agricultural products in the EU countries [8].

In the study by G.L. Kovalenko and O.A. Maslennikova [6], they substantiated the statement that the transfer of technology for the production of high-tech products for national economies is an important factor providing a competitive advantage in world markets in modern conditions.

In the study by N.I. Kuznetsov [9], he concluded that the development of biotechnology in Russia will enhance the status of the Russian state as a country with a high level of development of science and use of high technologies.

CONCLUSIONS

In conclusion of the conducted economic research it is necessary to draw the following conclusions.

The modern approach to conducting agricultural production in the world's leading agrarian countries is based on the fact that environmental safety is a more important criterion than economic profitability. This is reflected in the growth in the volume of production of environmentally friendly agricultural products in the world, reducing the chemicals influence on the agroecosystem, and increasing the proportion of biological plant protection products.

The active use of biological plant protection products in Russia's agriculture will increase the volume of environmentally friendly products. It will promote the growth of exports of these products to foreign markets.

Transfer of technologies that use biological plant protection systems in the production of high-technology crop production will provide competitive advantages to Russian agriculture in the world food markets.

The application of biological plant protection systems will reduce the negative impact on the environment from agricultural production.

An important role in the system of technology transfer in the production of high-tech products in agriculture should be given to major research centres and leading educational institutions.

The introduction and mass use of new technologies for the production of agricultural products will contribute to the effective development of Russia's agriculture, and will also promote the development of agrarian science.

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THE EFFECT OF VARIOUS TYPES BIOPESTICIDES ON THRIPS POPULATION DEVELOPMENT IN CHRYSANTEMUM PLANTS (*Dendrathema grandiflora* Tzvelev)

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Abstract

Chrysanthemum (Dendrathema grandiflora Tzvelev) is an Asteraceae family, very popular ornamental plant in the family, generally characterized by aromatic, deeply lobed, alternate leaves and often large and showy flowers. The main problems in chrysanthemum business is Thrips sp. This pest can attack chrysanthemum plants in all plant growth stadia, but the most harmful attacks occur in early formation phase. Thrips pest control recommendations on chrysanthemums have been provided by various authorized agencies, including through the use of resistant varieties. This study aimed to determine the effectiveness of various bio-pesticides and microbial pesticides. The study was conducted using a randomized block design with 5 replications. The experimental unit consists of 1 m^2 land-plot, and each plot is planted with 100 stool with 10 x 10 cm space. Results indicated that the Neem seed, Annona muricata, and Tinospora crispa extract as biopesticides, effectively controlled the total population of Thrips nympa and adult, but has no significant different on the extracts level between three plant species on Thrips population density. The microbial pesticide (Beuveria sp.,) Jatropha curca leaf extract, Mentha cordifolia leaves, were less effective in controlling the Thrips population, although it was better than the Thrips population in control.

Key words: *Dendrathema grandiflora Tzvelev, Thrips, bio-pesticides agents, microbial pesticides*

INTRODUCTION

Chrysanthemum (*Dendrathema grandiflora* Tzvelev) is the main national floriculture industry development program commodity, as export and local commodity in line with the increasing of income and society lifestyle changing. Chrysanthemum flowers are needed for many purposes (birthday, marriages parties and other ceremonies). Domestic market demand for Chrysanthemum flowers is estimated to increase 15 - 27% per year, in 2012 the area is 9,852,612 m^2 increased to 10,914,154 m^2 by 2016, and the production also develop from 397,651,571 stalks (2012) to 404,185,586 stalks (2016). The export of Chrysantemum also rise from 57,049 kg (2013) to 60,549 kg (2016).

One of the main problems in Chrysanthemum business is Thrips sp., that attacked in all development stadia, but the most harmful are in early interest formation phase. The direct impact of Thrips attacks is the formation of a shiny silvery color on the underside of the leaves that turns brownish in an advanced attack. The most severe attack on plants is characterized by the appearance of metabolic process disorders, so the leaves malformation becomes curly and wrinkled. In severe attacks, leaves, shoots and plant buds roll inward and bumps arise like tumors followed by inhibition of plant growth. Thrips attacks often cause dwarf plants followed by the shoots. The impact of indirect attacks, in the form of transmission of viral diseases

considering Thrips is a vector of mosaic virus disease and effective curly virus.

Symptoms of the attack are found in the dry season, if the insect attack is not immediately overcome, then the new buds formed will die so the plant cannot produce well. Usually Thrips pest attacks are followed by falling flower symptoms. This plant pest is very easy to see in the flowering plant, its small body extends like ants and these pests can move quickly and skip.

Thrips pest control recommendations on chrysanthemums have been provided by various authorized agencies, including through the use of resistant varieties of thrips attacks. Integrated thrips pest control measures, plant pest organism population are managed at a non-adverse level on an ongoing basis. On the other hand, to assemble the control component in an integrated manner, it is necessary information about epidemiology and bioecology to be able to give maximum effect of pest incidence without disturbing the balance of plant production ecosystem and increasing efficiency of production process by reducing the use of synthetic pesticide [11]. Based on this, it is necessary to carry out research on the effectiveness of various biopesticides on the Thrips pest population on Chrysanthemum spp.

The growing usage of chemical synthetic pesticides, is considered practical by plant lovers to control major pests and diseases. The use of biological pesticides has a positive impact on the environment even for its own users. According to World Health Organization (WHO), worldwide pesticide poisoning occurs annually between 44,000 - 2,000,000 people and of the highest number in developing countries. Pest and disease control can be done mechanically, technically and chemically. Mechanically is by catching pests that attack the plants or dispose of diseases parts of plants that are attacked by pests, or control of the technical culture between the air humidity regulation, the protective arrangement and the intensity of sunlight. The chemical control, are using insecticides and fungicides. Recommendation usage of insecticides and fungicides in the cultivation of medicinal plants are avoided, because the chemical residues can affect the medicinal compounds in the plant, so it is necessary to use biopesticide than chemical insecticides and fungicides. In general, biopesticides are defined as a pesticide whose base material is derived from plants and microbes. With advances in the field of chemistry and the development of analytical tools, many chemical compounds derived from plants have been isolated and identified even synthesized. The content of plant compounds can show various kinds of biological activity on insects such as inhibition/rejection of feeding, spanking rejection activities, growth and development inhibitory activities, and death effect, therefore the bioactive can be used to control of plant pest organism (PPO). This study aimed to determine the effectiveness of various biological agents, consisting of biological and microbial pesticides as biopesticide.

MATERIALS AND METHODS

The solution method of biopesticide making is as follows: (1) Neems solution: one kg small cuts Neems leaves was extracted with five liters of distillated water, and soaked overnight. Then the extract was filtered and added with 1 cc of soap solution for one liter of extract as adhesive. (2) Jatropha curcas seeds, that contains a toxic active ingredient are mixed with coconut oil as bait for mice (3) *Mentha cordifolia* leaves solution: 20 grams of mint leaves boiled in water then filtered and sprayed on Chrysanthemum plants. Thrips do not like the smell so they will dodge. (4) *Tinospora crispa* solution, mixed with lime and sulfur then pounded until smooth and stirred until blended. Furthermore, the material is inserted in a vat containing water and stirred well until submerged and flattened, then remained for one week, then stirring again and filtered. The precipitate can be used as organic fertilizer while the extract as aqueous solutions with a ratio of 1:3, is used to control the Thrips. The microbiology pesticides are, the Bacillus sp., Trichoderma sp., and Beuveria sp. obtained from Entomology laboratory, Ornamental Plant Research Center Segunung, West Java,

Indonesia. Other materials are soil, chrysanthemum seedlings (shoots tops), husks, fertilizers, nets, bamboo pieces, plastic straps, lamps, alcohol, paper label, root up fungicides, knives, scissors, jars, loops, microscopes, brushes, camera hoes and stationery.

The experiments using Randomized Block Design (RBD) with five replications. The experimental unit consists of one m^2 land-plot, which planted 100 cuttings with 10 x 10 cm space. Ten percent of total plant, was sampling from each plot, were taken by a random diagonal. Nine treatments, consisting of six vegetables and three microbial pesticides. The *Kulo* chrysanthemum seed, was obtained from the Department of Agriculture Tomohon City. Harvested Chrysanthemum seedlings are shoots five cm long, from the lateral buds of the parent plant. Shoot cuttings are rooted on burned husk medium and lighted. Firing is formed from 8^{th} days and is ready for use as propagation material when the rooting system has grown as intensive plants.

The treated land–plot, size 1 x 1 m^2 beds with five sub-plots for planting each varieties. Soil processing are according to the manner and habits of local farmers, each bed was given 30 ton/ha manure and liming with one ton/ha, after the manure and lime are mixed very well and let stand for one week. Urea was giving in two stages, when the plants aged 30 days and 60 days after planting, while SP36 and KCL given at the early planting time, and the weed control is done mechanically.

Thrips pest population observation was conducted on all plots by taking ten Chrysanthemum samples from each plot, in the bunch of the flower strings to observe whether or not Thrips pest was found. The Thrips, both nymph and imago found on the strands of Chrysanthemums are collected in a collection bottle containing 70% alcohol then counted. Sampling is done four times with interval once a week, from eighth weeks after planting until eleventh week, and then to calculate the average population of Thrips spp., using the formula:

(1) Average of Thrips population =
$$\frac{\text{Number of Nymph or Imago found}}{\text{Numbers of observation}}$$
(2) Percentage of flower attacked =
$$\frac{\text{Number of flower attacks}}{\text{Number of observed flower}} \times 100\%$$

Symptoms observation of the attacked Chrysantemum is done by taking the affected flowers and then observed the shape, color and other changes due to Thrips spp attacks. The percentage of infected flowers was done on 11-week-old plants by counting the number of flowers infected on a plurality of plant plots of each 100 plants. Criterion of flower attacked by the presence of symptoms of attack pest Thrips spp. and or the presence of nymph or imago in the flower of the sample plants.

RESULTS AND DISCUSSIONS

Number of Individual Thrips insects

Table 1. Effects of Various Control Agents on Total Number of Individuals Thrips Insects

Treatments	Total individual Thrips for each stool						
	7	21	35	49	63	74	90
1. **Neems**	1.82 f*)	2.79 f	3.81 f	4.17 c	4.28 e	5.41 g	5.84 fg
2. ***Jatropha curcas***	29.74 ab	42.69 a	45.61 ab	48.37 a	55.31 b	60.44 ab	64.18 b
3. ***Annona muricata***	5.37 ef	8.64 ef	9.23 f	10.49 c	11.73 e	13.72 f	14.29 f
4. ***Mentha cordifolia***	27.38 bc	30.41 c	35.62 cd	40.16 a	40.28 c	43.01 d	45.80 d
5. ***Tinospora crispa***	12.59 de	18.36 de	20.35 e	22.54 b	23.75 d	25.48 e	26.18 e
6. **Bacillus sp.**	17.90 cd	28.47 cd	30.52 de	42.41 a	43.83 c	50.63 bc	59.82 bc
7. **Trichoderma sp.**	20.42 bcd	33.16 bc	37.56 bc	45.39 a	46.82 bc	47.39 cd	49.02 cd
8. **Beuveria sp.**	1.42 f	2.15 f	2.31 f	2.95 c	3.01 e	3.56 g	3.99 g
9. **Distilled water as control**	39.35 a	38.26 ab	47.52 a	50.72 a	64.39 a	70.36 a	72.85 a

*) The average number followed by the same letter in each column is non-significant different according to Duncan's multiple range test at a real 95%
Source: Own calculation

Data on the influence of various control agents on the total number of Thrips individuals can be seen in Table 1.

In Table 1, shows that the number of individual Thrips treated with the formula Beuveria sp., is the lowest on weekly observations compared to other treatments. However, when compared with the Thrips population in Neems-treated plants, the number of individuals in the plant was not significantly difference. The *Annona muricata* seed extract is more effective to suppress the number of individual Thrips than the effect of *Tinospora crispa*, *Mentha cordifolia* and *Jatropa curcas* as the bio-pesticide, and *Tinospora crispa* plant extract is more effective in suppressing Thrips when compared with *Mentha cordifolia* leaf extract and *Jatropa curcas* but *Jatropa curcas* extract has no significant effect compared to *Mentha cordifolia* extract to Thrips population.

Among the three microbial pesticide formulas tested, the Beuveria sp formula is most effective against the thrips population density. This is because Beuveria sp. can directly colonize the Thrips body, so killed the Thrips insects. Bacillus spp., and Trichoderma spp., has no different effect on all observations when it is compared to control.

Number of Nympha Thrips

Data on the number of nympha Thrips can be seen in Table 2.

Table 2. Effects of Various Control Agents on Number of Individuals of Thrips Nympa Insects

Treatments	Total individual Thrips for each stool						
	7	21	35	49	63	74	90
1. Neem plant	1.82 e	1.55 d	1.23 e	1.90 f	1.44 c	2.16 e	2.16 e*)
2. *Jatropha curcas*	5.47 d	14.62 b	17.84 d	20.79 bc	30.46 a	34.86 ab	40.83 b
3. *Annona muricata*	3.54 de	5.89 cd	5.62 e	5.66 ef	5.66 c	6.41 de	6.82 de
4. *Mentha cordifolia* leaves	18.24 a	20.06 ab	23.25 ab	11.43 de	17.55 b	11.27 cd	13.29 d
5. *Tinospora crispa*	8.08 cd	12.14 bc	13.04 d	13.73 cd	13.95 b	12.84 cd	13.51 d
6. Bacillus sp.	12.68 bc	18.05 ab	20.18 bc	29.67 a	29.16 a	27.02 b	27.05 c
7. Trichoderma sp.	14.06 ab	22.95 a	19.08 cd	24.66 ab	17.38 b	16.88 c	16.29 d
8. Beuveria sp.	1.42 e	2.15 d	1.31 e	1.45 f	1.29 c	1.83 e	1.89 e
9. Distilled water as control	19.11 a	24.59 a	29.80 a	30.30 a	32.12 a	41.05 a	52.56 a

*) The average number followed by the same letter in each column is not significantly different according to Duncan's multiple range test at a real 95%

Source: Own calculation

Results indicated that the number of nympha Thrips varied according the treatment applied on Chrysanthemum plants. The number of nympa thrips increases following the research time increase. Treatment of neem extracts was most effective in suppressing the amount of nympha thrips compared to other treatments except the Beuveria sp treatment, has no difference of influence than the others. *Azadirachta indica* is a multi-functional plant, hence this plant is also known as the wonderful tree. The leaves and seeds of *Azadirachta indica* have many benefits [15]. The Neems seed used as biopesticides, have been widely demonstrated in several studies, including the ability to suppress Thrips population. The Neems plant contains the active substance azadiractin, glyceride oil, polyphenols, acetyloxifuranl dekahidro-tetrametil acid, heksosiklo-pentanatofiran, acetate-ketone, monoterpen, and hexahidrosi-tetrametil fenantenon [5]. Compounds such as azadirachtin serve as antifeedant to prevent, and as a repellent, also as bioinsecticides and larvacides. Neems leaf extract is safer and efficient to use because it is easy to obtain, not toxic to humans and easy to decompose, so environmental friendly [7].

Neems effectiveness in suppressing nympha Thrips turns out to be equivalent to Beuveria sp., infected the nympha Thrips directly, using hyphae or spores direct into the cuticle through the outer skin of insects. The growth of hyphae will release enzymes such as proteases, lipolytics, amylases, and chitinases.

These enzymes are capable of hydrolyzing the protein plexus commodities in the integument [2] that attacks and destroys the cuticle, allowing the hyphae to penetrate and enter and develop within the insect body. Mechanisms of infection are mechanically infected through pressure caused by the growing of *B.bassiana* conidium. The mechanical fungal infection of *B. bassiana* originates from penetration of the cuticle mycelium and then germinates and forms the apresorium,, attacks the epidermis and hypodermis. Hyphae then attacks the tissues and multiply in haemolymph [14].

The application of *Annona muricata* extract and *Tinospora crispa* have more effective effect on the population of Thrips nympha compared to the influence of *Jatropha curcas* and *Mentha cordifolia* leaves. The effectiveness of *Annona muricata* extract has been studied by several researchers. *Aedes aegypti* mosquito control research using bioinsecticide *Annona muricata* seed extract showed that the concentration between 15% to 60% caused the number of dead mosquitoes 12,5% to 97.5% for 60% concentration [12]. While *Tinospora* stem extract has also been cultured effectively controlling the earth wall because it is thought to contain many alkaloids. Results showed that the stem extract of Tinnospora crispa was effective against groundcover insect (*Scotinophara coarctata*), with 75% w/v has the better effectiveness [6].

Applications of Bacillus sp. and Trichoderma sp. has no different effect and less than *Annona muricata* leaf extract or *Tinospora crispa* extract, but can suppress nympha Thrips population compared to control. The utilization of fungi and bacteria as biological control agents has a promising prospect because of easily obtained, can prevent the occurrence of secondary pest explosions; and the plant products are free of pesticide residues; also reduce the farmers' dependence on chemical pesticides; more cheaper, safe for humans and environmentally friendly [10]. Using biopesticides to control the nympha Thrips biologically by microorganisms either mushrooms or bacteria can occur through one or several mechanisms such as antibiosis, competition, hyperparasit, induction of resistance and stimulate plant growth [9].

Table 3. Effects of Various Control Agents on Number of Individual Adult Thrips Insects

Treatments	Total individual Thrips for each stool						
	7	21	35	49	63	74	90
1. Neems plant	0.00 e	1.24 c	1.58 f	2.27 f	2.84 f	3.25 e	3.68 cd
2.*Jatropha curcas*	13.27 b	23.07 a	26.77 a	27.58 a	12.85 cd	18.58 bc	11.35 b
3.Annona muricata	1.83 c	2.75 c	3.61 ef	4.83 ef	5.49 def	7.31 de	9.47 bc
***4.Mentha cordifolia* leaves**	9.14 bc	10.35 b	12.47 bc	18.73 cd	22.73 b	31.74 a	32.51 a
5.Tinospora crispa	4.51 de	6.22 bc	7.31 de	8.81 de	9.80 cde	12.64 cd	14.67 b
6. Bacillus sp.	5.22 de	9.43 b	10.34 cd	12.74 d	14.67 bc	23.61 b	32.78 a
7.Trichoderma sp.	6.36 bcd	10.21 b	17.48 b	20.73 b	29.44 ab	30.51 a	32.73 a
8. Beuveria sp.	0 e	0 c	1.0 f	1.5 f	1.62 f	3.56 e	1.89 d
9. Distilled water as control	23.44 a	28.67 a	27.72 a	30.45 a	34.27 a	36.31 a	36.79 a

*) The average number followed by the same letter in each column is not significantly different according to Duncan's multiple range test at a real 95%.
Source: Own calculation

Adult Thrips Population Density

Adult Thrips population density in the first to third weeks is still low on all treatments. But the population density of Thrips increased significantly after that, because of the change in the growth phase of the nympha phase into adulthood. The treatment of Neems seed extract, *Annona muricata*, *Tinospora crispa* and microbial pesticide Beuveria sp., has significantly reducing adult Thrips population. In contrast, the application of leaf spacing, *Mentha cordifolia* leaves, and Bacillus sp. and Trichoderma sp. as microbial pesticides has no significant effect on the emphasis of Thrips population. This is evidenced by the density of adult Thrips in all treatments, which are not significantly different from the controls. The

ability to control adult Thrips insects on *Jatropha curcas* extract and *Mentha cordifolia* leaves extract is low. From the results of chemical analysis is known that *Jatropha curcas* bark contains solution of b-amyrin, and tarasterol. Meanwhile, the roots of the distance contain b-sitosterol, b-D-glucoside, marmesin, propasin, curculathyrane A and B, diterpenoid jatrophol, jatropholone A and B, chomarin tomentin, comarino-lignan jatrophin, and saponinda and flavonoid. Spacing contains curcacyline A and B compounds, saponins, flavonoids, tannins, and polyphenolic compounds. In the seed distance contained alkaloida compounds, saponins, and a kind of toxic protein called kurin. The seeds also contain 35-45% fatty oils consisting of various triglycerides of palmitic acid, stearate, and kurkalonat [1, 13].

Effectiveness of Thrips Control from Various Treatments of Biological Agents

The data in Table 4 indicates that the microbial pesticide *Beuveria* sp. most effectively controlling Thrips population, has suppression capability of 94.18 to 96.39%. Meanwhile, Thrips population suppression power by Neems treatment ranged from 91.78 to 95.37. Thus the two biological agents exhibit the highest ability to control the Thrips, compared to other treatments. And *Annona muricata* leaf extract and *Tinospora crispa,* also able to suppress the population between 77.42 - 86.35% and 52.01 - 68.01%, successively.

Mentha cordifolia leaves extract, *Jatropha curcas*, and Bacillus sp. and *Trichoderma* sp as microbial pesticides have the ability to control Thrips population are lower compared to Neems extract, *Annona muricata*, *Tinospora crispa* and microbial pesticide *Beuveria* sp. *Jatropha curcas* extract is able to suppress the Thrips population between 4.02 - 24.42%, while *Mentha cordifolia* leaves extract able to suppress Thrips population between 20.52 - 86.35%. Microbial pesticides of Bacillus sp and Trichoderma sp 16.38 to 54.51 and 10.51 to 48.10% respectively.

Table 4. Effectiveness of Thrips Insect Control from Various Treatments of Biological Agents

Treatments	Total individual Thrips for each stool						
	7	21	35	49	63	74	90
1. Neems plant	95.37 a	92.71 a	91.98 a	91.78a	93.35 a	92.31 e	91.98 a
2.*Jatropha curcas*	24.42 d	14.56 ef	4.02 f	4.63 fg	14.10 f	14.09 f	11.90 e
3.Annona muricata	86.35 a	77.42 b	80.58 b	79.32 b	81.78 b	80.50 b	80.38 b
***4.Mentha cordifolia* leaves**	30.42 d	20.52 d	25.04 de	20.82 d	37.44 d	38.87 d	37.13 d
5.Tinospora crispa	68.01 b	52.01 c	57.18 c	55.56 c	63.12 c	63.78 c	64.06 c
6. Bacillus sp.	54.51 bc	25.59 b	35.77 d	16.38 e	31.93 de	28.04 e	17.88 e
7.Trichoderma sp.	48.10 d	13.32 f	20.96 e	10.51ef	27.29 f	32.65 dc	32.71 d
8. Beuveria sp.	96.39 a	94.38 a	95.14 a	94.18 a	95.33 a	94.94 a	94.52 a
9. Distilled water as control	0 e	0 f	0 f	0 g	0 g	0 g	0 f

*) The average number followed by the same letter in each column is not significantly different according to Duncan's multiple range test at a real 95%.
Source: Own calculation

Percentage of Thrips Crops

Percentage of plants attacked by Thrips can be seen in Table 5. The percentage of plants attacked by Thrips on Neems application treatment, *Annona muricata* extract, *Tinospora crispa* leaves and microbial pesticide Beuveria sp. are less; compared to other treatments and controls. The ability of Neem leaves, *Annona muricata* leaves and *Tinospora crispa* in controlling the Thrips population is destroys the development of eggs, larvae and pupa, also to inhibits skin exchange, and interferes with insect communication; causes reducing appetite and blocking the ability to eat of insects, then refuse to eat, so inhibits the reproduction female insects, at least expelling the insects.

Meanwhile, Thrips stricken plants on the treatment of *Jatropha curcas, Mentha cordifolia* leaves, Bacillus sp. and Trichoderma sp. as biopesticide were not significantly different from controls. The

inability of *Jatropha curcas* agents, *Mentha cordifolia* leaves, and Bacillus sp. and Trichoderma sp. as microbial pesticides is caused of the biological agents has low control. The low efficacy may be caused by the emergence of resistance to the applied biopesticide.

Table 5. Effects of Various Control Agents on Percentage of Thrips attacks

Treatments	Thrips attack percentage on each stool						
	7	21	35	49	63	74	90
1. Neems plant	9.24 f	12.61 e	13.72 e	19..16 g	20.37 de	25.19 c	27.08 d
2.*Jatropha curcas*	24.58 bc	28.51 bc	35.72 bc	47.35 bc	58.71 b	58.44 a	67.28 ab
3.Annona muricata	15.62 de	19.37 de	27.53 cd	30.42 ef	31.50 cd	33.09 bc	34.30 d
***4.Mentha cordifolia* leaves**	26.28 b	32.63 b	36.71 b	41.36 cd	46.31 b	49.03 a	51.84 c
5.Tinospora crispa	17.31 cd	16.43 e	22.31 d	25.31 ef	33.15 c	38.45 b	36.17 d
6. Bacillus sp.	16.33 d	18.32 de	22.52 d	34.41 de	36.87 c	50.30 a	60.82 bc
7.Trichoderma sp.	13.26 de	23.17 cd	32.50 bc	55.39 b	48.42 b	51.12 a	62.14 b
8. Beuveria sp.	1.42 f	12.15 e	12.31 e	12.95 b	13.01 c	13.56 d	13.99 c
9. Distilled water as control	38.42 a	58.46 a	55.52 a	62.72 a	69.47 a	58.53 a	72.34 a

*) The average number followed by the same letter in each column is not significantly different according to Duncan's multiple range test at a real 95%
Source: Own calculation

Resistance in the field that is sometimes indicated by the decreased effectiveness of a control technology does not occur in a short period of time [8]. Pesticide resistance develops after a selection process that lasts for many generations. Resistance is an evolutionary phenomenon caused by selective selection of insecticide-treated insect pests.

In the natural frequency, the susceptible individual alleles are greater than the frequency of resistant individual alleles. Due to the persistent selection of sensitive individuals in a population and leaving resistant individuals. These resistant individuals will mate with one another to produce resistant offspring as well. Populations that remain alive in early pesticide applications will increase the proportion of individuals who are resistant to compounds and continue this trait on their offspring. Since pesticide users often assume that living pest individuals have not received lethal doses, farmers take action by increasing the dose of pesticides and application frequency. This action resulted in the disappearance of the proportion of sensitive individuals. This action increases the proportion of individuals who survive. From generation to generation the proportion of resistant individuals in a population will increase and eventually the population will be dominated by resistant individuals. Resistance will not be a problem until a population is dominated by resistant individuals so that pest control becomes ineffective.

One of the factors affecting the rate of development of resistance is the level of selection pressure received by an insect population. Under the same conditions, a population that receives more severe pressure will develop into a resistant population in a shorter time than the pest population that receives weak selection pressures.

Factors contributing to the development of resistance include genetic, biological and operational factors. Genetic factors include the frequency, number and dominance of resistant alleles. Biological-ecological factors include pest behavior, number of generations per year, longevity, mobility and migration [3]. Operational factors include the type and nature of the insecticides used previously, persistence, number of applications and target stage, dosage, frequency and mode of application, formulations, and others. Genetic and biological-ecological factors are more difficult to manage than operational factors [4]. Genetic and biological factors are the original properties of insects so that it is beyond of our control. By studying these properties can be calculated the risk of the

emergence of a resident population of an insect species.

CONCLUSIONS

Neems seeds, *Annona moricata* leaves, and *Tinospora crispa* extracts are effectively controlled the total population of individual nymph and adult Thrips populations. The level of effectiveness of controlling the extracts of these three plant species on Thrips population density is not different from the microbial pesticide Beuveria sp. Meanwhile, *Jatropha curca* extract, *Mentha cordifolia* leaves, and microbial pesticide Bacillus sp. and Trichoderma sp. are less effective in controlling the Thrips population, although it is better than the Thrips population in control plants.

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SYNERGY – RURAL TOURISM AND SUSTAINABLE DEVELOPMENT OF RURAL AREAS IN BULGARIA

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Abstract

Rural tourism in Bulgaria - a relatively fast growing and assertive field - is an alternative form of tourism. In the recent years, there is a positive trend and an increasing interest in this type of leisure by the tourists and tourism professionals too. Nearly all resources are available in Bulgaria for the sustainable development of rural tourism. Local economy and population in lagging and rural areas can to be helped with development and promotion of rural hiking. Bulgaria has with all necessary conditions and prerequisites for sustainable his development. The development and promotion of rural tourism in Bulgaria leads to a number of consequent positive and is particularly important for lagging and underdeveloped regions. In Bulgaria for the future sustainable development of rural tourism is related to: conservation and promotion of ecological resources and cultural heritage; plan and implement ad-hoc national and regional strategies for rural tourism development, improvement of existing infrastructure and activation of activities to promote its dissemination In the present study, we used a methodological approach that is implemented through specific methods: inquiry method and interviews, quantitative methods, etc.

Key words**:** *rural tourism, rural area, sustainable development*

INTRODUCTION

Rural areas occupy a substantial part of the territory of Bulgaria. They are characterized by considerable negative tendencies, which must be overcome in order to achieve the sustainable development of these regions.

There is still a negative trend in the differences between the living standards of people of working age living in the city – and of those in rural areas. These negative social trends could be mitigated and stopped with the establishment of working places in rural areas, i. e. the development of entrepreneurship. [1] Having the essentials elements, entrepreneurial activity in these areas may focus in rural tourism, since it brings revenue and direct contributes to the increase of the capital of the entrepreneurs in the business. It creates and maintains jobs, directly or indirectly, and in addition, we have to bear in mind that every workstation facilitates the detection of three to five jobs in other sectors related to it. That's why researchers believe that multiplicative effect on tourism in general and, in particular, in rural tourism, is much more strongly bound than in other sectors of the economy. The development of the rural and agrarian tourism attribute to better valorisation and use of a number of resources; affects to the reduce of the emigration from rural areas through the creation of working places in tourism and its related activities; directly reduces unemployment, facilitates the development of new activities and the diversification of production and the new skills and knowledge of those working in agriculture; leads to the creation of such a structure of agriculture to contribute to the development of the production of new, typical local products; helps to improve the quality of life in rural areas and reduce disparities between rural areas and industrialized and highly developed areas; helps to reduce budgetary imbalances between different types of tourism in the country; strengthens the economic activity in the area and thus improves the quality of life of the inhabitants In Bulgaria the niche of rural tourism is still insufficient, although there is significant potential for its development [5].

This article has for purpose to be clarify essence of rural hiking, to trace its state, main problems associated with its development and positive his influence for sustainable development of rural and trailing areas.

MATERIALS AND METHODS

The present paper is examining the following basic scientific methods and approaches: ***dialectical approach*** which examines all processes and phenomena and their actual relationship, mutual and continuous movement modality, modification; ***the system approach*** – through its application any phenomenon and process is taken as a system whose state depends on the structure, level and amendments of its constituent parts; ***abstract-logical approach*** which allows abstracting from particular characteristics and manifestations of the processes and phenomena and searches their deep innate characteristics. Specific manifestations of abstract approach are the analysis and synthesis, induction and deduction; ***situation approach***, which is taking into account the situation, the set of specific circumstances that have a strong influence on the behaviour of the individual and on the course of the phenomenon. This complex methodological approach is realized through the use of specific methods: ***inquiry method and interviews, quantitative methods***, etc. The precise use of the above-mentioned methods provides to author the opportunity to fully achieve the objective of the study.

RESULTS AND DISCUSSIONS

Situation of rural tourism

The roots of the Bulgarian spirit and character can be found in a Bulgarian village, preserving the utmost extravagance of the Bulgarian traditions. There are often mountainous and remote regions with significant background in rural economy and promising potential too, since they have succeeded to become a visible landmark of the European or even global map of the rural tourism. Of course, in Bulgaria these are just exceptions, while on the contrary, in other countries as for instance is France, Ireland, Netherlands, Ireland, Germany, Spain, the practice of rural tourism is stimulated in national level and there is also widespread culture of rural tourism amongst not only the tourism professionals but amongst inhabitants too. A tourist may travel to villages and rural areas after his seaside holidays. This trend could easily find a solid ground in Bulgaria too, since the relief of the country combines attractive beaches and mountainous areas of unique beauty. According to the Bulgarian Association for alternative tourism (BAAT) the interest in rural areas has increased. The increase in demand for the products of rural tourism is about 6% in last years. The majority of the visitors in the Bulgarian mountains and villages are Germans, French, Spanish, British and US citizens. Although The niche of the rural tourism is still insufficient, there are indeed significant preconditions for its development. In the recent years, the reorientation of the tourists for alternative tourism products is more and more visible in global level. Bulgaria has not yet reached the levels of other EU countries (Spain, France, Italy, etc) where the guest-houses are rented in a higher price than the hotels and offer the same conditions providing to the guests pure authenticity and customised services.

Guesthouses and family hotels located in rural areas are becoming more and more popular, being already a favourite place for relaxation and escape from the crowded urban centres. These types are predominantly micro-and small enterprises. [2] Bulgaria offers more than 1,200 sites for rural tourism, providing a total capacity of 209,000 beds for accommodation. The interest in building similar properties is growing steadily. During the previous programming period under the Rural Development Programme 2007-2013, (measure 311 and 312) it was implemented a significant number of projects for the construction or reconstruction of guest houses, family hotels, villas, motels and campgrounds. In the current programming period, these projects are implemented under the measure 6.4 "Investment support for non-agricultural activities in RURAL

DEVELOPMENT PROGRAMME [8]. This financing tool allows the funding of projects for ~~the~~ construction of new properties and for renovation of existing ones. The requirement is that they are up to 20 units. A prerequisite is the project to be implemented within a rural territory. It is not foreseen financing for investment within urban centres or developed resorts with mass tourism. Beneficiaries of the Measure 6.4. *"Investment support for non-agricultural activities"* could be newly created or existing micro firms (employing up to 9 persons including), based in a rural municipality. In case the applicant is a registered farmer, it is required that his farm should have a standard production volume (CSP) over 8,000 Euros. Grants will be up to 75% of the total eligible costs and up to 200,000 Euros [8] (Rural development programme 2014-2020). Not good interaction between local power and other important participants in tourism industry not waters to creating of more competitive tourist product and a fuller absorption of potential of rural hiking, despite that has positive trends in its development. Another factor which definitely affects the situation is the fact that the pace of development in rural tourism has not yet reached its full potential due to the lack of infrastructure (making mountain areas not easy accessible at all) and of efficient public services in remote tourist areas. The positive trends in the development of rural tourism are mainly the result of private initiative as well as of the constantly rising demand for high-quality tourist services. Along with agriculture, rural tourism is the other, with great importance sector which can provide sustainable, long-term employment and income for the rural population. This is primarily a family-type business, unlike the major hotels and resorts, which corporate investments. Here the question touches to the role of national policy in the area led to the absorption of EU funds in the direction of non-agricultural activities for rural tourism. The investments should be in family farms, small and medium-sized firms, rather than large structures in tourism. For the sustainable development of this type of tourism, we must develop a regulation for rural tourism, covering all the activities within it - that is, certification criteria, categorization of stars for sites, because the purpose of these regulations is to have one correct definition, which the subject develops and what services it provides to users. And at major hotels, places and small objects, there are abuses. These regulations must not be unregulated, or they are reduced to an absolute minimum in the interest of consumers and holidaymakers. Rural tourism seems to be a promising chance for the development of many areas in the Bulgarian territory. The most prominent destinations in Bulgaria today are located in the northern part of the Central Balkan Mountains, more specifically the areas within and around the municipalities of 'Elena' and 'Apriltsi'. Significant employment rates in rural tourism are met within the regions of Smolyan, and Blagoevgrad. There is also a remarkable employment rate during the summertime in 'Strandzha' villages and as well as in the villages of the Southern Black Sea coast. It should be outlined that, that the investments in rural tourism are returning and are also resistant when they are made after a serious business planning, and taking in consideration specific conditions, capacity and potential of each area. There are plenty of 'worst practices' to be mentioned from the previous programming periods as countless hotels and guesthouses are now standing almost abandoned. Measure 6.4 From "Programme for Development of Rural Areas" has key matter for effective score of projects from Ministry of „Agriculture and Forests", what assisted development of rural hiking and area through effective investment.

Essence of rural tourism and elements of its product

Rural tourism and its mode of organization does not imply a scale and pace that can bring great profit. After all, it is all about ~~a~~ small, family-run businesses, with relatively limited development opportunities. A guesthouse may not happen with 40 beds, because there is no already, guest house or hotel. However, it seems that it is a great opportunity when a variety of services and activities is offered to the visitor along with the accommodation. Through this policy, attractive services (e.g.

trekking, biking, climbing, etc) are offered by the guesthouse owners or in collaboration with specialized instructors, achieving to return an added value to the business and even to the wider area. Tourism professionals are still not aware about the exploitation possibilities to be offered in rural areas. There is a lack of knowledge and expertise especially in the basic elements of rural tourism product and the manner of their offering on the part of practitioners of rural tourism [3] In Bulgaria the lack of knowledge and experience in the opportunities for development in rural tourism, the poor knowledge of its nature by the seeker to practise this type of tourism, as well as the way of proposing to the proposer, to clarify his nature and items.

Rural tourism represents the tourism in a rural area, having as a primary objective the active or passive recreation at the tourist site with typical rural setting, making direct contact with farmers; and exploring the authentic and typical landscape ~~of~~ as well as the exploration of the regional cultural, natural, archaeological and historical capital. Rural tourism provides complex product and according to a broader definition "rural tourism includes a range of activities, services and amenities that are submitted by farmers and peasants in order to attract tourists in a given area and thus to gain extra income " [7] (Clarke, 1986). If that perception is more widely adopted, rural tourism will cover not only farmer's agricultural and tourism (this is the common understanding of the term), but also breaks in nature and non-urban areas, in addition to accommodation, services may include a variety of festivities, events, shopping of local handicraft. As a specialized form of tourism it contains three components**:** **overnight**, **food** and **extra activities**.

In rural tourism, it is necessary, on the one hand, to maintain the originality and authenticity of the sites for accommodation; and on the other hand, to create contemporary comfort with the use of rural tourism product since the tourist has it in their daily lives in the contemporary urban environment.

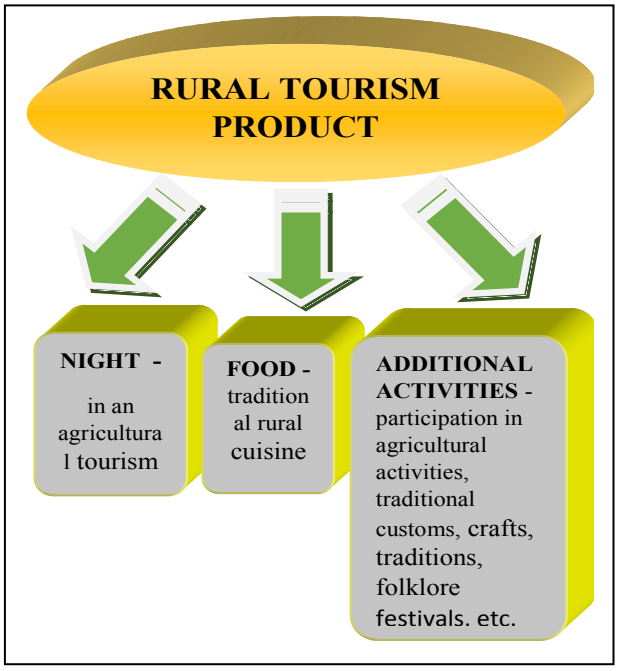

Fig. 1. Content of the rural tourism product
Source: author's development

Objects, on the one hand, the need to preserve its authentic, natural and distinctive looks and simplicity, and, on the other, to offer modern conditions for residence, for example: hygienic modern bathroom in the farmhouse with beamed ceilings and a thatched or by stone roof tiles, house to meet modern safety requirements, etc. Rural tourism is usually associated with a specific shape of the interior of the house – the wood-carved furniture, ceilings, natural fabric, decoration of old agricultural tools, authentic old household items, hand-embroidered tablecloths, dried flowers, etc., the coppersmith's products, pottery and other crafts.

The second element of the content of rural tourism product i.e. nutrition**,** should include traditional local dishes preferably made of local agricultural products. A traditional local dish can reflects the culture of the area and the nutrition habits of the inhabitants giving the opportunity to the tourist to become more familiar with the everyday life and activities of the locals. To that end we should not underestimate the value of the local cuisine as a basic element of the overall tourism product of a specific area. The primary purpose of the **'**culinary geography**'** is to allow local producers to create a local 'brand' as a vehicle to promote the area and its special

characteristics, to support this effort by producing products locally cultivated and preserved, retaining their authenticity. A local network or a cluster may also apply in this case as a tool–towards enhancing the final tourism product. This could also be combined with the concept of organic farming, fresh and healthy agrifood which preserves the local biodiversity.

The third element of the content of the rural tourism product concerns the additional activities which might include the following ones: diverse-trips, tours, picnics, trekking, climbing, canoeing, folklore festivities, etc. The competitiveness of rural tourism is determined by the content and the combination of its elements. In order to achieve a complex tourism product, it is very important to develop all three elements the content of these elements depends on the specific features and characteristics of the region, the possibilities for combination with other types of alternative tourism: e.g. ecological, culinary, wine, sports, and so forth.

Sustainable development of rural tourism and rural areas

The problems of developing and promoting rural tourism in Bulgaria, is formulated in the following way:

- Missing booking system for accommodation in rural tourism sites, and of tour operators offering rural tourism.
- Weak advertising-because of the lack of a good advertisement of the country's attractions abroad, yet tourists who choose this type of holiday, are mainly Bulgarians. They are about 85-90% of the tourists who choose rural tourism in and still is obviously a very small percentage of foreigners who prefer to relax in the countryside, mostly because of the weak marketing and advertising abroad in this direction.
- Thematic tourism product, connecting accommodation with a certain activity is now starting to be implemented.
- Rural tourism is seasonal, which reduces the annual implementation and profit and its product has a low added value.
- Lacking adequate infrastructure; bad road infrastructure; lack of directional signs, information, etc.
- Lack of experience and knowledge in the vast majority of practitioners or wishing to practice rural tourism.

Intellectual currents originated on tourism in rural areas has for objective the improvement of the social and economic way of life of the population in these disadvantaged regions through:

- The creation of new jobs;
- Infrastructure development in an environmentally-friendly way, uniting the efforts of the private and public sector;
- Creation of infrastructure, which would affect favourably the economic growth of the region, such as not exceeding the permissible load of the natural environment and has a positive impact on the quality of life in the area concerned;
- Stimulating exchanges between rural areas, and develop a positive attitude and knowledge of the rural community;
- The reduction in the number of young people leaving the countryside and moved into large cities, as well as the emigration out of Bulgaria, which will help to stabilize the population in the less developed regions still;
- Creating opportunities for the preservation of traditional agricultural activities and practices, "village" atmosphere and life;
- Contribution to the conservation of the historical, architectural, cultural and ethnographic identity of the region;
- Rural tourism complies with environmental requirements and avoids the negative impact of major tourist sites on the environment;
- Encouraging the preservation of the environment and contribute to the conservation of rare and endangered plants and animals;
- Emphasis is placed not only on the environment but also on the cultural sustainability. Rural tourism does not violate the cultural traditions of the community – the host;
- Rural tourism is a form that is based on natural, social and societal values that allow

the guest and the host to share experiences and positive experiences.

- Preserve family relationships with rural communities;
- Stimulate the development of local small businesses and thus encouraging the diversity of economic activities in rural areas;
- Development of tourism and organic farming, which is a prerequisite for the establishment of a means of livelihood of the people, to create jobs and revive the economy in the area.
- The restructuring of the agriculture and agri-food industry, development of authentic Bulgarian crop varieties and breeds of livestock, wine growing and winemaking, fruit-growing and canning industries, the cultivation of essential crops, etc.

Table1. Comparison between mass and rural tourism

Subjects	Mass tourism	Rural tourism
Tourist	passive recreation	physical activity
	encapsulation of personality	complicity in activities
	subject to the lowest price	an authentic rural environment
		exploratory activities
Industry	standardization	product diversification
	clothing	flexible specialization
	mergers	ecological orientation
	Search for economies of scale	increasing profits by increasing consumer experiences
Local community	more tourists at any price	links between economic activities
	export of income	cluster networks
	ecological crisis	community revival
	without a direct connection with cultural-historical, architectural landmarks	

Source: adapted by the authors

Entrepreneurs in mountain and rural territories of Bulgaria be appear important segment for achieve of better rural holding and economic tool for development in region. Rural tourism generates additional income for rural families, creating jobs and reducing unemployment, reduced direct emigration from rural areas, contributes to the development of new activities and the diversification of the economy [4]. Therefore, tourism services in the rural areas are able to support local population and communities in developing economic diversity. [6]

The potential of rural tourism must be recognized and thus used by these regions**;** a comprehensive analysis of the current situation should be made (along with a SWOT analysis) and a strategic plan to support rural tourism, should be developed with recommendations on specific measures for the promotion of the rural tourism of the region. This is partly due to the lack of an established institutional and legislative framework and official data on the economic outcomes of this type of tourism. There is no proper reflection of the share of taxes collected from rural tourism to other types of taxes in municipalities, which does not show its real impact on the local economy. There is also a lack of accurate data on the amount of rural tourism revenue. All this has an impact on our real assessment of the economic impact of rural tourism in the rural area concerned. However, without these official data, we can say that in poorly developed and lagging areas, rural tourism is an economic activity that has an economic and social impact on their development. The sustainable development of rural tourism leads to an improvement in the quality of life of the population in the region. It has a positive impact on local communities, it enables local citizens to participate in the social and political life of the region and the country, which encourages their participation in the development, supply and management of local tourist product. So they can judge the benefits it brings to them and its impact on the preservation of ecological and cultural values, preservation of traditions, landscape and biodiversity. The development of rural tourism leads to preservation, restoration, maintenance of the material and non-material cultural heritage.

The contribution of the rural tourism to the local economy is relatively small for most

rural destinations or at least it is the officially registered income. This partially happening due to the presence of the so called "gray" economy, which is facilitated by the lack of a well-established institutional and legislative framework and the lack of formal data for this type of business. In fact, there is no accurate data on the real income from rural tourism, and the ratio of taxes collected from tourism to all other taxes does not properly reflect the share of industry. This fact influences our awareness of the economic impact of a given area, but even with no formal data, it can easily be assumed that in underdeveloped areas rural tourism is the only economic activity with growth potential. In addition to financial outcomes, rural tourism development generally improves the quality of life (providing more personal contact, motivating people to better care for the environment, making these areas preferable in national development plans).

Rural tourism is not only an economic opportunity to develop rural and mountain lagging areas, but it has a positive environmental and social impact, a means of improving the quality of life; Representation of local citizens in government. All this leads to encouraging the development of meat communities, active local residents and tour operators. In this way local communities participate in the development and management of the tourist product and the benefits it will bring to them. The ecological aspect that this type of tourism has is expressed in the conservation of the landscape and biodiversity in the region concerned. Secondly, tourism can also serve as an element of conservation, for example, in the restoration, maintenance and protection of tangible or intangible cultural heritage. Creative potential stands out especially when the revival of certain cultural traditions for the purposes of tourism encourages individual creativity, artistic creativity and the fullness of familiarizing people with their environment and history.

In recent years, widespread popularity in literature and a number of attempts at practical realization has gained the cluster approach. It is based on partnership and co-operation of various direct and indirect participants in the execution of a particular activity or production of a particular product.

The cluster in tourism combines mostly representatives of small and medium-sized tourism businesses, for the exchange of experience and knowledge, for the development and the implementation of innovations, the inclusion in national and international networks, joint marketing activity. However, the utmost motivation for joining a cluster is not other than the economy of scales.

All these activities aim to provide more complete and quality service to tourists. For example, a single cluster can combine various sectors of tourism, culture, local industry, agriculture (agribusiness), and local government and municipal administration.

This kind of groupings formed on the basis of the so-called "Diagonal integration", providing complementarity to organizations and institutions in order to ensure a‟‘full pack' of the tourists' stay. Thus, the cross-sectoral cluster approach provides a better quality of tourism product and adds competitiveness to the rural tourism enterprise.

The cluster approach also provides an integrated development of the economy and economic life of the region - economic, social, environmental and institutional; regulated environmental impact; balancing the interests of business, the population's municipal power.

Through the integrated development of the economy in a certain region, it is achieved the so-called "Synergy effect" – a multidimensional effect and result. In economically underdeveloped or underdeveloped regions, the need for cluster, integrated approach is higher.

Economic life in underdeveloped areas requires diversification of the economy due to the impossibility of strong, forward-looking development of an individual business sector.

Apply the cluster approach by merging certain activities that are either organizationally and technologically related or not, for example:

-rural tourism and wine production and specific local food products;

-production of clothes - local costumes, souvenirs and pavilions for their sale;
-leisure and sports instructors and mountain guides;
-producing high-quality food made of products coming from local farmers and offering it in catering and family hotels;
In this way, the implementation of a diversification strategy in a particular rural area, the cluster approach, helps to create added value for the produced rural tourism product and makes it more attractive, more demanding and more sophisticated. The application of this approach is in line with the European Union Regulation No. 1698/2005 on the promotion of the diversification of the rural economy.

CONCLUSIONS

Rural tourism is one of the major tourism subcategories, being in the first line of the leisure market in many European countries. Changes in agriculture policy have made the future of many rural and mountainous regions in the country uncertain, and it is precisely the revival of these lagging areas that would be possible through the development of rural tourism, which has evolved significantly rapidly.
In a number of European countries, it is a core activity in the development of the local economy and a form not diversifying agriculture in an outside urban undeveloped rural environment.
This is due to the growing attractiveness of this type of tourism. As well as its rapid spread over time as a result of the uncertainty in rural development caused by changes in agricultural policy, rural tourism is the most appropriate tool for economic and social development of underdeveloped rural areas. This is done by keeping or even increasing employment, maintaining and creating local income, jobs and population growth, diversifying the professions offered, preserving services, supporting farms, increasing the number of cultural events, preserving nature or revitalizing rural crafts and arts to attract tourists, enables the acquisition of agricultural and culinary skills, enriches the knowledge of the countryside and culture of the region. Rural tourism often provides incentives for infrastructure development, helps raise funds for economic and social infrastructure, which in turn contributes to the growth of other economic sub-sectors in rural areas.

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RELATIONSHIP BETWEEN SUSTAINABLE DEVELOPMENT AND PUBLIC HEALTH. CASE STUDY ROMANIA

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Abstract

Health and well-being are the key drivers of social and economic development, as well as a major priority for the population and communities, as the deterioration in health generates the loss of life and the waste of resources in all sectors, besides suffering to people. Factors contributing to the prosperity also contribute to an increase in the health of the population, since fair access to education, decent living conditions and decent incomes contribute to maintaining health. At the same time, increasing work productivity, healthier aging of the population, and lower spending on sick leave and social benefits are influenced by population health. It is noticed that the current globalization process is becoming more and more conflicting from the point of view of the distribution of its offers, as it is accompanied by profound social inequality. In middle and low income countries, there is a marked increase in chronic disease that is increasingly worrying, we see increasing nutritional problems, an acute frequency of obesity worldwide, a demographic transition with population growth of the third age. Under these conditions, we consider that the relationship between sustainable development and public health are issues that are worth analyzing, so that public policies can take this into account and thus can contribute to increasing the well-being of the present and future generations.

Key words**:** *sustainable development, public health, Romania*

INTRODUCTION

Sustainable development is an increasingly controversial concept of the global ecological crisis of 1929-1930, nowadays representing a new path of humanity and being integrated with the economic, social and human spheres. Through sustainable development, we aim to ensure the best quality of life for all the inhabitants of the planet, both for the present generation and for future generations, putting man and his needs in a central place alongside the natural environment and protecting and preserving [6].

The strategic objectives for sustainable development of the European Union include, in addition to limiting climate change and its negative costs, promoting sustainable consumption patterns or avoiding overexploitation of natural resources, and human resource issues, such as: promoting good public health in fairness and improvement of protection against threats that may affect health; social inclusion, security and quality of life; solidarity between generations.

Therefore, health is an integral part of the concept of sustainable development, being integrated with sustainable development strategies and policies promoted for this purpose.

Starting with Agenda 21 that highlighted the role that health plays in sustainable development, concerns over this area have not ceased to exist.

Public health has officially become an area that has been within the competence of the European Union, with respect for the principle of subsidiarity, with the adoption of the Maastricht Treaty of 1992, and the Treaty of Amsterdam of 1997 stipulated that all policies in other areas, key aspects of Community action must take account of human health protection requirements [1].

The EU Sustainable Development Strategy of 2001 considered that one of its four priorities

is public health. The 2000 Millennium Summit in New York, which adopted the United Nations Millennium Declaration, promoted the idea of poverty reduction by analyzing the causes it generates and setting goals directly linked to global health improvement, such as: reducing child mortality; improving maternal health; combating HIV/AIDS, malaria and other diseases; eradication of extreme poverty and hunger; Ensuring environmental sustainability; stepping up a global partnership for development. The 2002 World Summit on Sustainable Development highlighted the relationship between health and environmental issues, highlighting the fact that sustainable development can not be achieved if there is a high prevalence of disease and the health of the population is dependent on a healthy environment.

It has been shown that there is a direct relationship between health, the environment and poverty. In 2006, the Sustainable Development Strategy of the United States introduced new public health challenges, as it was found that unsustainable trends persisted (Word). In 2007, the WHO report shows that high mobility, interdependence and interconnection as phenomena of the modern world offer many opportunities for rapid spread of infectious diseases, other major health risks for people who cause these diseases not only to spread faster, but also at shorter intervals [5]. At the EU level, there is a General Health and Consumer Protection Directorate of the European Commission that is active in the public health field and the Action Program 2007-2013 has made important contributions in reducing human health gaps / inequalities [7].

Among the 17 Sustainable Development Objectives of Agenda 2030 that aim to eradicate extreme poverty, combat inequalities and injustice and protect the planet, there is also objective 3 Health and well-being - Ensure a healthy life and promote the well-being of all at all ages [7].

As a member country of the European Union, Romania must ensure the implementation of the necessary measures to improve the health of the citizens, in harmony with the regional health policies and to contribute to the fulfillment of the Sustainable Development Objectives not only at national level but also at international level, supporting less developed countries through development assistance.

The National Strategy for Sustainable Development of Romania - Horizons 2013-2020-2030 has among its main directions the accelerated modernization of the education and training and public health systems, taking into account the unfavorable demographic evolutions and their impact on the labor market [3].

As far as public health is concerned, the national objective for Horizon 2013 was: Improving the structure of the health system, the quality of the medical act and the care provided in the health services; improving the health of the population and increasing the performance of the health system. The national 2020 target is: Achieving some parameters close to the current average level of population health status and quality of health services in other EU Member States; integrating health and demographic aspects into all Romanian public policies, and the national target for Horizon 2030 is: Full alignment with the average performance level, including in terms of funding for health services, of other EU Member States.

Therefore, public health is a concept to be followed and analyzed considering its importance in achieving sustainability goals [8].

MATERIALS AND METHODS

Sustainable development is an increasingly controversial concept of the global ecological crisis of 1929-1930, nowadays representing a new path of humanity and being integrated with the economic, social and human spheres. Through sustainable development, we aim to ensure the best quality of life for all the inhabitants of the planet, both for the present generation and for future generations, putting man and his needs in a central place alongside the natural environment and protecting and preserving [6].

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Therefore, public health is a concept to be followed and analyzed considering its importance in achieving sustainability goals.

RESULTS AND DISCUSSIONS

This paper aims to analyze the main public health indicators correlated with the population of Romania as well as GDP, given that there is a proportionality relationship between the GDP and the fraction allocated to health services, the poverty being directly related to the allocation health resources.
Based on the statistical data, it is observed that during the period 2007 - 2016 there was a continuous decrease of the population as a result of the migration of the labor force with Romania's entry into the European Union but at the same time due to decreased birth rate, aging population and increasing mortality. Compared to 2007, the decrease was 5.38% in 2016 for the resident population and 1.56% for the home population.

Table 1. Population by residence and population by residence in 2007-2016

Year	Population by home		Population by residence	
	Number of people	%	Number of people	%
2007	20,882.980	100.00	22,562,913	100.00
2008	20,537,848	98.35	22,542,169	99.91
2009	20,367,437	97.53	22,520,477	99.81
2010	20,246,798	96.95	22,492,083	99.69
2011	20,147,657	96.48	22,441,740	99.46
2012	20,060,182	96.06	22,401,865	99.29
2013	19,985,814	95.70	22,359,849	99.10
2014	19,913,193	95.36	22,299,730	98.83
2015	19,819,477	94.91	22,260,158	98.66
2016	19,760,314	94.62	22,214,995	98.46

Source: Own processing, Tempo online National Institute of Statistics [4].

By age group, during the period 2007-2016, there is a population aging process, with changes in the age group for the resident population showing a decrease of the young population aged 0-14 years by 1.2% and 1.8% of the population aged 15-49. Over the same period, the population aged 50-64 increased by 0.6%, and those aged over 65 increased by 2.4%.

Table 2.Structure of the population by age groups during the period 2007-2016 (%)

Year	Population by home				Population by residence			
	0-14 years	15-49 years	50-64 years	Over 65 years	0-14 years	15-49 years	50-64 years	Over 65 years
2007	16.6	49.9	18.4	15.1	15.4	52.4	17.8	14.4
2008	16.0	48.7	19.5	15.8	15.3	52.0	18.2	14.5
2009	15.8	48.1	20.0	16.1	15.3	51.7	18.5	14.5
2010	15.8	48.1	20.0	16.1	15.3	51.4	18.8	14.5
2011	15.8	48.1	20.0	16.1	15.2	51.2	19.0	14.6
2012	15.8	48.0	20.0	16.2	15.2	51.1	19.0	14.7
2013	15.6	48.1	19.9	16.4	15.1	51.1	19.0	14.8
2014	15.5	48.2	19.5	16.8	14.9	51.1	18.8	15.2
2015	15.5	48.2	19.1	17.2	14.8	51.2	18.5	15.5
2016	15.4	48.1	19.0	17.5	14.7	51.2	18.3	15.8

Source: Own processing, Tempo online National Institute of Statistics [4].

Regarding the share of age groups in the total population by residence, the same demographic population aging trend (figure 1), increasing the population aged between 15-49 years, followed by the share of the population between 50 and 50 -64 years, implying certain measures related to Romy ear's public health policy and the development of those areas that are characteristic of the health system that responds to the specific needs of an elderly population (Fig.1).

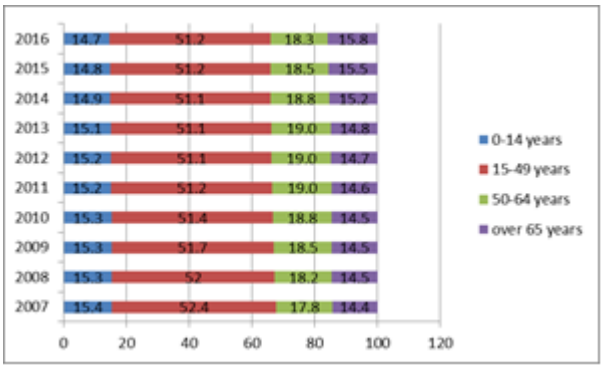

Fig. 1. Population structure by domicile and age groups over 2007-2016
Source: Tempo online National Institute of Statistics [4].

Analyzing the statistical data on birth rates highlights the fact that during the period 2007-2016 a negative natural increase was registered. The highest values of the indicator were recorded in 2012 and 2015, when the number of deaths exceeded by 73.3 thousand

persons, respectively 73 thousand newborns, which represented a 96% increase of negative growth compared to 2007. High values were also recorded in 2013, 2014 and 2016, with negative growth increases of 90%, 87% and 78% respectively (Table 3). The causes of the negative growth of the population are the decrease in the birth rate as well as the massive migration, one of the consequences being the decrease of the working population and the aging of the labor force, which influences the ratio of the active population to the inactive population. This has led to an increase in healthcare needs, with effects not only on the health system but also on the whole of society. Under these conditions, it is necessary to take measures that will contribute to the increase of the birth rate in Romania.

Table 3. Evolution of Birth, Mortality, and Natural Population of the Population (thousands people)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Born Live	214.7	221.9	222.4	212.2	196.2	180.7	176.0	183.7	187.3	190.2
Death	252.0	253.2	257.2	259.7	251.4	253.7	246.8	253.3	260.6	256.7
Natural growth	-37.3	-31.3	-34.8	-47.5	-55.2	-73.0	-70.8	-69.6	-73.3	-66.5

Source: Own processing, [4].

Fertility is the number of live births per 1,000 women of childbearing age 15-49 years of age. It can be seen that during the analyzed period this rate increased from 1.2 in 2007 to 1.6 in 2016 (Table 4).

Table 4. Total fertility rate (number of live births to a woman of childbearing age)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fertility Rate	1.2	1.3	1.3	1.3	1.2	1.4	1.4	1.6	1.6	1.6

Source: Own processing, [4].

Mortality measures the number of deaths within a population over a defined period of time. The variation in mortality rates influences both the natural growth rate and the life expectancy, while being influenced by the social, economic and biological factors as well as by the health services.
The mortality rate increased in the analyzed period from 11.2 deaths/1,000 inhabitants in 2007 to 13.1 deaths/ 1,000 inhabitants in 2016 (Table 5).

Table 5. General mortality rate (deaths per 1,000 inhabitants)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of death	11,2	11,2	11,4	11,5	11,2	12,6	12,4	12,8	13,2	13,1

Source: Own processing - Tempo online National Institute of Statistics, [4].

Life expectancy at birth is a major demographic indicator analyzed in correlation with the population mortality indicator but having an impact on all components of the standard of living. The standard of living is linked to the wealth and prosperity level of a population and is measured by the quality and quantity of the goods and services that a population and a person have.
The World Health Organization and Eurostat use information not only about life expectancy at birth, but also about healthy life expectancy, meaning the healthy lifestyle of life expectancy at birth. The indicator is the average number of years that a born is expected to live with good health and combines information on age-related health status and age-related morbidity data.
The analysis of the data in Table 6 shows that life expectancy increased in 2016 as compared to 2007 by 2.95 years. Life expectancy for men increased by 2.94 years, while in women it increased by 2.93 years. Women's life expectancy is almost 7 years higher for women than for men in 2016.

Table 6. Life expectancy at birth, by sex (%)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Male	69.17	69.99	70.19	70.27	70.63	71.24	71.73	71.97	71.94	72.121
Female	76.14	77.05	77.45	77.64	77.86	78.20	78.60	78.89	78.90	79.007
Total	72.61	73.47	73.76	73.90	74.20	74.69	75.15	75.41	75.39	75.566

Source: Own processing - Tempo online National Institute of Statistics, [4].

The evolution of life expectancy by gender highlights the fact that life expectancy has increased continuously from 2007 to 2016 for both male and female populations. A global study highlights the fact that the indicator has risen globally as a result of the decrease in mortality rates due to cancer and cardiovascular disease in rich countries and the increase in the survival rate of tuberculosis, diarrhea and malaria patients in poor countries (Global Burden of Disease, 2013).
Life expectancy is an important element in developing policies that take into account the life cycle, namely: employment policies, retirement policies, or health care policies (Fig. 2).

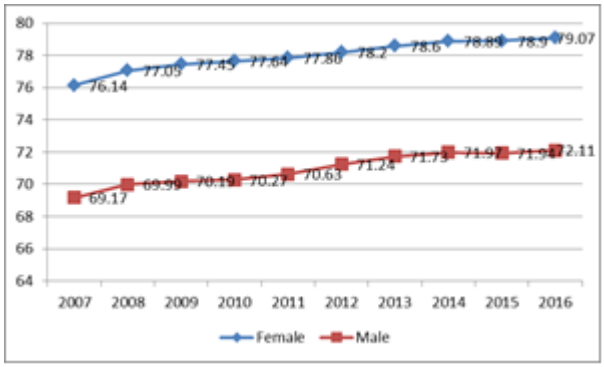

Fig. 2. Evolution of life expectancy at birth, by sex
Source: Own processing, [4].

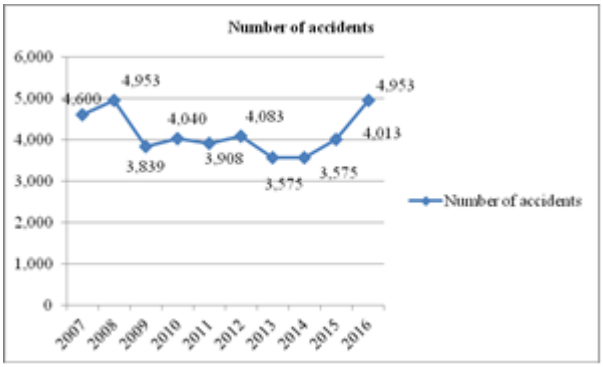

Fig. 3. Evolution of number of work accidents
Source: Own processing, [4].

Occupational accidents represent an area of contemporary public health with major consequences in the economic, social, legal or political sector. Concerns about improving health and safety at work must be a priority for all governments, given that these accidents generate both societal and organization costs but also suffering and disability that can compromise the life of the victim and family. Although safety and health at work have seen a development in recent years leading to a reduction in the number of work-related accidents, Romania needs to make further efforts to meet the European Union's 2020 targets and 2030 respectively.

The data analyzed show that the number of injuries at the workplace had an oscillating evolution. The smallest number of injuries registered in 2013, respectively 2014, when their number was 3,573 injured, and the highest number was registered in 2016 when it was 4,953 injured.

Table 7 - Number of injured at work

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of injuries	4,601	4,953	3,839	4,040	3,908	4,083	3,575	3,575	4,013	4,953

Source: Own processing, [4].

Starting with 2008 and until 2015, however, there is a decrease in the number of injuries at the workplace (Figure 3).

We believe that promoting a national strategy to reduce work-related accidents should take into account the premise that a policy of preventing and combating the phenomenon of labor crunching is less costly and far more efficient than the costs generated by the globalization of its consequences.

The quality of life is given by the perceptions of individuals on their social situations, in the context of the systems of cultural values in which they live and their own needs, standards and aspirations (WHO, 1998). One of the eight dimensions of quality of life is given by the affordability and quality of medical and social assistance services that are influenced by financial stability. Therefore the indicator Self reported unmet need for medical examination for financial reasons, is an important indicator of public health.

It is noticed that the share of persons who could not consult a specialist for financial reasons decreased from 72.5% in 2007 to 61.2% in 2016. The peak year was represented by 2011 when the number of these persons was 76.8%, followed by a further drop in this share by 2016.

Table 8. Self reported unmet need for medical examination for financial reasons, by sex (%)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Male	71.5	71.6	70.4	71.0	74.2	73.6	72.6	74.1	69.6	57.3
Female	73.2	72.7	74.7	74.9	78.4	75.8	72.5	72.7	73.7	63.5
Total	**72.5**	**72.2**	**73.0**	**73.4**	**76.8**	**74.9**	**72.5**	**73.2**	**72.1**	**61.2**

Source: Own processing - Tempo online National Institute of Statistics, [4].

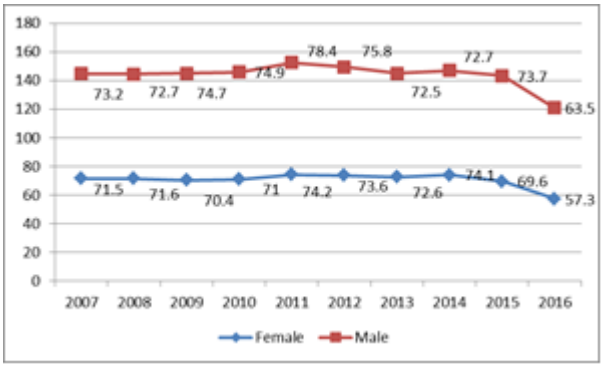

Fig. 4. Evolution of self reported unmet need for medical examination for financial reasons, by sex
Source: Own processing, [4].

Analyzing the Self reported unmet need for medical examination for financial reasons, by sex it is found that the number of women who give up medical services is higher than the number of men, but the indicator's evolution is relatively similar (Fig.4).

Analyzing the self-reported situation, the highest share of age groups is represented by people over 50 years old. From one year to another, however, it is found that the share of persons aged 15-24 years has increased from 45.3% in 2008 to 70.9% in 2016, for persons aged 25-34 the share decreased from 85.4% in 2011 to 60.5% in 2016. Decreases were also recorded between 2007 and 2016 for age groups 50-64, 65-74 years and over 75 years.

Table 9. Self reported unmet need for medical examination for financial reasons, by age groups (%)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
15-24 years	59.7	45.3	68.4	86.9	79.6	79.5	62.7	65.2	52.0	70.9
25-34 years	68.9	59.9	56.7	73.9	85.4	74.6	64.7	69.6	60.7	60.5
35-49 years	67.2	70.1	72.7	70.2	72.5	74.5	68.9	79.9	58.6	71.0
50-64 years	71.9	75.2	80.7	76.4	80.6	75.4	75.6	72.3	58.7	61.9
65-74 years	77.5	76.4	72.7	71.9	75.7	75.4	73.1	73.0	87.3	59.5
75 years and Over	76.5	72.7	67.7	70.5	71.8	73.8	73.7	72.3	86.0	55.7

Source: Own processing - Tempo online National Institute of Statistics, [4].

Suicide is the most important public health issue globally. Statistics show that suicide has become a third cause of mortality, especially among certain population groups, the most affected being the age group of 25 to 54 years. From the existing data on Romania in the period 2007-2016, it is noted that there have been various variations from one year to the next. The magnitude of the suicide rate calculated as suicide rate per 100,000 inhabitants is over six times higher among men than among women in 2013 and 2015, more than 4 times higher in 2007 and 2008 and more than 5 times higher in the rest of the period. The causes of suicide are mental disorders, alcohol addiction, chronic or acute illness, etc. People are confronted with the lack of money, the loss of jobs, the couple's problems, and the hardships of daily living that pushes them into taking suicidal decisions. On age groups, the largest proportion of suicides is recorded for men over age 45, and among women over 50 years of age.

Although the WHO report shows that most countries in the world are committed to reducing suicide rates by as much as 10 percent by 2020, few countries have included suicide prevention among the priorities of public health programs.

Table 10. Suicide rate, by sex (%)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Male	18.0	18.4	20.0	21.0	19.6	21.9	20.9	19.4	19.5	17.1
Female	3.9	3.9	3.4	4.0	3.4	3.4	3.6	3.2	3.4	3.2

Source: Own processing, Tempo online National Institute of Statistics, [4].

Romania is facing a profound socio-economic transformation as a result of recent demographic changes. Estimates show that the proportion of the population aged 65 or over will increase from 15% today to 30% in 2060, which will result in a strong pressure on the costs of medical services, long-term care services and on pension insurance. On the other hand, the current health status of the young and middle-aged population, as well as the quality of medical services, will influence how life expectancy will evolve and increase the need for long-term care.

Analyzing the Death Rate of Chronic Diseases, for people with age less than 65 years, the number of deaths due to chronic diseases increased by 5% in 2016 compared to 2007. The highest death rate was recorded in 2012 of 240.4 deaths to 100,000 inhabitants. By sex, it is found that the number of deaths is higher among men, almost double the death of women due to cortical diseases, throughout the analyzed period.

Therefore, chronic growing diseases place great pressure on public health budgets, which implies the need to develop modern and flexible policies that allow for investment and innovation to adapt and rethink care systems through better integration services and ensuring continuity of care.

Achieving a long-term health level as well as ensuring a productive life can be achieved by preventing, early diagnosis or treatment of chronic diseases, but also by reviewing the health and pharmaceutical policies that will help increase the quality of health care of the population elderly.

Table 11. Death rate of chronic diseases, for persons with age less then 65 years, by sex (deaths per 100,000 inhabitants)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Male	291.3	298.6	304.7	301.7	284.2	321.2	313.2	318.7	315.5	311.0
Female	150.2	149.0	149.6	145.7	139.2	158.5	158.7	157.8	155.2	152.1
Total	221.1	224.2	227.5	224.3	212.1	240.4	237.9	239.2	236.3	232.6

Source: Own processing - Tempo online National Institute of Statistics. [4].

Life expectancy shows the average number of years a person has to live with, living in the rest of his life in terms of age-related mortality over the reference period. This life expectancy for each person changes as the individual ages or as mortality trends change.
Statistical data shows that while we live on average more, the healthy life expectancy is decreasing. Analyzing Life expectancy at age 65 for the period 2007-2016 we find that women have a higher life expectancy than men, and this life expectancy has increased for both categories. If in 2007 women's life expectancy was over 81 years, and in men of nearly 79 years, it grew from one year to another reaching 83 years for women in 2016 and nearly 80 years for men.
The setting up of public health policies, employment policies, retirement policies must take into account life expectancy at certain ages as they take into account the life cycle. Life expectancy at age 65 is an important indicator in assessing the longevity of an aging population, given that the elderly have a poor health status and have a high mortality rate compared to other age groups.

Table 12. Life expectancy at age 65, by sex (years)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Male	13.61	13.97	14.07	14.09	14.16	14.30	14.53	14.67	14.58	14.61
Female	16.44	16.97	17.22	17.32	17.35	17.49	17.78	18.01	17.97	18.02
Both sexes	15.17	15.62	15.80	15.86	15.91	16.06	16.32	16.51	16.44	16.48

Source: Own processing, Tempo online National Institute of Statistics, [4].

According to a study by the World Health Organization (WHO), at least 20% of Europe's population suffers from noise, and noise pollution is the cause of many diseases: cardiovascular disease, hearing loss, insomnia, speech difficulties, psychiatric disorders, neuroses, etc. . Environmental noise assessment and management refers to the noise exposure of urban areas built, public parks and gardens, quiet areas in agglomerations and open spaces, proximity to educational establishments, hospitals and other buildings and areas sensitive to noise.
Between 2007 and 2016, the share of the affected population oscillated between 27% in 2012 and nearly 35% in 2007 and 2016. Given the many health problems that can be generated by noise, this indicator should be taken into account when elaborated public health policies.

Table 13. Proportion of population living in households considering that they suffer from noise (%)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Nuber of people	34,5	31,3	34,9	31,5	28,0	27,1	26,5	34,5	31,3	34,9

Source: Own processing, Tempo online National Institute of Statistics, [4].

Another aspect to be pursued in public health policy-making is the value of GDP, based on several assumptions, namely: the role that GDP has in developing to improve health; health investment, although indispensable for healthcare, has a subsidiary, additive or multiplier impact on public health; a national economic and social development program should cover the requirements of health insurance and be subordinated to the need to increase the quality of life [2].

Table 14. Gross National Income (as GDP share) %

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gross National Income	97.3	98.1	99.1	99.1	99.0	98.7	98.1	99.0	97.9	97.6

Source: Own processing, Tempo online National Institute of Statistics, [4].

Thus, at the level of Romania, the gross national income reached the highest weight at the level of 2009-2011 when it stood at 99% of GDP, decreasing by almost 2% in the years 2015 and 2016.

Table 15. GDP per capita ($/resident)

Anul	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP	8,326	10,352	8,445	8,212	9,127	8,542	9,568	9,998	8,951	9,540

Source: Own processing - Tempo online National Institute of Statistics, [4].
GDP per capita has increased over the period under review, which means an increase in productivity and, at the same time, an increase in living standards with direct health implications.

CONCLUSIONS

Sustainable development is closely linked to the quality of life and the life expectancy of the population. At the same time, the relationship between economic growth and population health is evident, because sustainable economic growth is based on a healthy workforce and, in turn, economic well-being contributes to maintaining health. Therefore, public health can be considered as one of the major factors of socio-economic development.

Romania faces the phenomena mentioned in the paper, such as the decline in the labor force due to the aging of the population, the increase in mortality, the decrease in the birth rate. All these aspects can be offset by an increase in the health of the population and by the increase in life expectancy.

At the same time, healthcare affects public spending on medical services, early retirement, medical leave, etc. these expenditures can be directed to increasing the quality of life. In other words, maintaining the health of polluting and its productivity is closely linked, and the cost of productivity is one of the indicators that influences GDP.

Another element that can be tracked by using the information presented in the paper is prevention, which in turn can reduce the incidence of diseases and reduce public spending.

Therefore, the health aspect is important for countries with an aging population, such as Romania, is at the basis of public policy formulation, because it is obvious that public health investments for health are much lower than expenditures related to improving health.

In conclusion, we believe that maintaining health and prolonging life expectancy must be an important objective of each country's policy, given that improving the health of the population is an important indicator of the sustainable development of a society.

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CONTINUOUS ANAEROBIC BIODIGESTION OF THE LIQUID SUBSTRATE EXTRACTED FROM PINEAPPLE STUBBLE IN BIODIGESTERS OF 0.1 AND 4.6 L

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Abstract

The pineapple crop represents the most important agricultural activity in Costa Rica, from the economic point of view, represents 32% of agricultural exports. The sowing area is estimated at 58,000 hectares. However, this activity generates a considerable amount of biomass in the order of 340 metric tons per hectare, of which 26% corresponds to fruit and 74% to organic agricultural waste (OAW), so called pineapple stubble. This is a generator of environmental problems because it is not treated adequately in the field, where it is opted for the use of herbicides to cause its degradation and then incorporate it into the soil, a practice that has generated problems of contamination of groundwater and the pest of the stable fly Stomoxys Calcitrans. The stubble of the pineapple has the highest energy potential, within the OAW that are generated in the agricultural activity in the country as mentioned by Coto in 2013. The use of pineapple stubble juice was evaluated as a substrate for biodigestion in mesophilic conditions, using the Hohenheim methodology with volumes of 100 ml and in 6 liters CSTD biodigesters. Three types of substrate were evaluated: 100% stubble juice, a mixture of 90% juice and 10% cow manure and a mixture of 80% juice and 20% cow manure. The substrate of 100% pure pineapple stubble juice showed the best performance in biogas production. In the Hohenheim test the accumulated production was 320 ml, while the 9010 mixture produced 280 ml and the mixture 80 -20 produced 250 ml. In the CSTD reactor test, the substrate 100% stubble juice had an accumulated production of 170 liters; the 90-10 mixture produced 60 liters. The 80-20 mixture collapsed from day 20, ceasing gas production. The behavior of the pH and the FOS/TAC test showed stable behavior during the process in all cases. It was demonstrated that pure stubble juice is a good substrate for the biodigestion process; with which the technology of anaerobic biodigestion is presented as an important alternative for the use of this kind of OAW.

Key words**:** *anaerobic biodigestion, pineapple stubble, biogas production, renewable energies, etc.*

INTRODUCTION

The export of fresh pineapple from Costa Rica reached a value of 942 million dollars in the year 2017. This means an increase in national income of 7.9% more than the year previous and produced a total of 32 thousand direct jobs (CANAPEP 2018) [2]. In global terms, the FAO (2018) registered Costa Rica as the main pineapple exporter in the world in 2016: placed on the market 2,930,661 tonnes of pineapple that represented 11.35% of the market world. [6]

With respect to the planted area, there is a discrepancy between CANAPEP (2018) that declares 44,500 hectares and the survey with remote sensors made by PRIAS in 2016 that identified 58,607.5 hectares (MINAE 2017) [11].

Each hectare generates a quantity of stubble estimated at 250 tonnes, representing an organic agricultural waste with a high value energy that is not being used.

According to Coto (2013) the Costa Rican pineapple sector does not consider the viability technological and economic use of the waste produced by their farms, which puts highlight the need to investigate this bioenergetic potential, especially from the anaerobic digestion of pineapple stubble. [4]

The anaerobic biodigestion process is a complex process in which the organic matter is degraded by a series of metabolic interactions performed by a microbial community, acting in concert in a proper

environmental conditions, in which take place the develop of microorganisms of vital importance, as well as the substrate that serves as a source of feeding for bacteria and carbon for the generation of methane gas as mentioned by Khanal in 2008 [9].

Pineapple stubble as substrate

Extracts in water of pineapple stubble represent 11% m/m of the findings of Irías in 2014[8]. Pineapple residues have high contents of holocelluloses [3, 8] and high acidity [8].

Both characteristics hinder the anaerobic biodigestion of pineapple waste because the celluloses they are not digestible and the microorganisms responsible for the process do not tolerate acidity. As was indicated by McMorrow *et al* in 1969, who worked with pineapple waste from canned fruit in Hawaii, the liquid phase of the pineapple substrate has a relatively high content of sugars, but is low in organic acids. In the initial phases of the biodigestion of the pineapple liquid substrate, the microorganisms are converted into nucleic acids [10].

Subsequently, the pH increases and the fatty acids decay slightly with a concomitant improvement in the quality of the gas (35% methane). According to Aworanti *et al (*2018) the pineapple substrate showed an increase in the production of biogas as the total solids content and the temperature of the biodigester increased in the ranges of 4 to 8% and 40 to 60°C, respectively [1].

The purpose of the experiments described here was to establish the productive potential of biogas produced from the juice extracted from the pineapple stubble on a laboratory scale by means of continuous feeding tests following the VDI 4630 standard. (Ingenieure Verein Deutschland 2006) [7].

MATERIALS AND METHODS

The pineapple stubble used in these trials came from the Piñales de Santa Clara farm, located in San Gerardo de Río Cuarto (10°25'50.42 "N, 84°08'48.38" W, 161 masl). The soils of the farm belong to the order of the inceptisols. The pineapple stubble was subjected to a pre-treatment consisting of two stages: first, the cutting of the fibers with a chopping machine or "chipper"; second, the extraction of stubble juice with a sugar cane mill ("trapiche"). The pressing operation was repeated two consecutive times. The determination of total solids (ST) was made from three subsamples to have three repetitions.

The crucibles were previously brought to constant weight, placing them in a muffle at 550°C for 45 minutes. Once cooled (in a desiccator), the crucibles were weighed in vacuum. 20 ml of the sample was added to each crucible and weighed again, then placed in a furnace at a temperature of 105°C for six hours to reach constant weight. After being cooled the samples were weighed again.

Subsequently, for the determination of the volatile solids (SV), the samples were placed for 45 min in a muffle at a temperature of 550°C. Both ST and SV were determined by mass differences using an analytical balance.

Continuous biodigestion tests were carried out applying two different types of tests. In one case, the Hohenheim fermentation test was used in 100 ml syringes and, in another, the test was applied using 6 liter bioreactors (gross volume) with a functional volume of 4.6 L. The measurement of the volume of gas produced by the biodigesters of 6 liters was made with a gasometer Ritter and, the determination of the quality of the gas with the help of a Multitec 560, Sewerin.

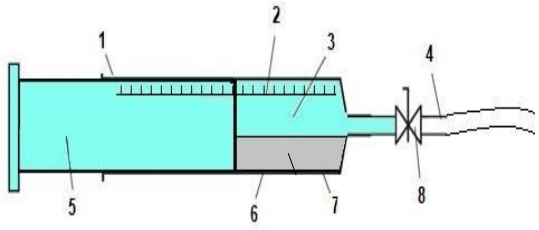
Fermentation test with Hohenheim Method.

Figure 1 shows the schematic representation of the syringes used in the Hohenheim fermentation test.

This method does not need an additional gas sampling tube. Between measurement periods, the biogas remains in the syringe, which also serves as a fermentation chamber. The biogas produced from the disintegration of the substrate displaces the plunger of the syringe, which allows measuring the amount of gas generated in a given time.

Gas losses are avoided by placing hoses on the tip of the syringes, which are sealed by presses.

Due to the limited volume of gas produced, in this test it was not possible to determine the quality of the biogas.



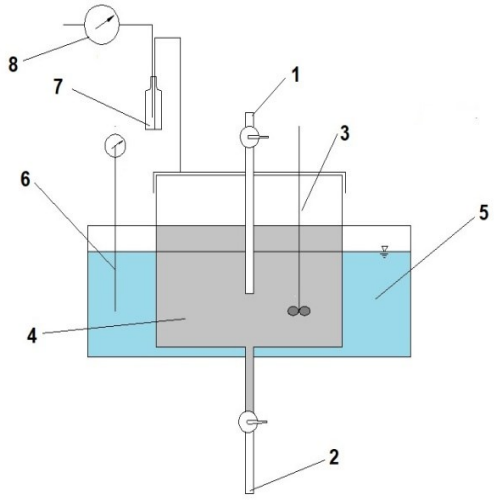
1 Lubricant and sealer
2 1cc scale for measuring gas
3 Gas chamber
4 Hose
5 Plunger
6 Glass syringe
7 Substrate
8 Press

Fig. 1. Schematic diagram of the Hohenheim fermentation test.
Source: Adapted from VDI 4630 [6]

Figure 2 shows the assembly of the test done in the laboratory installed in the EEFBM. The syringes were placed inside a chamber with temperature control and mechanical agitation. The temperature used was 37°C and the relative humidity was set at 80%. This methodology allows testing of different substrates simultaneously with several repetitions. Although the Hohenheim methodology is designed to perform batch tests, this time continuous tests were run, for which it was necessary to extract an amount of effluent equal to that of substrate fed (6 ml daily), to maintain the volume of constant matter in the syringes. In the first feeding, the syringes were inoculated with 5 ml of effluent from an active biodigester and the substrate corresponding to each treatment, in accordance with the VDI 4630 standard [7].

Fig. 2. Assembly of the Hohenheim fermentation test in an incubator with relative humidity and fixed temperature
Source: Own elaboration.

The treatments consisted of three types of substrate: pure pineapple juice and its mixture with dung in the proportions of 90:10 and 70:30. The trial had three repetitions of each treatment. It started on January 29, 2018 and included observations of the volume of gas produced during 96 hours. In these tests, due to its characteristics of using very small amounts of substrate, it was not possible to perform pH or FOS/information over a relatively long period to analyze the behavior of the process with various types of substrate under the same operating conditions. The test was carried out in three 6 liters biodigesters placed in a water bath and provided with internal stirring, temperature control, connection with the Ritter gas meters and the Sewerin brand biocontrol unit, as shown in Figure 3. Each Biodigester was fed with the same substrates (treatments) already indicated in the Hohenheim fermentation section. The temperature condition was mesophilic (37 ° C on average).



Legend:
1 Substrate entry
2 Substrate output
3 Agitator
4 Substrate
5 Bath Maria
6 Temperature sensor
7 Water trap
8 Gasometer

Fig. 3. Schematic diagram of the fermentation test in 6 liters biodigesters.
Source: Own elaboration.

An amount of 4 L inoculum was initially placed in each digester. Substrate feeding

started with small amounts (0.5 kg ST / m³ and day) and was increased every two days by 0.5 units, according to VDI 4630 procedure. However, when observing that there was no biogas production and that the values of FOS/TAC were very low, it was decided to reduce by 30% the amount of substrate feeding trying to bring such values to the range of 0.3-0.4.

The parameters measured daily were pH, temperature, FOS/TAC balance and gas production. The pH was measured according to the norm using "peachimeter", which was calibrated with buffers of pH 4.0 and 7.0. The FOS/TAC determination was carried out with the HACH titration test, using the titrator AT 1000. The gas production was measured with a Ritter drum gasometer of 0.5 L.

Fig. 4. Assembly of fermentation test with 6 liters biodigesters.
Source: Own elaboration.

RESULTS AND DISCUSSIONS

The three analyzed substrates were characterized in terms of their ST, SV and pH content (Table 1). The stubble juice showed the highest levels of ST and SV, as well as the lowest pH value. In general, as the dung content of the substrate was increased the content of ST and SV decreased and the pH value increased. In all cases, the content of ST and SV were within the range of operation of a biodigester of the completely agitated type, which is less than 10%. Frequent agitation homogenized both the distribution of solids within the digester and its temperature. This condition occurred both in the test with syringes and in that of the 6-liter biodigesters. Despite the low pH values initially observed, there was no need to make any correction.

Table 1. Content of total solids (ST), volatile solids (SV) and pH of the three substrates analyzed

Treatment	Total solids (ST) (%)	Volatile solids (ST) (%)	pH
Pineapple stubble juice	4.102	3.102	4.22
90% juice and 10% dung	3.8975	2.943	4.31
70% juice and 30% dung	3.4885	2.625	4.51

Source: Own elaboration.

Figure 5 shows the variation of the pH of each treatment as a function of the time of the substrate at the entrance and its exit (effluent) from the 6 L biodigesters.

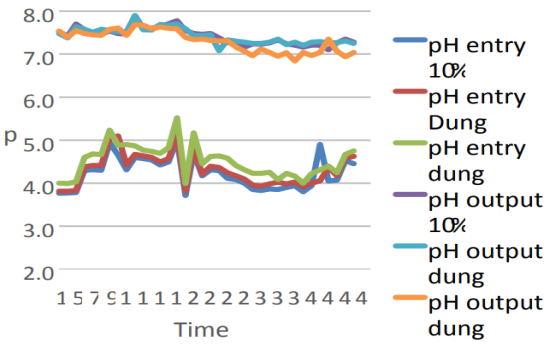


Fig. 5. Variation of the pH of the feeding substrates and the effluent of the digester during the tests.
Source: Own elaboration.

Figure 6 indicates the FOS/TAC balance of each treatment observed in the biodigesters of 6 L as a function of time.

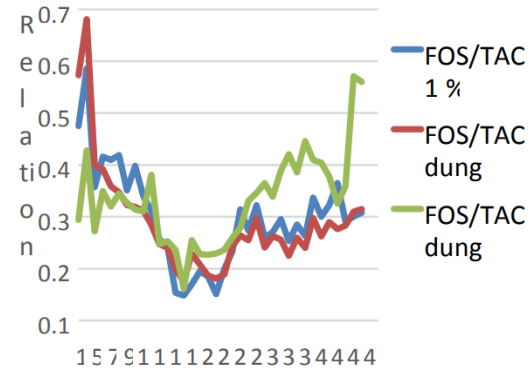


Fig. 6. Variation of the ratio FOS / TAC in the digesters during the tests.
Source: Own elaboration.

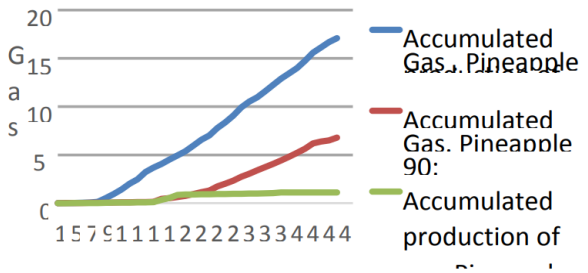


Fig. 7. Gas production of the treatments against time in digesters of 6 L.
Source: Own elaboration.

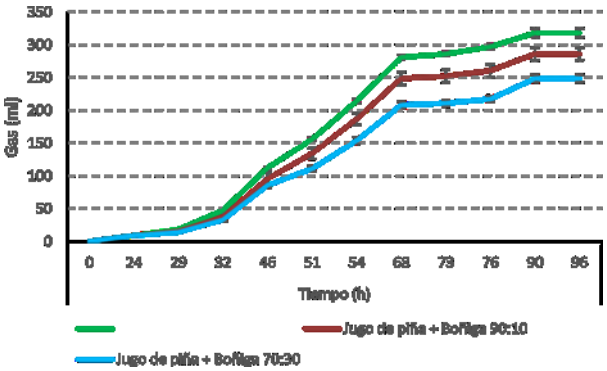


Fig. 8. Gas production of the three treatments as a function of time in Hohenheim fermenters of 100 ml. The daily diet was 6 ml.
Source: Own elaboration.

According to their characterization (Table 1), the treatments used are adequate to process them with wet anaerobic biodigestion. Despite the relatively low pH of all the treatments, it was not necessary to make acidity corrections using alkaline substances. This showed that the communities of microorganisms managed to carry out the disintegration of the substrate despite its initial acidity and that the system possesses a good buffering capacity of the pH. Figure 5 showed that the intervention of the microorganisms managed to neutralize the pH of the substrate. Therefore, it is possible to conclude that the behavior presented by the three treatments is stable, keeping the reactor within the ideal range of operation. This ensures the balance between the phases of the biodigestion process, that of methane production, since methanogenic bacteria are inhibited in conditions of pH lower than 6.7.
The FOS/TAC test is an indicator to evaluate the biodigestion processes in a reactor in operation. The TAC value is an estimate of the buffer capacity of the sample and the FOS value corresponds to the content of volatile fatty acids. The value of the FOS/TAC ratio is an indication of the stability of the anaerobic process of degradation of organic matter. As a general reference for a stable operation values are assumed in the range of 0.15 to 0.45. Values below this range could indicate a condition called "alkalosis" or inadequate feeding, which could lead to an increase in pH values and a reduction in the content of organic acids. All this would harm the hydrolysis and the formation of acids. On the contrary, a value higher than the indicated range is an indicator of a condition called "acidosis" in which there is an accumulation of fatty acids, which can cause acidification of the system as mentioned by Voß in 2009 [14]. According to the empirical values provided by Deula - Nienburg [5], the maximum production of biogas occurs when the value of the FOS/TAC balance ranges from 0.3 to 0.4. Above this range there would be an overload of organic matter that will be higher the higher the value obtained. Above 0.6 the load of organic matter would be excessive. Values below the range are an indication that food is precarious. Below 0.2 the biomass load is considered very low as found by Mézes *et al.,* in 2011 [11].
Initially the values of this parameter were high (Figure 6). Therefore, according to the recommendation, the amount of biomass fed must be reduced. However, the amount of biomass added was actually low, since the recommendations of the VDI 4630 standard were being followed. As the trial progressed, the amounts of biomass fed instead of being reduced increased and the FOS/TAC values They tended to go down until they reached the ideal range. This behavior can be attributed to the fact that the initial stage of the process is in a transition in which the process of biodigestion is not totally stable because the microbial population has not developed enough quantity or variety. Under these conditions, the concentration of volatile fatty acids (VFA) and the alkalinity of the system have not reached an equilibrium.
Therefore, the condition of the digester can not be assessed only based on the FOS/TAC balance.

According to Rosato (2017) this titration method (the FOS/TAC) allows to obtain some information about the order of magnitude of the concentration of the VFA and the alkalinity of the system [13]. However, the parameters must be analyzed separately within a context, which is the state of the observed system, characterized by a set of variables and not only the FOS/TAC balance. According to Rosato (2017), in the case of a single-step biodigester (the whole process is carried out in the same container or container, that is, without separation of the stages in several digesters), it is necessary to monitor at least twenty parameters to characterize its state adequately and thus know the margin of stability and efficiency [13]. Therefore, maintaining the FOS-TAC relationship in the range of accepted values does not necessarily allow the stable operation of the system. By contrasting the behavior of the pH (Figure 5) and the FOS-TAC ratio for treatments 1 and 2 during the first seven days the system (Figure 6) there was a transition process in which the values of FOS / TAC did not faithfully reflect the state of the system, since the pH values indicated a balanced system. Note that biogas production started on day seven for 100% juice treatment and on day 19 for 90:10 treatment (juice: dung). This last treatment showed a significant increase on day 25 (diauxiatic behavior).

From the above, it can be inferred that before starting the production of biogas, the system went through a transition stage in which the microbial population was in the process of growing and adapting to the feeding substrate and, once a number condition had been reached. and type of bacteria (that is, once the consortium of bacteria was defined and stabilized), they achieved a growing and sustainable gas production. Once the recommended FOS/TAC range of 0.3 to 0.4 was reached, the trend continued to decrease until day 25, when an upward trend began (Figure 6). This behavior responded to the fact that, based on the values obtained and the Deula - Nienburg recommendation, the quantities of substrate fed were systematically increased in search of a positive response.

By observing the behavior of biogas production (Figures 7), it can be seen that the systems operate normally, which indicates that they are "healthy". The treatment of pure juice showed a growing and sustained gas production from day seven, coinciding with the moment in which the system reached optimal values of FOS/TAC (Figure 6). At that time the pH was also in the optimal range (Figure 5). The treatment with more dung (70% juice and 30% dung) had a very different behavior than the other two treatments, presenting higher FOS/TAC values than the other two. He also showed abrupt elevations above 0.5 when the other two treatments were in the recommended range. The gas production of the continuous test with Hohenheim biodigesters showed the significant behavior of the three treatments after 51 hours of observation. In this case, the treatment with more content of dung did not show a behavior inconsistent with the pattern observed in the other two treatments. In all cases, there was a production of biogas proportional to the content of pineapple stubble juice from the substrate.

CONCLUSIONS

Under soil, but especially climate conditions of the year 2016 and the technology used, Premium wheat varieties tested had values of protein content between 13.7% and 15.9%. The average value of the six analyzed varieties was 14.6%. The lowest protein content was recorded in the 4- Atrium variant, 13.7% and the highest in 5 Arnold variant, 15.9%. Arnold variety was the only one to exceed the protein content of control (15.2%). Variants 2-Bitop, 5- Arnold and 6-Joseph obtained protein content values that exceeded the calculated average value of the varieties. Concerning gluten content of varieties, the average value was 29.9%, surpassed only by the variant 2-Bitop and the Arnold variety. Bitop variety was the variety that also recorded the highest content in gluten, 31.8%. As a witness, all varieties studied added a gluten content of between 1 and 3.1%.

In terms of hectoliter weight values, the highest value, 80.8%, was recorded in the 2-

Bitop variant. All the studied varieties exceeded the value of hectoliter weight recorded by control, (75.1%), the recorded increase being between 3.3 and 5.7%. All recorded values were over 78%.

The mass of one thousand grains had the lowest value, 35.44 g, for Fulvio 3-variant and the highest, 43.06 g, for 2- Bitop variant.

Regarding the profitability obtained by the studied varieties, it overcome in all variants the production of control, the differences being very significant and consisted in crop profitability ranging from 568 to 1,666 kg/ha. The highest production was recorded in Midas 1 variant, 8,158 kg/ha and the lowest at Arnold 5 variant, 7,060 kg/ha. As compared to average production, the 1 variant Midas obtained the highest crop profitability, 693 kg/ha, a very significant increase.

Compared to the production average, Fulvio 3 variant and Atrium 4 variant did not show any significant differences. Compared to the production average of the six varieties (7,465 kg/ha), 5 variant Arnold and 6 variant Josef made very significant harvest minuses, resulting in production differences of 973 kg/ha and 405 kg/ha, which means, in relative values, a minus production of 5.4 to 13%.

All the studied variants have confirmed the excellent value of the varieties regarding some qualitative indices but also regarding the recorded productions.

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FRAME TECHNOLOGY FOR CHRYSANTHEMUMS IN THE CONVENTIONAL AND ORGANIC FARMING SYSTEM

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Abstract

Chrysanthemum occupies an important place in the top of the cultivated flowers, due to its decorative qualities, being one of the most beautiful autumn plants. The chrysanthemum culture is of particular importance due to the period when it appears on the market, September-December, when other flowers are not found or are in insufficient quantities. Economic importance of the culture of chrysanthemums resides in the fact that it can be an important source of income due to density appropriate for the culture, the level of investment gains and values that can be obtained per unit area values are much higher compared to other agricultural crops. The paper analyses the economic efficiency of cultivation of chrysanthemums in the system of conventional agriculture and organic farming - weather 2018/2019 using indicators of profitability (gross rates of return, breakeven, etc.), which can influence which can influence the decision making required for the future production cycle.

Key words**:** *economic efficiency, profitability threshold, chrysanthemum culture*

INTRODUCTION

Flowers, at present, have become commodities, unlike the events of our lives. Floriculture tries to keep pace with the development of the entire agriculture, thus increasing the number of cultivated species, modernizing the culture technologies and deepening the knowledge regarding the agrobiological particularities of the plants [1] [3].

Photo 1. Chrysanthemum - Chrysanthemum spp.
Source: http://www.finegardening.com

The last autumn flowers, chrysanthemums, are highly appreciated due to the variety of shapes and sizes of the inflorescence, the multitude of colours (red, pink, white, yellow), with a discreetly specific fragrance, are suitable for modern dwellings. Chrysanthemums have a flower similar to daisies, anemones or beaten flowers, as shampoos of different sizes, capable of withstanding frost (blooming until the end of November) [5] [6].

Cultivated and reproduced for centuries has a large number of species. Chrysanthemums, also called bush shrubs, daisies, autumn daisies, are a kind of flower (Chrysanthemum), native to Asia and northeast Europe. Chrysanthemum species are perennial, grassy plants that grow up to 50-150 cm high, with deeply curved leaves and large flowers of various colours. Chrysanthemums can be grown in gardens, solariums, greenhouses, gardens or for decorating green spaces.

MATERIALS AND METHODS

The frame technology for chrysanthemums in the conventional and organic farming system has been adapted to the resources and conditions existing at SCDL Buzau. In order to determine the economic efficiency of the culture, the main indicators were taken into account: costs, prices, profit and profit rate.

It has also started from conventional and environment-friendly production technology according to the scheme below:

A. Application of fertilizers

	Conventional system	Ecological system
Basic fertilization	Organic fertilizers: fertilizers: 60 - 80 t/ha degraded manure + 25 - 35 t/ha peat	
	-90 – 120 kg/ha phosphorus -150 – 170 kg/ha potassium	-ecological fertilizers can be used as starter fertilizers at the doses recommended by the technical research
Method of application	-It is run with the 40-45 cp tractor in aggregate with the fertilizer machine -Autumn under the main base: phosphorus, potassium, organic fertilizers, peat -In spring, in the preparation of the germinating bed: ecological fertilizers	

Source: [2] [4]

B. Soil works

	Conventional system	Ecological system
Works executed in autumn		
Discarding previous culture	-It aims to clean the land from the vegetal remains of the previous culture -It is run with 40 - 45 hp tractor	
Maintenance leveling	-It has the role of leveling the soil after performing the blocking work -It is carried out with a tractor of 40 - 45 hp in aggregate with the grader	
Deep soil mobilization (shrubs)	-it is done for the incorporation of organic fertilizers into the soil as well as for loosening and soil breaking -It is run with 40 - 45 hp tractor in plow and adjustable hitch	
Works executed in the spring		
Disinfection of soil and protected space	-aims to destroy pathogens from soil and protected space to create optimum conditions for plant growth and development -Use chemicals specific to disinfection -It is carried out with the 40-45 cp tractor in the aggregate with the machine to perform the treatments	is not done
Preparing the germinative bed	-It has the role of grinding, chopping and leveling the soil for planting -It is carried out with a tractor of 40 - 45 hp in aggregate with the combiner	
Open gullies	-It is run with a 40-45 cp tractor in aggregate with the open-gauge machine	
Soil modeling on rough terrain	-It is carried out in 100-100 cm wide furrows, separated by 40 cm trails -It is run with a tractor of 40 - 45 HP in aggregate with the modeling machine	

Source: [7] [8]

C. Setting up the culture

	Conventional system	Ecological system
The way of planting	-is executed manually in the spring	
Density of plants	-200.000-300.000 cuttings/ha depending on the plant's management system (1 or more floral stems)	
Planting distance	-15cm/10-12 cm -20 cm/18 cm -22cm/18cm	
Depth of planting	-just to cover the cuttings with earth	

Source: [9] [10]

D. Maintenance of culture

	Conventional system	Ecological system
Watering	-dripping is recommended, ensuring that the plant's water needs are constantly maintained -Watering is done before planting -After planting it is recommended not to irrigate for a period of about 6-7 days to favor the rooting of the cuttings	
Maintaining atmospheric humidity	-It is carried out in order to ensure an atmospheric humidity of about 80-85% during vegetative growth and about 70% from the time of the appearance of floral buds -It is executed with fine spraying	
Additional fertilization	-in order to ensure the necessary nutrients of plants at all times	
	-The products recommended by the technical research are used	-Use recommended organic products
pinching	-It is done for the ramification of the plant and for the delay of the flowering -runs 2 weeks after planting and consists of removing the vegetative tip of the stem or shoots above 5 to 6 leaves -it can be repeated 1-2 times depending on the degree of branching desired or the time chosen for flowering	
Removal of unnecessary shoots	-Apart from 2-4 shoots to be led as floral stems, remove all other shoots formed after the pinching -Run when the shoots are about 10 cm long	
Pinching	-removing side shoots from the leaves (cops) to obtain unrivaled flora strains -runs throughout the growing season, when the children are 5-6 cm long	
Elimination of drags	-It is always made to compete for growing floral stems -Run when dragons are 5-6 cm long	
Embellish	-Perform to obtain the type of standard flower or twig -It is repeatedly executed, depending on the particularities of the growth of each variety	
Trellising	-is made to obtain straight, superior floral stems -It is executed by installing or building into crops of nets for plant support	
Combating diseases and pests	-it is executed manually with devices specific to application of plant protection treatments in protected areas	
	-is carried out by preventive and curative application of phytosanitary treatments with the recommended products	-is carried out by the preventive application of plant protection products with environmentally friendly products

Source: [2] [7]

E. Harvesting

	Conventional system	Ecological system
Standard chrysanthemum	Harvesting takes place in the maximum or near-complete opening phase;	
Chrysanthemum twig	Harvesting occurs when 5-6 inflorescences are open	
output	It varies depending on the plant management system	

Source: [8] [10]

RESULTS AND DISCUSSIONS

The revenue and expenditure budget for the protected area crystals crop - conventional system, has been calculated for an estimated

production of 960.000 pieces (cut flowers)/hectares.

Table 1. The main predicted indicators for conventional chrysanthemum cultivation between 2018 and 2019 (protected area, average potential) with an estimated production of 960,000 cut flowers / hectare

No. crt	Indicators	U.M	Value	
			lei	Euro (4,6 lei/euro)
1	A VALUE OF PRODUCTION, of which:	lei	1,168,330.4	253,984.9
2	B (+).SUBSIDIES	lei	542.8	118
3	C (=) GROSS PRODUCT	lei	1,168,873.2	254,102.9
4	D (-) TOTAL EXPENSES	lei	898,715.7	195,373.0
5	I. VARIABLE CHARGES	lei	271,866.7	59,101.5
6	II. FIXED EXPENSES	lei	626,849.0	136,271.5
7	E (=) TAXABLE INCOME	lei	269,614.7	58,611.9
8	E.1(-) Taxes	lei	26,961.5	5,861.2
9	F (=)NET INCOME + subsidies	lei	243,196.0	52,868.7
10	F.1 (=)NET INCOME	lei	242,653.2	52,750.7
11	G. RATED INCOME TAX	%	30	6.5
12	H. RATE INCOME NET + subsidies	%	27.1	5.9
13	H.1 RATE INCOME NET	%	27	5.9
14	COST OF PRODUCTION	Units. Cut flowers	0.9	0.2
15	PREVIOUS INTEREST PRICE MARKET	Units. Cut flowers	1.2	0.3

Source: processing ICEADR calculations.

For the crop of chrysanthemums grown in conventional protected area, at an estimated average production of 960,000 pieces of cut flowers/ha, a production value of 1,168,330.4 lei/ha corresponds, which by adding the subsidy of 542.8 lei/ha, determines the realization of a gross product of 1,168,873.2 lei/ha (Table 1).

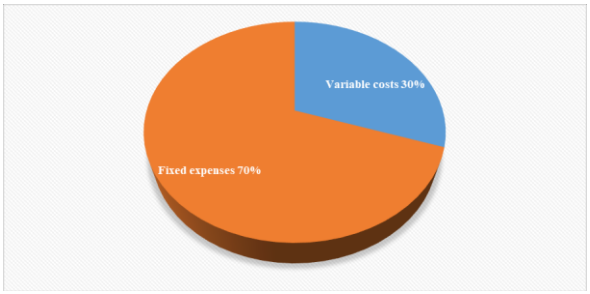

Fig. 1. Distribution of total agrotechnical costs for chrysanthemum culture (cut flowers) in conventional protected space
Source: processing ICEADR calculations.

Of the total expenditure, the variable costs 30%, and the value inputs with materials and materials account for 78% of the variable costs. With a weight of 70% of total expenditures, fixed expenses are formed in 95% of the permanent labor force consumption value (Fig. 1.) (Fig. 2.).

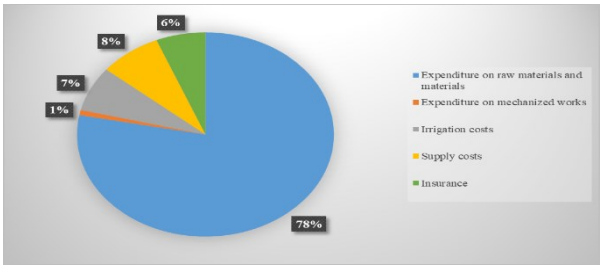

Fig. 2. Distribution of variable costs for chrysanthemum culture (cut flowers) in conventional protected space
Source: processing ICEADR calculations.

By lowering the total expenditures from the realized revenues, the taxable income is 269,614.7 lei/ha, and finally a net income of 242,653.2 lei/ha and a net income of 27% (Fig. 3).

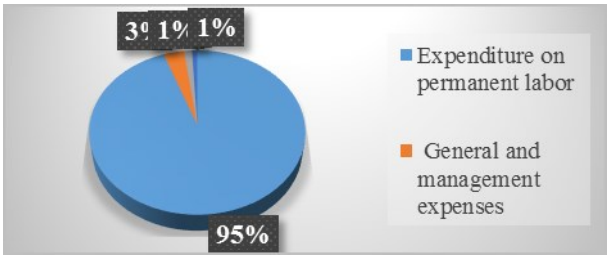

Fig. 3. Distribution of Fixed Costs for Chrysanthemum Culture (cut flowers) in conventional protected space
Source: processing ICEADR calculations.

The production cost of 0,94 lei/thread resulting from the ratio of total expenditures to the estimated average production represents the representative synthetic indicator of the economic efficiency level for the chrysanthemum culture in protected space - conventional system (Table 1).

In order to ensure profitability for the chrysanthemum culture, the foreseeable domestic market price of 1.22 lei/ thread was calculated by multiplying the production cost by a coefficient of 1.30 (Table 1).

The income and expenditure budget for the protected chrysanthemum culture - an ecological system, has been calculated for an

estimated production of 960,000 pieces (cut flowers)/hectares (Table 1).

Table 2. The main predicted indicators for ecological chrysanthemum cultivation between 2018 and 2019 (protected area, average potential), with an estimated production of 720,000 cut flowers per hectare

No. crt	Indicators	U.M	Value	
			lei	Euro (4,6 lei/euro)
1	A VALUE OF PRODUCTION, of which:	lei	1,211,762.4	263,426.6
2	B (+).SUBSIDIES	lei	2,152.8	468
3	C (=) GROSS PRODUCT	lei	1,213,915.2	263,894.6
4	D (-) TOTAL EXPENSES	lei	865,544.6	188,161.9
5	I. VARIABLE CHARGES	lei	277,013.0	60,220.2
6	II. FIXED EXPENSES	lei	588,531.6	127,941.7
7	E (=) TAXABLE INCOME	lei	346,217.8	75,264.7
8	E.1(-) Taxes	lei	34,621.8	7,526.5
9	F (=)NET INCOME + subsidies	lei	313,748.8	68,206.3
10	F.1 (=)NET INCOME	lei	311,596.0	67,738.3
11	G. RATED INCOME TAX	%	40	8.7
12	H. RATE INCOME NET + subsidies	%	36.2	7.9
13	H.1 RATE INCOME NET	%	36	7.8
14	COST OF PRODUCTION	Units. Cut flowers	1.2	0.3
15	PREVIOUS INTEREST PRICE MARKET	Units. Cut flowers	1.7	0.4

Source: processing ICEADR calculations.

In the case of cultivated chrysanthemums in ecologically protected space, for an estimated average production of 720,000 pieces of cut flowers/ha corresponds to a production value of 1,211,762.4 lei/ha, and by adding the subsidy of 2,152. 8 lei / ha, it is determined the realization of a gross product of 1,213,915.2 lei/ha (Table 2).

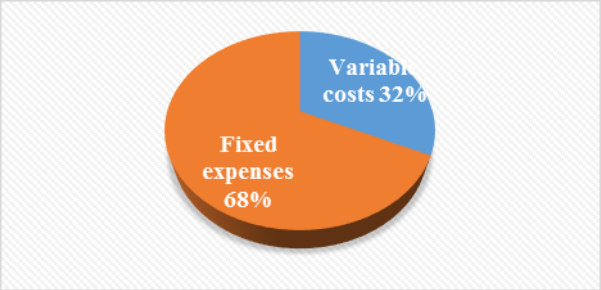

Fig. 4. Distribution of total agrotechnical expenses for chrysanthemum culture (cut flowers) in ecologically protected space
Source: processing ICEADR calculations.

Of the total expenditures, the variable costs 32%, and the value inputs with materials and materials represent 77% of the variable expenses. With a share of 68% of total expenditures, fixed expenses are formed in 94% of the permanent labor force consumption value (Fig. 4) (Fig. 5).

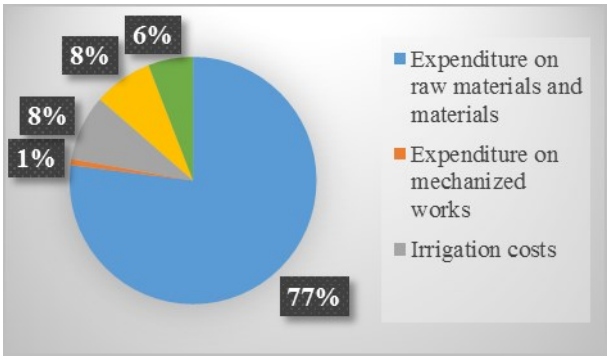

Fig.5. Distribution of variable costs for chrysanthemum culture (cut flowers) in ecologically protected space
Source: processing ICEADR calculations.

By lowering the total expenses from the realized revenues, the taxable income is 346,217.8 lei/ha, and finally a net income of 311,596 lei/ha and a net income of 36%.

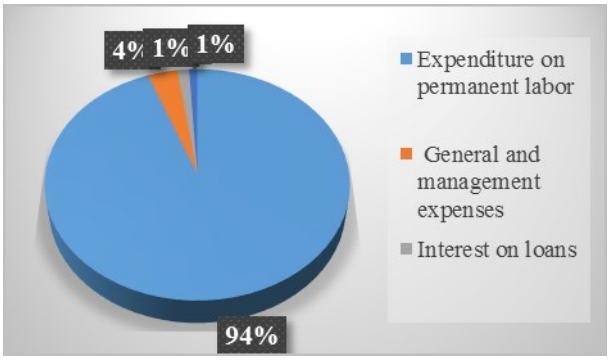

Fig. 6. Distribution of Fixed Costs for Chrysanthemum Culture (Cut Flowers) in Ecological Protected Area
Source: processing ICEADR calculations.

Synthetic indicator representative of the level of economic efficiency at which the chrysanthemum culture is obtained in a protected environment - ecological system, the production cost of 1.20 lei/thread results from the ratio of total expenditures to the estimated average production (Fig. 5).
In order to ensure profitability for the chrysanthemum culture, the foreseeable domestic market price of 1.68 lei/thread was calculated by multiplying the production cost by a coefficient of 1.4 (Table 2).

Table 3. Analysis of economic indicators of synthesis for chrysanthemum culture in conventional and ecologically protected areas - prognoses 2018/2019

No. crt.	Economic indicators of synthesis	U.M.	Conv.	Ecol.	Deviations	
					UM	%
1	Average production at ha	1,000 cut flowers/ha	960.0	720.0	-240.0	75.0
2	Production value at ha	lei/ha	1,168,330.4	1,211,762.4	43,432.0	103.7
3	Production costs per hectare	lei/ha	898,715.7	865,544.6	-33,171.1	96.3
4	Variable costs	lei	271,866.7	277,013.0	5,146.3	101.9
5	Raw materials and materials	lei	212,180.7	213,283.8	1,103.1	100.5
6	Expenditure on permanent labor	lei	591,982.0	554,666.6	-37,315.4	93.7
7	Fixed costs	lei	626,849.0	588,531.6	-38,317.4	93.9
8	Unit production cost	lei/cut flowers	0.9	1.2	0.3	128.4
9	Cost of capitalization	lei/ cut flowers	1.2	1.7	0.5	138.3
10	Productivity of work in physical expression	man-hours / ton	37.7	47.4	9.7	125.7
11	Profit or loss per unit of production	lei/ha	269,614.7	346,217.8	76,603.1	128.4
12	Profit sau pierdere pe unitatea de produs	lei/1000 cut flowers	280.8	480.9	200.0	171.2
13	Rate of return	%	30.0	40.0	10.0	133.3
14	The threshold of return in units of value	lei	816,950.8	762,942.9	-54,007.9	93.4
15	Revenue threshold in physical units	cut flowers/ha	671,276.5	453,322.3	-217,954.2	67.5
16	Risk of exploitation risk	%	69.9	63.0	-7.0	90.0
17	Security Index (Is)		0.3	0.4	0.1	123.2

Source: processing ICEADR calculations.

The data of the table above presents an analysis of the synthetic economic indicators for the cultivation of field chrysanthemums for the two systems: conventional and ecological. From this analysis it follows that (Table 3):

• The production of chrysanthemums, cut flowers, is smaller in the organic system by 25% compared to the conventional system, but the value of organic production exceeds by 3.7% the conventional one.

• the value of the production obtained exceeds the expenses incurred by 30% in the conventional system and by 40% in the ecological system.

• Variable expenditures represent 30% and 32% respectively, the difference being covered by fixed costs. Consumed resources, materials and materials are 0.52% higher than the conventional one.

• Representative synthetic indicator in the estimation of the economic efficiency of the expenses per product, the unit production cost is 0.9 lei/thread in the conventional system and 1.2 lei/thread in ecological system, mainly because of lower production by 25%.

•The average price of recovery is 1.2 lei/thread in the conventional system and 41.7% higher in the ecological system. Regarding the productivity of work, the realization of 1,000 conventional chrysanthemum threads requires 37 hours consumption, of which 0.1 hours for mechanical works and 37.9 hours for manual works, and in the ecological system a consumption of 47.4 hours, of which 0,1 hours for mechanical works and 47.3 hours for manual works.

• The rate of risk exploitation is a synthetic indicator that assesses the possible risk of achieving the expected output. For the chrysanthemum culture, in protected space, the indicator is 69,9% in the conventional system and 63% in the ecological system.

CONCLUSIONS

The culture of this plant is an economically advantageous activity due to the period when it appears on the market, September-December, when other flowers are not found or are in insufficient quantities.

Considering that for the production of a chrysanthemum in a conventional system, the unit production cost amounts to 0.9 lei, and in the case of chrysanthemum grown in ecological system is 1.2 lei, we can notice its profitability in terms of profit 0.3 lei/thread (chrysanthemum cultivated in conventional system) and 0.5 lei/thread (chrysanthemum cultivated in ecological system).

Also, the profitability threshold is the physical or value level of the production where the value of the output obtained fully covers the costs incurred, namely the level at which the culture starts to be profitable. Thus, we mention that in the conventional chrysanthemum culture the profitability is shown starting with the average production of 671.3 thousand yarns/ha corresponding to the value of 816,950.8 lei, and in ecological system this threshold is lower by 32.5% in physical units and 6.6% in units of value.

At the same time, the security index refers to the security margin that is ensured by the culture, which is 0.3 in the conventional system and 0.4 in the ecological system,

increasing it in the same way as the security index.

Note that both chrysanthemums grown in conventional and organic farming systems can be a profitable activity for florists.

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ANALYSIS OF PRODUCTION AND PROFITABILITY OF CHICKEN EGG FARMS IN ABIA STATE, NIGERIA

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Abstract

The study was to analyze Production and profitability of Chicken Egg farms in Abia State Nigeria . Primary data gathered with structured questionnaire from 120 chicken egg producing farms were analysed with descriptive and inferential techniques (frequency distribution Tables, mean, standard deviation, farm budget and Ordinary least square regression). In terms production characteristics, 51.7% of the farms had existed for at least 10 years, with 45.8% of them located in semi-urban areas, operating with staff strength of 1-5 persons with mean monthly pay of ₦10,000.00. The mean annual production estimates revealed that the farms incurred annual cost (variable and fixed) of ₦33,602,206.0 *and earned mean annual net profit of* ₦18,757,794.0. *Profitability of chicken egg production was highly determined by location of the farm, level of education of the manager, use of paid labour, and interest paid on borrowed funds; but moderately influenced by age of the farm manager, total eggs produced, cost of feeds consumed by the birds, and production experience of the manager. We recommended strict enforcement of disbursement of low interest livestock loans, and setting up of chicken egg production clusters managed by educated and experienced managers by farmers and Abia State Government.*

Key words**:** *production, profitability, chicken eggs, Abia State*

INTRODUCTION

Chicken products (meat and eggs) had long been ranked second to Cow milk and are the most economically viable sources of animal protein [8]. Chicken eggs are familiar, versatile, nutritious, economical and quite easy to prepare as meals for well-balanced diets for man [10, 9]. Consuming chicken eggs on regular basis do effectively correct nutritional imbalance among vulnerable groups such as nursing mothers and children [14].

The Food and Agriculture [3] have advised that countries who do not want to resort to importation of chicken-fresh eggs should embrace massive production of eggs using prolific birds. Accordingly, Chickens for farm-fresh egg production offer considerable potential for bridging nutritional gap in Nigeria in view of the existence of high yielding exotic breeds of birds which easily are adapting to local environment and managed with simple production technology with high returns on investment. Improvements in husbandry and management are needed to lower production costs and enhance production efficiency [2]. One hen lays only one egg in a day and skips some days when it does not lay any egg at all. This physiological behaviours in egg laying is based on the hen's reproductive system. An egg forms within a hen soon after the previous egg was laid. It takes about 26 hours for one egg to form fully within the egg track. Most hens lay their eggs later in the day especially when the sun has gone down, since egg laying is sensitive to sunlight. The length of time a hen lays her eggs vary and within every week, the hen skips a day before a subsequent egg lay. In intensive commercial flock production using deep litter or battery cages a hen may lay for as long as 20 to 24 months depending on her breed, management given to the pullets before egg laying, nutrition, light exposure and space allowed per bird. The longer the egg lay and the peak period of lay the more

the returns to a farmer from egg sales given that egg prices are favourable.

Profitability in chicken egg production depends mostly on breeds, cost of day old chicks, equipment, feeds, drugs, water and other veterinary charges. The production systems under which the egg laying birds are reared also have serious implications on profits realizable [15]. Chicken egg farming have been recognized as a farm enterprise to which many farmers are developing interest in Nigeria [11, 2], this study has found it necessary to identify the chicken egg farms in Abia state; discuss the production characteristics of chicken egg farms in the State; as well as analyze profitability of getting involved in the enterprise in the area.

MATERIALS AND METHODS

Study Area

This investigation was carried out in one of the South Eastern States of Nigeria called Abia. Abia State is amongst the thirty six states of Nigeria. Abia is located approximately within Longitudes 04^0 $45^/$ and 06^0 $17^/$ East of the Greenwich Meridian within Latitudes 07^0 $00^/$ and 08^0 $10^/$ North of the Equator. The area occupied by the state is about 5,833.7 Km^2 distant from Lagos (commercial capital of Nigeria) by 596 Km and distant from Abuja the Federal Administrative Capital by 498 Km [1]. The state has its administrative headquarters at Umuahia occupied by a population of 2,833,999 made up of 1,434,193 males and 1,399,806 females [4], administered with seventeen (17) Local Government Areas (LGAs). Agricultural activities in the state are overseen under three zones namely Aba, Umuahia, and Ohafia Agricultural zones. These zones have an estimated 315,910 farm households [10]. Livestock produced in the area include muturu cattle, rabbits, poultry, goats, pigs, and sheep. Veterinary services to livestock farms are provided by Private and Ministry-based practitioners in the state .

Sampling Technique

In selecting locations and chicken egg producing farms involved in this study, multi-stage random sampling technique was used. In the first stage, two LGAs were randomly chosen from each of the three (3) agricultural zones giving a sample of six LGAs. The LGAs selected at this stage and their (zones) were Isiala Ngwa North, Umuahia North (Umuahia Agricultural zone), Ugwu-nagbo, Aba North (Aba Agricultural zone) and Ohafia, Bende (Ohafia Agricultural zone). Second, a random sample of 20 poultry farms with chicken egg enterprises was selected from sampling frame poultry farms drawn in the state with the assistance of zonal agricultural Extension officers. This gave a sample of 120 chicken egg producing farms from where production data was gathered for this study.

Data Collection

Primary data on Chicken egg production activities were collected from the selected poultry farms. Data gathered included age of farm(s), location of the farm, Household labour used, Level of formal education of farm manager, number of egg laying birds, weekly egg production, poultry production system used, duration of egg gathering, quantity of feed used per week, monthly veterinary charges paid, salaries and wages paid, cost of transportation paid for feeds, wood shavings, drugs bought, payments for electricity charges, amount of loans taken, interest charges on loan, volume of water used per batch of birds reared, annual depreciation charges on poultry pens, cages, water tanks, egg crates, feeders, drinkers, and vehicles.

Data Analytical Technique

Data were subjected to two inferential models namely farm budget model and Ordinary Least Square (OLS) regression model. These models are as shown below:

$$\mathbf{NFI=\sum P_i Y-\sum P_{xi} X_j-\sum Z_k} \quad \mathbf{\ldots(1)}$$

Where:

NFI = Net Farm income from farm fresh whole Chicken eggs;

Y_i = Quantity of Chicken Eggs gathered by ith farm in a year (crates) i = 1, 2, 3…n;

P_i = Price per crate of Egg collected (₦);

X_j= Quantity of jth Variable cost item incurred in Producing Chicken Egg (j= 1, 2, 3, …m);

P_{xi} = Unit price of the jth variable cost item (₦);
Z_k = The cost of k^{th} fixed cost item in Producing Chicken egg (k = 1, 2, 3,...,k);
$\sum$ = Summation sign.

The depreciation cost of all fixed production items was determined following straight line method with assumed scrap value of zero naira after three years. Thus:

Annual depreciation = Current Value of Chicken Egg Producing Fixed cost item÷ Expected lifespan of chicken Egg producing fixed cost item …(2)

The OLS profit regression model was implicitly stated as follows:

$\prod = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, \varepsilon i)$ …(3)

Where
$\prod$ = Annual Net Production Profit (₦ '000);
X1= Wages/Salaries of production staff (₦ '000);
X2= Transportation Charges on feeds and other inputs (₦ '000);
X3 = Age of Chicken Egg Farm (Years);
X4 = Total annual number of Crates of gathered Fresh Chicken Eggs (Crates);
X5 = Cost of Feed Consumed by Layer Chicken birds (₦ '000);
X6 = Mode of Production (Battery Cages=0; Deep litter=1);
X7 = Education level of Farm manager (Years);
X8 = Amount of borrowed fund invested (₦ '000);
X9 = Interest charge on borrowed funds (₦ '000);
X10 = Depreciation of fixed Assets (₦ '000);
Ei = Stochastic Error term.

RESULTS AND DISCUSSIONS

Chicken Egg Production

The Production characteristics of Chicken Egg producing farms in Abia State are shown in Table 1. The Table revealed distribution of the age of Chicken egg farms, their location, system of Production, stock size, egg production system, daily egg production, and labour used. In terms of the age of the farms, the Table revealed that a reasonable proportion of the Chicken egg farms (51.7%) had existed for 6 to 10 years in Abia State and as low as 6.7% of the farms having existed for 16 years to 20 years in the area.

The mean age of the existence of the Chicken egg farms in the area is 8.0 years. Being able to sustain production for 8 years and upwards suggests that the farms at least had been breaking even. Profitability is a very important determinant of sustainability of an enterprise or business [6].

The Table further revealed that most of the Chicken egg producing farms (45.8%) was located in the semi-urban areas and as much as 37.5% of them in rural areas and the remaining 16.7% of them domicile in the urban centres.

The farms produce Chicken eggs under two popular production systems: Deep litter system (82.5%) and Battery Cage system (17.5%). In terms of production scale, they are mainly small scale poultry operators with as high as 90.9% of them stocking less than 1,000 birds. This conforms to findings of earlier researchers [7,12,13] and [15]. Cumulatively, less than 10.0% of the farms stocked between 1,001 and 5,000 laying birds. Daily egg collection varied based on the stage of growth of the birds (from the stage they started laying eggs to the stage when the birds were culled).

The Table revealed a modal range of 101 to 200 eggs per day accounted for by 33.4% of the farms and a least range of 501 to 1,200 birds accounted for by 0.8%.

Chicken egg producing farms in Abia State relied more on hired labour as 74.1% of the farms hired at most 5 persons and 4.2 % of them hired at most 20 persons depending on farm size and scale of production.

Hired labour attracted monthly wage of between ₦10,000.00 and ₦40,000.00 with a mean monthly wage of ₦11,028.20 in the area.

Table 1. Distribution of chicken egg farms by their Age (Years of existence) in Abia State

Age of Farm (Years)	Number (n=120)	Percentage (%)	Mean ± SD
1 - 5	**38**	**31.7**	
11 - 15	**12**	**10.0**	
16 -20	**8**	**6.7**	**7.6 ± 7.0**
Location			
Urban Area	20	16.7	
Semi-Urban Area	55	45.8	
Rural Area	45	37.5	
System of Production			
Battery Cage	21	17.5	
Deep Litter	99	82.5	
Stock Size of Chicken Egg Birds			658.8 ± 180.6
< 1,000	109	90.9	
1,001 - 2,000	7	5.8	
2,001 - 3,000	1	0.8	
3,001 - 4,000	2	1.7	
4,001 - 5,000	1	0.8	
Daily Egg Collected (Crates)			240 ± 196.3
< 100	30	25.0	
101 - 200	40	33.4	
201 -300	25	20.8	
301 - 400	22	18.3	
401 - 500	2	1.7	
501 - 1,200	1	0.8	
Number of Hired Labour			5.0 ± 3.0
1 - 5	89	74.1	
6 - 10	18	15.0	
11 - 15	8	6.7	
16 - 20	5	4.2	
Hired Labour Monthly Wage (₦)			9,479.4 ± 11,028.2
1,000 - 10,000	75	62.5	
10,001 - 20,000	41	34.2	
20,001 - 30,000	3	2.5	
30,001 - 40,000	1	0.8	

Source: Own Calculations, 2016

Egg production involved using inputs (laying birds, water, feed, drugs, other materials and labour) to technically give outputs as products (eggs, poultry droppings, and spent layer birds). A product is a commodity when all units of its production are identical. This shows that commodities are fungible and mean that each unit of the commodity is exactly like every other unit of it and should tend to be raw material [5]. The annual production of Chicken eggs, culled layers and poultry droppings involved combining resources which included water, feed, drugs, power, and asset depreciations as shown in Table 2.

Table 2. Estimated Net farm Annual Profit of chicken egg farms in Abia State, Nigeria in 2015

Item Estimated	Total annual cost (N)	Percentage of total cost (%)
A. Variable Cost:		
Stock of Birds(3000 Birds at egg laying stage)	3,000,000.0	8.9
Commercial Feed (14,100 Bags*)	30,033,000.0	89.4
Hired labour (mean=4persons)	72,000.0	0.2
Water (416,000 litters)	208,000.0	0.6
Transportation cost/month	36,000.0	0.1
Taxes and Levies/month	18,000.0	0.05
Medication/bird	38,100.0	0.1
Egg storage cost/month	24,000.0	0.07
Total Variable Cost (TVC)	**33,429,100.0**	**99.5**
B. Fixed Cost		
Depreciation of Drinkers/month	20,919.6	0.06
Depreciation of Feeders/month	14,164.8	0.04
Depr. of Egg Packaging crates/month	21,310.8	0.06
Depr. of Production pens/Buildings/month	116,710.8	0.3
Total Fixed Costs (TFC)	**173,106.0**	**0.5**
Annual Total Production cost	**33,602,206.0**	**100.0**
C. Revenue		
Egg Sales (28,000 crates)	22,400,000.0	
Poultry Droppings (8,000 bags)	2,000,000.0	
Empty feed bags (249,600 bags)	24,960,000.0	
Spent Layers (3,000 birds)	3,000,000.0	
Total Revenue (TR)	**52,360,000.0**	
Gross Margin GM= (TR - TVC)	**18,930,900.0**	
Net Profit (GM-FC)	**18,757,794.0**	

Source: Own Calculations, 2016.
* Feeds were sourced from various vendors and many farmers formulated the feeds used.

Profitability

The profitability of Chicken egg producing farms was estimated as annual net farm profit from farmers whose birds had been laying and who have been selling eggs as at the time of the survey shown in Table 2.

The Table revealed the Total Variable Cost (TVC), Total Fixed Cost (TFC) and Total

Revenue estimates of the farms. The TVC of ₦33,429,100.0 estimated included 3,000 layers at egg laying stage, feeds fed, hired labour, water, transportation, taxes and levies, medication and egg storage charges. Among these cost items, the feed cost of egg laying birds constituted largest proportion of 89.4% and egg storage cost was the least accounting for 0.07% of the total costs.

The Table further showed the TFC of ₦173,106.00 to consist of cost of depreciation of assets (building, feeders, drinkers, and empty egg crates). The total revenue items included eggs sold, poultry droppings sold, empty feed bags sold and old layers sold within the year under review. The annual profits were shown in terms of Gross Margin or difference between annual total revenue and the variable cost (₦18,930,900.0) and net profit or difference between annual Gross margin and the fixed costs (₦18,757,794.0).

Determinants of Profitability of Chicken Egg Production

Table 3 shows estimates of factors influencing profitability of chicken egg production enterprises based on use of the Ordinary Least Square in Abia State, Nigeria. Four functional forms tried: Linear, Exponential, Double-logarithmic, and semi-logarithmic posted highly significant F-ratios suggesting that any of them can be used to explain the factors influencing the profits realized by farms in production of the chicken eggs in the area. Comparatively, the double logarithmic functional form was chosen as the lead equation having the highest F-ratio of 67.92 and exposing the highest number of significant variables (nine out of eleven variables regressed). The coefficient of these variables conformed to *a priori* expectations. The highly positive significant factors that influenced profitability of chicken egg production in the state were staff wages and salaries, education level of farm manager, and location of egg producing farms. The Table revealed only one highly significant factor (interest paid on borrowed funds) and two moderately significant factors (transportation charges, cost of feeds consumed by the birds) as negatively influencing profitability of chicken egg production. This suggests that the higher the interest paid on production loans, and the higher the transportation charges on products and inputs the less the profit earned by chicken egg producing farmers.

The number of eggs produced, age of the farm, and the borrowed funds invested are factors that positively but moderately influenced profitability of production in chicken egg farms in Abia State, Nigeria. The higher the value of any of these factors, the higher the profits realized from producing chicken eggs.

Table 3. Ordinary Least Square Estimates of factors that influenced profitability in chicken egg production in Abia State, Nigeria

Variable	Functional forms			
	Linear	Exponential	Double Log.§	Semi Log.
Constant	2921 (8.3)***	13.22 (5.2)***	5.82 (8.5)***	3724 (-6.8)***
Produced eggs (crates)	-7453 (-2.6)**	0.025 (2.6)**	1.89 (2.5)**	-351 (-2.7)**
Staff wages and Salaries	1845 (1.7)	0.123 (2.3)*	1.03 (3.1)***	3113 (1.2)
Transportation Charges	1922 (2.3)*	-0.50 (-0.01)	-1.64 (-2.6)**	7147 (0.9)
Age of Farm	-4857 (-2.1)*	-5.16 (-1.3)	-0.79 (-2.4)**	-1136 (-1.2)
Cost of Feed Consumed	1950 (2.4)**	0.130 (1.3)	-1.77 (-2.6)**	-5036 (-3.2)***
Mode of production	-2.980(-0.28)	0.406 (0.969)	0.053 (0;478)	99904 (2.56)**
Borrowed fund Invested	23669 (1.93)*	-2.229 (2.5)**	1.104 (2.56)**	45302 (1.4)
Interest paid on loan	-1.92(-2.5)**	-6.94 (2.2)**	-1.2 (-3.1)***	-1944 (-1.44)
Location of farm	17.84 (0.9)	0.04 (0.83)	0.311 (4.9)***	2066 (6.6)***
Asset Depreciation	0.891 (1.5)	-0.41 (-1.35)	0.001 (0.23)	190.8 (1.11)
R^2	0.814	0.840	0.908	0.784
Adjusted R^2	0.790	0.826	0.872	0.766
F-Ratio	60.13***	63.08***	67.92***	55.82***

Source: Own Calculation, 2016. § = Lead Equation
***, **, * , represent Significance at 1.0%, 5.0%, and 10.0% alpha levels of probabilities. Figures in Brackets are t-values.

Policy Issues and Recommendations

Issue of high cost of feeds was common with all the poultry farms. This challenge can locally be managed by finding alternative cheap feed stuff blended with other ingredients as locally available and used to supplement the regular commercial chicken feeds. Cooperative societies and contact farmers in the area can go into experimentation to identify good local feed stuff that are readily within their easy reach, edible and nutritious to egg laying chickens.

Chicken egg farms are better located within suburban areas to ensure high profitability.
We recommended strict enforcement of disbursement of low interest livestock loans, and setting up of chicken egg production clusters managed by educated and experienced managers by farmers and the Abia State Government.

CONCLUSIONS

Chicken egg farms produce profitably in Abia State, Nigeria. Their production is largely in small scale under deep litter poultry system with few of them producing as medium scale farms both in deep litter and battery cage poultry systems. Chicken eggs are produced as Table eggs and this constitutes the primary product of this enterprise with culled birds and poultry droppings produced as secondary products. All products are marketed for income by the producing farms.

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ANALYSIS OF INCOME AND PROFITABILITY OF CHICKEN EGG MARKETING BUSINESS IN ABIA STATE, NIGERIA

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Abstract

This analysis of marketing and profitability of Chicken egg business was done with data collected from egg traders in Abia State, Nigeria. A total of 60 egg traders made up of 30 wholesalers and 30 retailers were involved as a panel and supplied answers to questions in a questionnaire administered fortnightly for two months in their market locations across the Agricultural zones. Data gathered were analysed with both descriptive and inferential statistical tools. Chicken egg farmers, rural egg buyers, wholesalers and retailers constituted marketing stakeholders. Other egg market characteristics are: 65.0% of the egg markets were located in urban centres, 38.0% of them located in semi-urban areas with only 4.0% of the markets located in rural communities. Selling prices of the eggs varied along the distributive channel such that bulk of the share of net marketing margin (58.30%) was enjoyed by the chicken egg farmer and the least (4.81%) received by the wholesalers. These notwithstanding, the marketing of Chicken eggs was profitable to wholesalers as they on average realized ₦ 137,764.80 as monthly net returns. Profitability was determined by egg price, marketing experience, amount of fund invested, quantity of eggs sold and transport costs. The wholesale egg traders should take advantage of bank credits to increase their trade capitals and the Abia State Government should maintain the rural and urban roads to help reduce cost of transporting eggs in the area.

Key words**:** *chicken egg, marketing, profitability, wholesaler*

INTRODUCTION

Poultry products (meat and eggs) marketed in most developing countries especially in Africa remains quite expensive, with their marketing system being informal and poorly developed [5]. Chicken egg marketing commence from farms where farmers sort and grade the eggs in trays and crates and from where egg assemblers pay and take delivery of their purchases to owned or rented stalls. [2] observed that the eggs are packaged in crates of 30 pieces and sold to middlemen (retailers and wholesalers) and some other consumers especially households, fast food centres' and schools. The chicken eggs also find wide uses in eateries, bakeries where they are good food ingredients for cakes and rolls. The demand for Chicken eggs in Nigeria is high and have positively correlated with periods of religious festivals such as Muslim fast (Ramadan) and Christian Christmas when demand for eggs are highest [2]. [10] had noted that protein intake in foods by Nigerians was below universal recommendation. They noted that persons in urban areas in Nigeria took an average of 28 grammes of animal protein per caput per day, with those in rural areas taking an average of 17 grammes of protein per caput per day. These are below the Food and Agriculture Organization (FAO) recommended 35 grammes of animal protein intake per caput per day [4]. Children and persons with acute protein deficiency in their diets are expected to buy more and consume more chicken eggs and by doing so shift more income to chicken egg sellers.

Notwithstanding how people have been convinced to buy more chicken products, the income from chicken egg sales have been highly unequal amongst Chicken egg marketers as it is skewed in favour high scale traders. The inequality was confirmed by an estimated Gini coefficient of 0.82196 in Benin

City Nigeria [6]. This estimated index showed that 82.19% of the accrued income from egg marketing in the area needed to be redistributed to achieve perfect distribution amongst the egg marketers in the city yearly. This scenario replicates in most parts of Abia State with suggestive welfare implications. Wherever income earning is distributed poorly, it manifests in some feel of insecurity and heightens trade competition amongst the relatively low-income earners. The low income earning chicken egg marketers can only save much of their income to accumulate reasonable saving for scale enhancement investment required to push up economic growth in the livestock sub-sector. Afolabi (2007) confirmed the high level of income inequality but revealed that egg marketing business was profitable as the participants in the channel of egg distribution receive different profits from differences in parts of prices paid which they received [3].

This difference in the price paid to a first seller and that paid by the final buyer constitutes what is referred to as marketing margin. Thus, every category of middlemen in the distributive channel of a farm product (including chicken egg) earns a margin for the duties performed in the marketing channel. Many issues (wages, transport costs, hidden costs, and category of marketer) implicate on the margins which over time tend to be fixed and force marketing margins to be stable more than the prices [8]. A trade business is profitable when it yields financial gain to the trader or to the entrepreneur. This study recognized the nexus relationship amongst profit, income and marketing activities and investigated it under the following specific objectives: (i) description of marketing characteristics of Chicken egg traders in Aba Abia State, Nigeria; (ii) estimation of share of gross marketing margins to chicken egg stakeholders (farmers, rural market assemblers, wholesalers, and retailers) in the study area; (iii) analysing net marketing returns (profits) to wholesalers of chicken egg in the study area; and (iv) determining factors influencing profitability of wholesale chicken egg marketers.

MATERIALS AND METHODS

Area of Study

This investigation was conducted in Abia State, Nigeria. The State Abia is located in south eastern Nigeria and is one of the thirty-six (36) states in the Federal Republic of Nigeria. Geographically, Abia state occupies a land area of 7,677.2 square kilometres within Longitudes 7^0 $5^/$ E and 7^0 $3^/$ E of the Greenwich Meridian and Latitudes 4^0 $5^/$ and $6^07^/$ N of the Equator. The State has network of motorable roads that link its three agricultural zones with neighbouring States of Imo to its West, Anambra to its North-West, Ebonyi and Cross River states to its North-East, Akwa Ibom to the East, and Rivers state to the South. There are cosmopolitan markets in each of Aba, Umuahia and Ohafia (the three Agricultural zones) in Abia State, Nigeria. Abia has a population of 2,833,999 made up of 1,434,193 (55.0%) males and 1,399,806 (45.0%) females, with a density of 448 persons per square kilometre [7].

Sampling Technique

This study applied multi-stage random sampling method in selecting chicken egg markets and egg marketers in the Agricultural zones of Abia State, Nigeria. First, the three agricultural zones of the state (Aba, Umuahia, and Ohafia) were recognized and guided the selection of the subjects. Second, two markets (one rural and the other urban or semi urban) were randomly chosen from each of the agricultural zones. This gave a total of 12 markets (6 rural markets and 6 urban/semi-urban markets). The markets chosen are: from Aba agricultural zone, Ngwa road market (urban) and Ekeakpara market (rural); from Umuahia agricultural zone, Orie Ugba market (urban) and Orie Ntigha market (rural); and from Ohafia agricultural zone, Uzuakoli market (semi-urban), Ukwu Nwangwu market (rural). Third, from each of the chosen urban/semi-urban markets, 14 egg traders were randomly selected (7 wholesalers and 7 retailers); and from each of the chosen rural markets, 6 egg traders were also randomly selected (3 wholesalers and 3 retailers). This gave a total of sixty (60) chicken egg traders, made up of thirty (30) wholesalers and thirty

(30) egg retailers that constituted a panel involved in this study.

Data Collection

Primary data were collected with a questionnaire administered monthly in a series of three months of egg market survey. This panel data was gathered on marketing characteristic activities, unit trade prices, quantities of eggs bought and sold, transportation cost, storage/stall charges, cost of packaging material(s), wages to casual and permanent purchasing and sales workers.

Analytical Technique

The data gathered were subjected to a set of multiple analytical techniques. Descriptively, objectives (i) was realized with frequency distribution Table in which percentages, mean, and standard deviation helped in describing trade variables. The Gross marketing Margins - objective (ii) was estimated and shared amongst stakeholders as recommended by [9] and used by [1]. The final consumer price is the base or common denominator for calculating all marketing margins. The price variations at different segments of the market are compared with this final price paid by the consumer.

Total Gross Marketing Margin (TGMM) = $\frac{\text{Consumer's Price – Farmer's Price}}{\text{Consumer's Price}} \times \frac{100}{1}$ **.....(1)**

Share of margin to the farmer (producer)(GMMp) = $\frac{\text{Consumer's Price – GMM}}{\text{Consumer's Price}} \times \frac{100}{1}$ .....…(2)

Net Marketing Margins to wholesaler or Retailer = $\frac{\text{GMM- Marketing Costs}}{\text{Consumer's Price}} \times \frac{100}{1}$ ….....(3)

Net marketing returns, objective (iii) was estimated using the farm budget technique. The model was specified as follows:

$$\mathbf{NMR} = \sum \mathbf{P_i Y_i} - \sum \mathbf{P_{xi} X_j} - \sum \mathbf{Z_k} \quad \text{….....} (4)$$

where:
NMR= Net Marketing Returns (₦'000);
Pi = Price of crate of chicken eggs sold by ith trader (₦);
Yi = Quantity of chicken eggs sold by ith trader (crates);
Pxi = Unit price of marketing variable inputs used in trading on chicken egg (₦);
Xj = Quantity of jth variable marketing inputs used in chicken egg trade.'
Zk = Value of depreciated marketing assets (Fixed Costs) used in chicken egg trade (₦);
∑ = Summation sign/

The factors that influenced profitability of wholesale chicken egg trade were estimated using Ordinary Least Square (OLS) regression of a profit model. This model implicitly was shown as follows:

$$\prod = f(X1, X2, X3, X4, X5, X6, X7, X8, X9, ei)$$

where:
∏ = Monthly profit from chicken egg sales (₦);
X1 = Transportation charges (₦);
X2 = Chicken egg Marketing Experience (₦);
X3= Sales Market location (urban=1; semi-urban =2; rural =3);
X4 = Interest charged on borrowed funds (₦);
X5 = Quantity of Chicken eggs sold (Number of Crates);
X6 = Egg storage charges (₦);
X7 = Amount of fund invested (₦);
X8 = Unit selling price (₦/Crate);
X9 = Other marketing Charges (packaging materials, rent on stalls,) (₦);
ei = Stochastic Error term.

RESULTS AND DISCUSSIONS

Marketing Characteristics of Chicken Egg Trade

Table 1 shows the distribution of attributes associated with trade on chicken eggs as observed in the study area. The Table showed the distribution of 225 identified stakeholders in the marketing of chicken eggs as follows: egg farms (53.3%), rural egg buyers (20.1%), wholesalers (13.3%), retailers (13.3%). It further showed that more than half (63.3%) of the traders on chicken egg business carried out their trade in urban markets, 20.0% of them traded in semi-urban areas and as low as

16.7% of them traded on it in the rural areas. This distribution clearly portrayed chicken egg as a commodity that is supplied and traded more in areas of high population density. The mean monthly number of chicken eggs traded (683.7 crates) was distributed as follows: less than 500 crates was traded by 46.7% of the traders; between 500 and 1,000 crates was traded by 36.7% of the traders; and greater than 1,000 crates was traded by 16.7% of the traders. The mean monthly income from the sales of the chicken eggs was ₦472,700.00.

Table 1. Market Characteristics of Chicken Egg Stakeholders and Trade in Aba, Abia State Nigeria

Trade Attribute	**Number of Stakeholders /Traders**	**Percent (%)**
Chicken Egg Stakeholders:		
Egg farms	120	53.3
Rural egg buyers	45	20.1
Wholesalers	30	13.3
Retailers	30	13.3
Total number of stakeholders	***225***	***100.0***
Business location:		
Urban market traders	38	63.3
Semi-urban market traders	12	20.0
Rural market traders	10	16.7
Total	***60***	***100.0***
Monthly number Crates of eggs traded:		
Less than 500	28	46.7
500-1,000	22	36.7
Greater than 1,000	10	16.6
Total	***60***	***100.0***
Mean 683.3. crates		
Std. Dev. 72.7		
Monthly income from chicken egg		
Sales **(₦'000)**		
300-450	16	26.7
451-650	21	35.0
651-850	18	30.0
851-900	3	5.0
Greater than 900	2	3.3
Total	***60***	***100.0***
Mean monthly 472.70		

Field Survey, 2017.

Share of Marketing Margins to Chicken Egg Stakeholders

The share of the differences in the prices paid on chicken eggs between stakeholders (farmers, rural egg buyers, wholesalers and retailers) are shown in Table 2. The Table revealed that the selling price of a crate of chicken egg varied at different stages of the distributive channel from ₦728.80 at the farm level to ₦900.00 at the final consumer level. However, the chicken egg farmer received the bulk of the marketing margin (81.0%) and the rural egg buyer received the least 5.38% along the channel. In terms of net marketing margins, the wholesaler received the least (4.81). This suggests that the wholesaler incurred much of the trading costs (transportation, packaging, damage and display costs). Chicken egg is a very fragile commodity that attracts high handling charges.

Table 2. Distribution of Mean monthly Shares of Marketing Margins to Chicken Egg Stakeholders in Aba Agricultural Zone, Nigeria

Stakeholder	**Price received/paid ₦/Crate of 30 Eggs**	**Share of Gross Marketing Margin (%)**	**Net Marketing Margin (%)**
Chicken Egg Farmer	728.80	81.00	58.30
Rural Egg Buyer	770.20	5.38	4.80
Egg Wholesaler	800.60	5.81	4.81
Egg Retailer	850.00	7.81	6.76
Consumer	900.00	100.00	100.00
Total GMM = 19.0			

Field Survey, 2017.

Wholesaler Profitability in Chicken Egg Trade

Table 3 revealed that chicken egg wholesale trade was a profitable business in Abia State Nigeria. The Table showed that the trade was one that was executed with less than 1.0% fixed cost investment since the costs involved were mostly variable costs (99.7%). The wholesalers on the average incurred a monthly total cost of ₦3,139,735.20 and were able to post a net return of ₦137,764.80 from a gross margin of ₦138,829.80. The nature of chicken eggs as not storing for long period on shelves, fragile in handling and the fact that consumers demand them fresh require dealers to often be ready with cash (high liquidity) to provide this highly solvent commodity to the stalls. These

could implicate on the skill required and profit realizable from this trade.

Table 3. Analysis of Monthly Profitability of Chicken Egg Wholesaler Business in Abia State, Nigeria

Item	Average Quantity	Unit Price (₦/Unit)	Total Value ₦	% of Total Cost
Purchase of Chicken Eggs	3,450 crates	770.20	2,657,190.00	84.63
Labour cost (loading & off-loading of Eggs)	90 Man-days	1,500.00	135,000.00	4.29
Transportation of Eggs	3,450 crates	60.00	172,500.00	5.49
Storage cost	3,450 crates	50.00	172,500.00	5.49
Cost of Packaging Materials			1,480.20	0.05
Total Variable Cost (TVC) …a			3,138,670.20	99.7
Fixed Cost: …b Depreciation (display counters, tables, chairs, plastic crates)			1,065.00	0.03
Total Cost (a + b)			3,139,735.20	100.0
Revenue:				
Egg Sales	3,450 crates	950.00	3,277,500.00	
Total Revenue (TR) …c			3,277,500.00	
Gross Margin (GM)=(c - a)			138,829.80	
Net Returns (GM – b)			137,764.80	

Computed from Field Survey Data, 2017.

Determinants of Profitability of Chicken Egg Wholesale Business

Positive net returns or profit is one variable that that motivates an investor to remain in business. Chicken egg marketing business which was shown to be profitable (Table 3) was further investigated for factors that determine its profitability with Ordinary Least Square regression model. The estimates of the wholesaler's profitability in chicken egg marketing are shown as Table 4. Four functional forms (Linear, Exponential, Double Logarithmic, and Semi-Logarithmic) were tried, and all fitted the data well as shown by values of their F-statistic ratios. However, on basis of the R-Squared values and the number of revealed significant variables, the Exponential functional form gave a better fit and was used as lead equation in further discussion. The Table showed that experience in chicken egg marketing, amount of fund invested, and unit sales price were variables that positively and very highly determined profitability ($p< 0.001$) in chicken egg marketing. Another positive factor(s) that determined profitability amongst this category of traders at relatively lower probability ($P<0.05$) was the quantity of chicken eggs sold while cost of transportation at that same level of probability had negative and significant influence on profitability of chicken egg business.

These revelations suggest that while efforts should be made to increase every of the factors that had positive significant influence we must make efforts to reduce the cost of transporting chicken eggs amongst the wholesalers to enhance the profitability.

Table 4. Ordinary Least Squared (OLS) Estimates of Factors that Influenced Profitability of Chicken Egg Wholesale Trade in Abia State, Nigeria

Variables	Functional Forms			
	Linear	Exponential +	Double Log.	Semi-Log.
Constant	6168.9 *** (9.44)	10.03*** (4.263)	-27.91*** (-6.30)	-1287*** (-5.04)
Transportation	-6329 (-1.04)	-726** (-2.52)	-0.176 (-0.67)	-2996.7 (-1.71)
Marketing Experience	170.8 (0.730)	0.0349*** (3.89)	-0.255 (-0.713)	-21277 (-0.732)
Market Location	480.9** (2.57)	0.238 (-1.18)	0.147*** (3.38)	262.2** (2.71)
Interest charged on Loans	23.4** (2.72)	0.310 (1.22)	0.068 (0.92)	244.9 (1.17)
Quantity of Eggs Sold	9.072*** (3.94)	0.0031** (2.75)	0.085** (2.51)	212.0** (2,72)
Storage charges	39.89 (0.524)	0.008 (1.32)	3.21 (1.49)	159.7 (0.549)
Amount of fund Invested	124.9 (0.424)	0.611*** (3.72)	0.721*** (2.97)	522,6** (2.53)
Sales Price	8.13 (0.35)	0.003*** (4.23)	0.196 (1.11)	-48.16** (-2.51)
Other costs	-10.7 (-1.09)	-0.004 (-0.927)	0.123 (1.48)	-508.9 (-1.26)
R-Squared	0.668	0.869	0.665	0.728
Adjusted R-Squared	0.642	0.843	0.558	0.706
F-Statistic	71.11***	79.22***	55.22***	72.39***

Level of significance: **= 5.0%; *= 1.0%. Dependent Variable= Monthly profit from chicken egg sales (₦); 1US$ =₦350.00.**

Source:Estimated from Field Survey Data, 2017

CONCLUSIONS

Chicken eggs are traded at the rural, semi-urban, and urban markets with some level of price variations. The farmers relatively received more shares of the marketing margins than the traders from sale of chicken eggs. Chicken egg sales was a profitable but involved use of more cash (liquidity) than items of fixed costs. Many factors

significantly enhanced profitability of chicken egg marketing but the cost of transportation.
We recommended that wholesale egg traders should take advantage of bank credits to increase their trade capitals while Abia State Government should maintain the rural and urban roads to help reduce cost of transporting eggs in the area.

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EFFECT OF BAHIAGRASS COVER ON THE CHEMICAL PROPERTIES OF AN ULTISOL AT DIFFERENT LEVELS OF SLOPE IN UMUDIKE, NIGERIA

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Abstract

The effect of Bahia grass (Paspalum notatum) on the chemical properties of an ultisol at different levels of slope was carried out in Umuahia, Southeastern Nigeria. The use of Paspalum notatum has attracted considerable research attention with respect to forage production and erosion control. Little information is available on the influence of this grasscover management on soil chemical properties. This research work was carried out at different levels of slope planted with Paspalum notatum (4%, 20% and 33%) and also on bare soil. The study has shown that the slopes planted with Paspalum notatum gave significantly higher results of the chemical properties than the open adjacent bare soil. In all the parameters considered in this study, the values obtained in 4% slope was higher than those obtained in 20% as well as 33% and the bare soil, in the following significant order: 4%> 20% > 33% > Bare soil. However, 4% slope had higher values of phosphorus (P) than the similar values of 33% and 20%, while Bare soil gave the least value in the order: 4%> 33% = 20% > Bare soil. Also, the exchangeable acidity (H^+ and Al^{3+}) values were significantly ($P<0.05$) higher in bare soil than in those slopes planted with Paspalum notatum. This result also pointed to the fact that the pH of the soils planted with Paspalum notatum gave higher values than the corresponding bare soil. Therefore, Paspalum notatum improved very highly the chemical properties of the tropical soils, whereas bare soil had no such effect.

Key words**:** *bahia grass, chemical properties, ultisol, slope levels*

INTRODUCTION

Bahia grasscover (*Paspalum notatum),* a perennial grass has the characteristics of rapid growth, strong resistance to stress and high biomass yield. The grass has been widely grown in the tropics and subtropics for the purposes of lawn establishment, forage crop growth, erosion control and slope stabilization. The plants develop an extensive root system that plays a crucial role in the protection of both soil and water [37], [34], [38]. In recent years, this grass has been found effective in revegetation of mined lands, uptake of heavy elements e.g. Cs and Sr. [8],[28],[35]. Previous studies showed that *Paspalum notatum* was one of the suitable grasses for restoring an oil shale waste dump due to its good adaptability to the waste [35],[12]. The change from agricultural to grassland which is referred to as land use conversion influences change in production of biomass as well as nutrient cycling have influence on soil properties [5],[36]. This particular change in land use from agriculture to grassland/ forest, brought the development of a longer tree biomass [31] and increased the availability of plant nutrients [17]. This also increases soil organic carbon, microbial biomass and potential nitrogen mineralization rate, reducing the soil bulk density [17]. Soils under grass cover have shown better chemical properties than soils under forest cover and also bare soils [23].

Soil landscape relationships due to anthropogenic and natural activities can also influence the properties of soils through the summits to the foot slopes and in most cases, Soil organic matter (SOM) and nutrient reserves are really affected. Thus, soil properties which include morphological, physical and chemical as well as depths for crop production often vary among landscape position and which potentially limit Crop production [29].

Fallow/grassland have higher soil organic carbon values than cropland, but lower values than forest for different depths which was consistent with the results of [9] and [11]. The relatively low vegetative cover, especially at the upper and mid-slope, may also account for low organic carbon values as well as soil total nitrogen. However, relatively high vegetation coverage and thick litter fall and animal tissue in the forest are helpful to reduce soil erosion as well as accumulate soil organic carbon, total nitrogen, available phosphorus, and cation exchange capacity as stated by [9] and [33].

However, increased organic carbon values of the soils at lower slopes may be due to organic matter accumulation resulting from litter falls. [16] found that soil organic carbon content increases with slope because of the stronger soil erosion at high slopes. On the other hand, relatively high soil organic matter (SOC) (11.2%) at the uplands than mid slope position maybe due to its flatness. [15] also reported that SOC may be a direct product of mineralization rates rather than being more strongly related to material deposited and eroded due to enhanced erosion process on disturbed hill slope. The orientation of the study area in terms of the upper, middle and bottom slope positions, relate the properties of the soil in different landscape positions. [3] however, studied the properties of the soil in relation to land form positions and found significant differences among soil properties of sand, silt, pH and exchangeable calcium and magnesium mostly decreased down the slope.

Land use and slope affect soil properties. Pearson coefficients of interaction between land use and slope position to soil properties (0 – 20cm depth) revealed that overall degree of correlations is highly dependent on environmental variables. Total Organic Carbon (C), Nitrogen (N) and Phosphorus (P) in the middle slope soils were the lowest among the soils in the three topographic positions [4]. According to the findings of [28], organic carbon, available nitrogen (N), available potassium (K), extractable iron (Fe) and exchangeable sodium (Na), were highest on the summit, while pH, available phosphorus, exchangeable calcium (Ca), and Magnesium (Mg) were significantly higher on the foot slope at surface soils [29].

[14] used slope position and aspect to estimate N- Cycling rate in Minnesota Prairie, USA, but found small variation with the subtle topography. [6] found slope to be controlling factor for soil pH in mountainous areas of Eastern Taiwan. Appropriate soil management practices like grass cover could increase the (SOM) content to become a source of slow release of nutrients to the soil [13]. The major objective of this research work was to determine the effect of *Paspalum notatum* on the chemical properties of an Ultisol at different levels of slope.

MATERIALS AND METHODS

Location

The experiment was conducted within the premises of Abia State University, Umuahia Campus. The area is located in Umudike, Umuahia, South Eastern Nigeria which lies at latitude 05^0 29^0 North, longitude 07^0 33^0 East and is at 122m (400 feet) above sea level. This falls within the humid rainforest zone of West Africa which is characterized by long duration of rainfall and a short period of dry season.

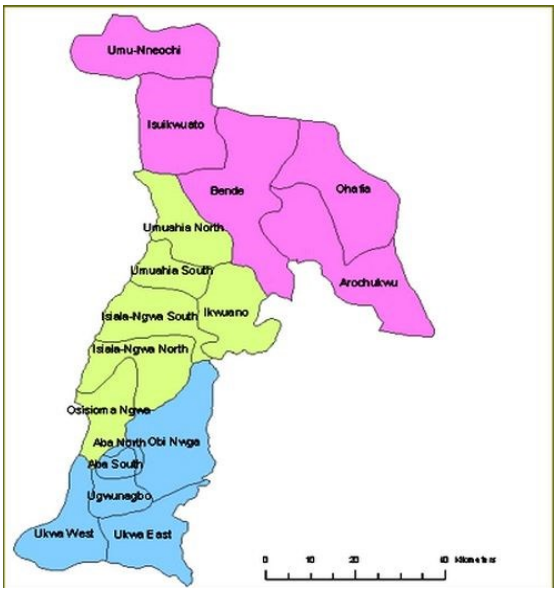

Fig. 1. Map of Abia State showing Umuahia the Project Site [Abia State University, Umuahia Campus Nigeria]

The vegetation predominant in the study site is tropical rainforest in which medium size trees (8.29 m) long, such as *Terminalia spp*, *Milicius spp*., etc are predominant. Below the trees are grasses and shrubs.

The predominant soils of the study area as in other parts of Nigeria are classified as ultisols [21]. These soils have a number of soil related constraints to agricultural productivity, poor structural stability and high susceptibility to soil erosion and drought trees [21].

It is notable with very little rainfall, hotter days, cooler nights and lower humidity ending in February. It has an average rainfall of 2000 mm, ambient temperature of 26^0C with maximum temperature of 33^0C and minimum temperature of 22^0C. Relative humidity ranges from 50-95%.

Soil Slope

Soil slope is particularly important in terms of its effect on erosion. Slope can be measured in percent (rise/run) 100 degrees. The amount of surface residue required reducing erosion increases with slope and as soil texture gets finer.

To convert percent slope to slope in degrees;
"Angle in degrees" = cotangent.
(Percent slope/100) = cotangent (Rise/Run)
Percent slope = tangent (percent slope/100).

Soils in low-lying areas have higher water content, more weathering, thicker soils and vegetation.

Therefore, slope gradient is referred to as the angle of inclination of the soil surface from the horizontal. It is however expressed in percentage, which also is the number of feet rise or fall in 100ft of horizontal distance.

Table 1. Slope Description, Percentage and Class

Percent slope	Slope class	Description
0 – 2	A	Nearly level
3 – 6	B	Gently sloping
7 – 12	C	Moderately sloping
13 – 18	D	Strongly sloping
19 – 25	E	Moderately steep
26 – 35	F	Steep
>35	G	Very steep

Source: Purdue University. March 2010-Soil Slope [25]

This is important because it influences the rate at which runoff flows on the soil surface and erodes the soil.

Slope shape either straight, concave or convex and slope length are also important properties of soil surfaces.

Steep slope encourages accelerated erosion, reduces the amount of water percolation through the soil and decreases the upper portion of the soil.

Soil Sampling

Twelve (12) soil samples were collected for the experiment from three different locations at the depth of 0-20cm. Three soil samples were collected from bare soil or open adjacent sites to where *Paspalum notatum* was established by the University. However, three (3) other samples were collected from the slopes of 4, 20 and 33% which were planted with *Paspalum notatum* at three locations A, B. and C. The samples were transferred to the laboratory for routine analysis; therefore, these soil samples collected were air-dried and passed through a 2mm sieve to remove large particles, debris and stones. A total of twelve soil samples were collected.

Laboratory investigation

The dried and sieved samples of soil were used to analyzed for pH, ECEC, Organic Carbon/ organic Matter, Base saturation, exchangeable acidity, available phosphorous, total nitrogen and exchangeable bases.

Soil Reaction

The pH of the soil was determined in both distilled water and salt (potassium chloride-KCl) at the ratio of 1:2.5 (soil sample to distilled water/KCl ratio).

Organic Carbon

The organic carbon content of the soil was determined using the method of [32]: while the soil organic matter was determined by multiplying % organic carbon with 1.724 (Van Bermeleen factor - carbon comprises 58% organic matter). The soil organic carbon was oxidized using 1N potassium dichromate solution and concentrated sulphuric acid. The percentage Organic Carbon was determined by titrating with 1N ferrous ammonium sulphate liquid.

Effective Cation Exchange Capacity

In addition, the effective cation exchange capacity (ECEC) was determined using the summation method, which implies the

addition of the exchangeable cations and total exchangeable bases.

Total Nitrogen

This was determined using the fractionation method; the wet oxidative digestion by Kjeldahl.

Exchangeable Acidity

Exchangeable acidity (H^+ and Al^{3+}) was determined using the titration method of [18].

Base Saturation

Base saturation was determined by calculation. Base saturation equals total exchangeable bases divided by Effective Cation exchange capacity, multiplied by hundred i.e.

$$BS = \frac{TEB}{ECEC} \times 100$$

It is the amount of basic cations that occupy the cation sites.

Available Phosphorus

This was determined by the [2]. Brays method 2 (0.3N ammonium fluoride x 0.1N HCl). The phosphorus with the unit part per million (ppm) was determined using a photo electric calorimeter and converted to Kilogramme by multiplying by 2.24.

Exchangeable Bases

The complex metric titration method was used to determine the values of Calcium (Ca) and Magnesium (Mg) predominant in the soils of the study site. Also, sodium (Na) and Potassium (K) were determined by the Flame-photometric method. The soil sample was leached with ammonium chloride and ammonium hydroxide buffer 10 solutions.

RESULTS AND DISCUSSIONS

Effect of *Paspalum notatum* on soil chemical properties different slope levels.

pH, Organic Carbon/ Organic Matter, Nitrogen, Available Phosphorus.

The results in Tables 2 and 3 summarized the effect of *Paspalum notatum* on the organic carbon, total nitrogen, pH as well as available phosphorus of soils at different slope levels. The results also show there were significant changes ($P < 0.05$) in organic carbon, total nitrogen, pH and available phosphorus due to influence of *Paspalum notatum.* Generally, the tables also show that there were significant changes in all the parameters as follows: 4%> 20%> 33%> bare soil, except in exchangeable acidity where bare soil had the highest values in the following order: bare soil >33% >20% >4% and in available phosphorus where 4%> 33% = 20%> bare soil. However, *Paspalum notatum* gave significantly higher values than the bare soil as a result of increased root activities by microbes due to high organic carbon and organic matter contents of *Paspalum notatum*.

Soil Reaction (pH)

Some increase in pH of the soils planted with *Paspalum notatum* was observed in the various slopes. For example, the pH in water of the bare soil was raised slightly from 4.9 to a mean of 5.5, 5.2 and 5.1 for 4, 20 and 33% slopes, respectively. Also, the pH in KCl was raised from 3.7 to 4.3, 4.1 and 4.0 for 4, 20 and 33% slopes, respectively. The relative improvement was in the order: Bare soil < 4% > 20% = 33% for pH in water. The very acidic nature of the bare soil according to [20] is as a result of a problem of exposure of very acidic subsoil due to erosion. They attributed this low values partly because the soils are heavily leached of the basic cations due to very heavy rainfall associated with the rainforest zone.

Organic Carbon

Also, the results obtained from Tables 2 and 3 show that the percentage organic carbon content of the bare soil ranged from 1.04 to 1.06 with mean of 1.05%. Then, the organic carbon content of *Paspalum notatum* at 4% slope ranged from 2.18 to 2.20% with mean of 2.19%, while that of 20% slope is 2.14 to 2.16 with mean of 2.15%, and 33% slope ranged from 1.71 to 1.74% with mean of 1.72%.

Similarly, Tables 2 and 3 show that organic matter values derived from organic matter of bare soil had significantly the same trend and ranged from 1.79 to 1.83% with mean of 1.81%. In addition, the organic matter values of *Paspalum notatum* at 4% slope ranged from 3.76 to 3.79% with mean of 3.78% while 20% slope gave a range value of 3.69 to 3.72% with mean of 3.71% and 33% slope ranged from 2.95 to 2.99% with mean of 2.97%. The organic carbon/organic matter

contents were highest at 4%, followed by 20%, and 33%, while the least value was obtained in bare soil, that is O% slope (4%> 20> 33%> bare soil). All levels of slope as well as the bare soil were significant at P < 0.05. The tables pointed to the fact that *Paspalum notatum* (grass cover) significantly increased the percentage organic carbon as well as organic matter content of the soils on the slopes than the bare adjacent soil. Therefore, these soils contain the largest terrestrial carbon pool and thus play a crucial role in the global carbon cycle. Also, high organic carbon (OC) stocks are predominant in grassland soils. Hence, [19] concluded that grasslands have high inherent soil organic matter values that supplies plant nutrients and increases cation exchange capacity. This high level of organic carbon and organic matter contents could be attributed to the presence of vegetation, utilization of carbon in photosynthesis and organic matter decomposition through litter fall and decomposition processes [24].

Table 2. Effect of *Paspalum notatum* on Organic Carbon, Total nitrogen, pH and Available phosphorus at different slope levels in Umudike, Umuahia, Nigeria

Slope %	Location	Attribute						
		pH		OC	OM	N	Avail.P	
		H_20	KCl	(%)	(%)	(%)	(Mg/kg)	C:N
0	A	5.0	3.9	1.06	1.83	0.090	18.60	11.78
Bare	B	4.9	3.9	1.04	1.79	0.089	18.00	11.69
Soil	C	4.9	3.5	1.05	1.81	0.091	17.50	11.54
	Mean	4.9*	3.7*	1.05*	1.81*	0.09*	18.03*	11.67
4	A	5.4	4.3	2.19	3.78	0.181	26.00	12.10
	B	5.5	4.1	2.18	3.76	0.185	27.20	11.78
	C	5.5	4.4	2.20	3.79	0.187	26.80	11.76
	Mean	5.5*	4.3*	2.19*	3.78	0.18*	26.67*	12.17
20	A	5.2	4.2	2.16	3.72	0.178	20.40	12.13
	B	5.2	4.0	2.14	3.68	0.180	20.40	11.89
	C	5.3	4.2	2.15	3.71	0.180	21.80	11.94
	Mean	5.2*	4.1*	2.15*	3.70*	0.18*	21.00*	11.94
33	A	5.1	4.0	1.74	2.99	0.142	22.20	12.25
	B	5.1	4.0	1.71	2.95	0.144	22.00	11.88
	C	5.1	4.0	1.72	2.97	0.140	21.80	12.29
	Mean	5.1*	4.0*	1.72*	2.97*	0.14*	22.00*	12.29
F-LSD $_{0.05}$		0.11	0.29	0.01	0.02	0.00	1.26	

OC = Organic carbon; OM = Organic matter; N = Total nitrogen; Avail. P = Available Phosphorus,
*=Significant at P < 0.05, a = High significance, b = Higher significance, c = Highest significance,
d = Most significant, Same letters means that they are equal
Source: Own results.

Total Nitrogen

Also, results obtained from Tables 2 and 3 show that total nitrogen in the bare soil (0 slope) ranged from 0.089 to 0.091 with mean value of 0.09%. In *Paspalum notatum* at 4% slope, total nitrogen content ranged from 0.181 to 0.187 with mean value of 0.18%, while at 20%, it ranged from 0.178 to 0.180 with mean of 0.18% and at 33%, it ranged from 0.140 to 0.144 with mean of 0.14%. There was an increase in total nitrogen content of soils planted with *Paspalum notatum* at various slope levels compared with the bare adjacent soil. Comparatively, the results of total nitrogen were in the following significant order: bare soil(0) <4% = 20%> 33%. All levels of slope as well as the bare soil were significant at P = 0.05. Tables 2 and 3 pointed to the fact that *Paspalum notatum* on the slopes significantly increased total nitrogen content than in bare soil. Incorporating cover crops into Christmas tree plantations may potentially improve soil fertility, tree growth and quality and be an alternative to commercial nitrogen (N) fertilizers. [26] as well as [10] confirmed that

plant community biomass is increased as a result of habitat productivity, this will definitely cause an increase in soil Carbon (C), nitrogen (N) and phosphorus (P) accumulation and storage at different soil depths, especially topsoil layers, mostly due to increased plant C, N and P addition to the soils.

Table 3. Mean values of Organic carbon, Total Nitrogen, pH and Available Phosphorus of soils planted with *Paspalum notatum on different slopes*

Slope (%)	Attribute						
	pH		OC	OM	N	Avail.P	
	H_20	KCl	(%)	(%)	(%)	(Mg/kg)	C:N
Bare soil (0)	4.9[a]	3.7[a]	1.05[a]	1.81[a]	0.09[a]	18.03[a]	11.67
4	5.5[c]	4.3[b]	2.19[d]	3.78[d]	0.18[c]	26.67[c]	12.17
20	5.2[b]	4.1[b]	2.15[c]	3.70[c]	0.18[c]	21.00[b]	11.94
23	5.1[b]	4.0[b]	1.72[b]	2.97[b]	0.14[b]	22.00[b]	12.29
F-LSD$_{0.05}$	0.11*	0.29*	0.01*	0.02*	0.00	1.26*	

OC = Organic carbon; OM = Organic matter; N = Total nitrogen; Avail. P = Available Phosphorus,
*=Significant at P < 0.05, a = High significance, b = Higher significance, c = Highest significance,
d = Most significant, Same letters means that they are equal
Source: Own results.

Available Phosphorus

The results of the available phosphorus in the bare soil ranged from 17.5 to 18.6 with mean of 18.03. In *Paspalum notatum* at 4%, it ranged from 26.0 to 27.2 with mean of 26.67, while at 20%, ranged from 20.4 to 21.8 with mean of 21.00, and 33% slope ranged from 21.8 to 22.2 with mean of 22.00 Mg/kg. There was an increase in available phosphorus content of soils planted with *Paspalum notatum* at various slope levels when compared with the bare soil. The relative increase in the available phosphorus is in the significant order: Bare soil(0) <4% >33% = 20%. All levels of slope as well as the bare soil were significant at P < 0.05. Tables 2 and 3 pointed to the fact that *Paspalum notatum* on the slopes significantly increased available phosphorus content than in bare soil. [26] as well as [10] confirmed that grassland causes an increase in soil nutrients (C, P, N) accumulations and storage at different soil depths, especially top soil layers, mostly due to increased plant phosphorus, carbon and nitrogen inputs in the experimental soil.

Effective Cation Exchange Capacity

Therefore, the results in Tables 4 and 5 show an increase in the effective cation exchange capacity of soils planted with *Paspalum notatum* in the various slope levels. Effective cation exchange capacity (ECEC) of the adjacent bare soil was greatly increased from 4.76 to a mean of 6.80, 5.87 and 5.21 cmol/kg for 4, 20 and 33% slopes, respectively. The relative improvement was in the order: Bare soil <4% >20% >33%. All levels of slope as well as the bare soil were significant at P < 0.05.

However, planting of *Paspalum notatum* also greatly improved the exchangeable bases of the soils. Generally, the levels of increase in content of these bases were highest in the soils planted with *Paspalum notatum* than in their adjacent bare soil. The increase in cations contributed significantly to the effective cation exchange capacity (ECEC) of the study soils. Also, the ECEC followed the pattern of organic matter values. This trend was expected since in humid tropical soils rich in low activity clays, organic matter is the main contributor to cation exchange capacity (CEC) according to [27].

Exchangeable Acidity (H^+, Al^{3+})

In addition, the results in Tables 4 and 5 indicated a decrease in exchangeable acidity of the soils planted with *Paspalum notatum* which was observed in the various slope levels. According to the Tables, exchangeable acidity in the adjacent bare soil was decreased from 1.84 to 0.82, 1.02 and 1.73 cmol/kg for 4, 20 and 33% slope levels, respectively.

Also, in all levels of slope planted with *Paspalum notatum*, there was no significant increase in aluminum concentration at P <

0.05 was observed, whereas, there was significant increase in their adjacent bare soils. However, the relative decrease in exchangeable acidity was in the significant order: bare soil(0) >33% >20% >4%. [27] stated that on sites that have a tendency to iron or aluminum toxicity, humifying organic matter works to combat toxic metal concentrations by forming complexes with a high molecular weight; where there is absence or little presence of organic matter, aluminum toxicity cannot be combated. This is confirmed with the significant increase in aluminum and hydrogen saturation in adjacent bare soil (Table 4) than in soils planted with *Paspalum notatum*, leading to higher concentration of exchangeable acidity in bare soil than in soils planted with *Paspalum notatum* as in the order above.

Table 4. Effect of *Paspalum notatum* on exchangeable bases and cation exchange capacity of soils on different slopes

Slope (%)	Location	Na^+	Ca^{++}	Mg^{++}	K^+	Al^{+++}	H^+	EA	ECEC	BS
		----------Cmol(+)kg^{-1}----------							---------%---------	
0	A	0.095	1.80	0.80	0.089	0.48	1.40	1.88	4.66	59.69
Bare	B	0.098	2.60	0.80	0.088	0.26	1.60	1.80	4.79	62.34
Soil	C	0.095	1.80	1.60	0.088	0.15	1.70	1.85	4.83	61.76
	Mean	0.10^a	1.87^a	0.87^a	0.09^a	0.28^a	1.57^b	1.84^d	4.76^a	61.26^a
4	A	0.118	3.00	2.60	0.148	0.01	0.92	0.93	6.80	86.30
	B	0.124	3.10	2.80	0.167	-	0.73	0.73	6.92	89.46
	C	0.120	3.00	2.60	0.155	-	0.80	0.80	6.68	87.95
	Mean	0.12^c	3.03^c	2.67^d	0.16^d	0.01^{NS}	0.82^a	0.82^a	6.80^d	87.90^d
20	A	0.113	2.80	2.00	0.133	0.04	1.00	1.04	6.09	82.85
	B	0.115	2.60	2.00	0.135	0.16	0.84	1.00	5.85	82.90
	C	0.114	2.60	1.80	0.138	0.02	1.00	1.02	5.67	82.04
	Mean	0.11^b	2.67^b	1.93^c	0.14^c	0.07^{NS}	0.95^a	1.02^b	5.87^c	82.60^c
33	A	0.100	2.00	1.00	0.105	0.40	1.40	1.80	5.01	64.04
	B	0.100	2.00	1.40	0.107	0.80	1.60	1.68	5.29	68.19
	C	0.101	2.00	1.40	0.110	0.22	1.50	1.72	5.33	67.74
	Mean	0.10^a	2.00^b	1.27^b	0.11^b	0.23^{NS}	150^b	1.73^c	5.21^b	66.66^b
F-LSD 0.05		0.00*	0.18*	0.31*	0.01*	0.23	0.25*	0.07*	0.34*	2.11*

Na = Sodium; Ca^{++} = Calcium; Mg^{++} = Magnesium; K^+ = Potassium, NS = Not significant, EA = Exchangeable acidity; CEC = Cation exchange capacity; ECEC = Effective cation exchange capacity; BS = Base saturation; Al. Sat. = Aluminum saturation; *=Significant at $P < 0.05$, a = High significance, b = Higher significance, c = Highest significance, d = Most significant, Same letters means that they are equal
Source: Own results.

Base Saturation

Tables 4 and 5 indicated some increase in base saturation of the soils planted with *Paspalum notatum* in the various slopes. Base saturation of the bare soil was raised from 61.26 to a mean of 87.90, 82.60 and 66.66 for 4, 20 and 33% slopes, respectively. The high improvement was in the order: Bare soil < 4% > 20% > 33%. All levels of slope as well as the bare soil were significant at P = 0.05. Addition or planting of *Paspalum notatum* increased the base saturation of the soils. This is so because, a decrease in exchangeable acidity increased CEC, thereby increasing the base saturation and vice versa. Table 3 shows an increase in percentage base saturation in soils planted with *Paspalum notatum*. This result follows the same trend as ECEC. Hence, the addition or planting of *Paspalum notatum* reduced the exchangeable acidity as well as the Al^{3+} and H^+ of the soils according to [27].

Total Exchangeable Bases (Ca^{2+}, Mg^{2+}, Na^+, K^+)

Some increase in the calcium content of the soils planted with *Paspalum notatum* was observed in the various slopes (Tables 4 and 5). Calcium content of the bare soil was raised from 1.87 to 3.03, 2.70 and 2.00 (Cmol/kg) for 4, 20 and 33% slopes, respectively. The

high improvement was in the order: Bare soil < 4% > 20% > 33%. All levels of slope as well as the bare soil were significant at P < 0.05.

Magnesium content in the soils planted with *Paspalum notatum* increased in the various slopes. Magnesium content was raised from 0.87 to a mean of 2.67, 1.93 and 1.27 for 4, 20 and 33% slopes respectively. The high improvement was in the order: Bare soil < 4% > 20% > 33%. All levels of slope as well as the bare soil were significant at P < 0.05 (Table 5).

Table 5. Mean values of exchangeable bases and cation exchange capacity of soils planted with *Paspalum notatum* on different slopes

Slope (%)	Na^+	Ca^{++}	Mg^{++}	K^+	Al^{+++}	H^+	EA	ECEC	BS
	----------Cmol(+)kg^{-1}----------							----------%----------	
Bare Soil (0)	0.10^a	1.87^a	0.87^a	0.09^a	0.28^a	157^b	1.84^d	4.76^a	61.26^a
4	0.12^c	3.03^d	2.67^d	0.16^d	0.01^{NS}	0.82^a	0.82^a	6.80^d	87.90^d
20	0.11^b	2.67^c	1.93^c	0.14^c	0.07^{NS}	0.95^a	1.02^b	5.87^c	82.60^c
33	0.10^a	2.00^b	1.27^b	0.11^b	0.23^{NS}	1.50^b	1.73^c	5.21^b	66.66^b
F-LSD 0.05	0.00	0.18	0.31	0.01	0.23	0.25	0.07	0.34	2.11

Na^+ = Sodium; Ca^{++} = Calcium; Mg^{++} = Magnesium; K^+ = Potassium, EA = Exchangeable acidity; CEC = Cation exchange capacity; ECEC = Effective cation exchange capacity; BS = Base saturation; Al. Sat. = Aluminum saturation; *=Significant at P = 0.05, NS=Not significant, *=Significant at P = 0.05, a = High significance, b = Higher significance, c = Highest significance, d = Most significant, Same letters means that they are equal
Source: Own results.

Some slight increase in the sodium content of the soils planted with *Paspalum notatum* was observed in the various slopes. Sodium content of the bare soil was slightly raised from 0.10 to 0.12 and 0.11 for 4% and 20% slopes, respectively; it was same with that of 33% slope. The slight improvement was in the order. Bare soil = 33% < 4% > 20%. All levels of slope as well as the bare soil were significant at P < 0.05.

Similarly, some increase in the potassium content of the soils planted with *Paspalum notatum* was observed in the various slopes (Table 5). Potassium content of the bare soil was raised from 0.09 to a mean of 0.16, 0.14 and 0.11 for 4%, 20% and 33% slopes, respectively. The slight improvement was in the order: Bare soil < 4% > 20% > 33%. All levels of slope as well as the bare soil were significant at P = 0.05. [30] opined that in semi-arid and tropical climates, it is common to find higher soil organic matter and nutrient (Ca, Mg, Na, K, N) contents under grassland and tree canopies than in adjacent open land (bare soil). [1] stated that the inclusion of grassland, trees and other perennials in farm lands can markedly improve soil physical and chemical conditions in the long run. [7] and [22] confirmed that the major recognized ways of adding organic matter and nutrient (Ca^{2+}, Mg^{2+}, Na^+, K^+, N, etc) to the soil from the trees and grasses standing on it, is through litter fall and the decay of grasses. This is however confirmed with the high results of the chemical properties of the soils which were planted with *Paspalum notatum*.

In addition, Table 6 shows the relationships between organic matter and some selected chemical properties of the soils which were planted with Bahia grass as well as the soils of the adjacent bare soil. There was Significant correlation at P < 0.05 was observed between organic matter and some selected chemical properties except for potassium (K) which had R^2 and r values as 0.119 and 0.345, respectively. Therefore, organic matter influenced these properties positively.

Table 6. Some relationships between Organic matter and some selected chemical properties of the soils

Dependent Variable	Correlation Coefficient (r)	Coefficient of Determination (r^2)
N	0.998*	0.996
Na	0.787*	0.620
Ca	0.878*	0.771
Mg	0.890*	0.792
K	0.345^{ns}	0.119

* = Significant correlation, ns = No significant correlation
Source: Own results.

CONCLUSIONS

This research on the effect of *Paspalum notatum* on the chemical properties of an ultisol was carried out at Abia State University Umuahia Campus Teaching and Research Farm. It has actually given the results of the chemical properties of soils located at the three (3) different slope levels namely: 4%, 20% and 33%, which however were compared with the open adjacent bare soil.

The results of study have shown that the slopes planted with *Paspalum notatum* gave significantly higher chemical properties than the open adjacent bare soil. In all the parameters considered in this study, the values obtained in 4% slope was higher than those obtained in 20% as well as 33% and the adjacent bare soil in the following significant order: 4%> 20%> 33%> bare soil. However, 4% slope had higher value of phosphorus (P) than the similar values of 33% and 20%, while Bare soil gave the least value in the order: 4%> 33%> = 20%> bare soil. Also, exchangeable acidity (H^+ and Al^{3+}) was highest in bare soil than in the slopes planted with *Paspalum notatum.* This result also pointed to the fact that the pH of the soils planted with *Paspalum notatum* was significantly higher than those of the bare soils. Therefore, *Paspalum notatum* improved very highly the chemical properties of the soils at various slope levels, whereas bare soil had no much affect on the soils.

Recommendations

The following recommendations are made based on the results obtained in this study:

(i)From the results of this study, *Paspalum notatum* had been discovered to be included among the grass cover management that would enhance erosion management because of its high nutrient composition especially organic matter and rooting system.

(ii)It is hoped that *Paspalum notatum* if established on slopes that are prone to erosion could help improve the soil organic matter as well as soil aggregates, reduce run off and encourage infiltration.

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EFFECT OF SOME INDIGENOUS TREES ON EARTHWORM ACTIVITIES AND PHYSICAL PROPERTIES OF AN ULTISOL IN UMUAHIA, SOUTHEASTERN NIGERIA

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Abstract

The effect of some indigenous trees on earthworm activities and physical properties of an ultisol were studied at Umudike, Nigeria. These studies were carried out under some indigenous tree canopies namely: cacao, breadfruit, avocado pear and mango, and were compared with the soils of their open adjacent sites, ten meters away at different soil depths (0-15 cm and 15 – 30 cm). Generally, soils under tree canopies at various soil depths had lower bulk density, higher total porosity, and water stable aggregates than the adjacent sites. Example, the soils under cacao (Theobroma cacao L.) canopy had significantly higher values of total porosity, water stable aggregate and lower values of bulk density than the soils under mango, avocado pear and bread fruit and their adjacent sites. Mango tree gave the least values at various soil depths. Also, soils under tree canopies gave significantly (P = 0.05) higher values of earthworm population and casts than those of their adjacent sites at various soil depths, for instance at 0 – 15cm soil depth, cacao (14.00 and 9.00) gave significantly higher mean values of earthworm population and casts than mango (5.00 and 2.33), breadfruit (9.67 and 6.00) and avocado pear (8.00 and 4.00) per M^2, respectively. They were in the following significant decreasing magnitude: cacao > Breadfruit > avocado > mango. Mango gave significantly (P = 0.05) the least mean values of earthworm population and casts'.

Key words**:** *indigenous trees, earthworms, physical properties, ultisol, Nigeria*

INTRODUCTION

Agroforestry has tremendous potentials to enhance productivity, sustainability and diversification of farming systems. Inclusion of trees and other woody perennials in farm lands can markedly improve soil physical conditions in the long run [4]. The major recognized avenue for addition of organic matter (and hence, of nutrients) to the soil from the trees standing on it, is through litter fall, that is, through dead and falling leaves, twigs, branches, fruits and so on [9]. Soils under trees have higher permeability, greater water-holding capacity, a higher infiltration rate and enhanced soil productivity [36],[1],[3]. Increased soil productivity is made possible by the build-up and subsequent decomposition of forest floor materials and release of nutrient elements. The buildup of the forest litter depends upon the annual input of litter and the rate of decomposition of the forest floor material by the decomposing community (Soil organisms) [23],[18].

Trees augment soil input, reducing losses, improving soil physical properties through soil organic matter build up form leaf litter. [31]. In addition, the presence of trees and litter restore soil organic matter as well as the physical condition which are considered the key factors in soil fertility, improvement and maintenance [28].

Tree plantations are becoming an increasingly common land use type in tropical areas. [15] indicates that this land cover in the tropics accounts for more than 60 million hectares of plantations which have been established for different reasons including the shift in timber production from native forests to plantation restoration of degraded lands or as catalysts of forest succession [8] and buffer zones for biodiversity conservation [33] among others.

[41] conceptualized that tree plantations may influence earthworm abundance by altering the chemical or physical properties of the soil such as the moisture regime, pH, soil organic matter levels and litter inputs. Also, native tree plantations can benefit the establishment

of populations of native earthworm species [40]. Since earthworms dominate soil macrofauna in tropical ecosystem, they greatly impact soil processes affecting plant growth. Their role as ecosystem engineers [21] is also important for biodiversity conservation and restoration of degraded lands. Plantation with native species, like breadfruit, can serve as refuge for native earthworm diversity and abundance.

[6] examined the influence of earthworms on surface litter decomposition in maize agro ecosystems and noted an increased rate of decomposition of the surface litter.

Earthworms are long time adored creatures in many cultures, probably because of the role they are believed to play in the fertility improvement of the soil. The Chinese characterized earthworms as the "angel of the earth". Aristotle aptly referred to them as the 'intestines of the soil", though he might be referring to the appearance rather than their functions, and Cleopatra decreed them "Sacred" [5]. However, [19] observed the usefulness of earthworms as an active agent in introducing suitable physical and micro-biological changes in the soil, thereby, directly increasing the fertility and crop producing power of the soil. [24] noted that in Bangalore, India, earthworms successfully decomposed sugar factory residuals and turned them into soil nutrients that made farmers using the material reduce chemical fertilizer by 50 percent. Earthworm casts contain 5 times nitrogen, 1.5 times calcium, 3 times magnesium, 11 times potash as well as 1.4 times more humus than the already existing top soil [11]. [12] also noted that earthworm casts generally have a higher ammonium concentration as well as water holding capacity than the corresponding original top soil. In addition, earthworm casts have high denitrification potentials and assimilable products that mineralized rapidly and, therefore, represent a potentially significant source of readily available nutrients for plant growth [10]. [19] observed that there is early seedling and rapid plant growth when earthworm casts are mixed with soil.

Earthworm borrows provide network of passages through the soil which improves soil aeration [26]. [5] stated that earthworm burrows can make up 5% of the total soil volume, and observed that high earthworm population enhances soil aeration, drainage and infiltration. [27] noted that earthworms bring to the soil surface casts of about 2 - 5.8 t/ha on agricultural land, 15 t/ha in temperate woodland and about 50 t/ha in tropical forest. Trees affect earthworms positively (through litter inputs) thereby promoting the establishment of the earthworms benefited from the basal resource [37]. This study was carried to determine the effect of trees on earthworm activities and some physical properties of soils of southeastern Nigeria.

MATERIALS AND METHODS

General Description of the Site Location

The studies were carried out on the experimental research farm of the Cacao Research Institute of Nigeria (CRIN) Ibeku sub-station at Ajata-Ibeku, Umuahia North Local Government Area, Nigeria and Abia State University Umuahia Campus Teaching and Research Farm all in, Abia State.

The Cocoa Research Institute of Nigeria (CRIN) Ibeku sub-station at Ajata-Ibeku is located on latitude 0.5^0 29N and Longitude 0.7^0 33E in the rainforest ecological zone of south eastern Nigeria and lies at a mean elevation of 122 metres (400 ft) above sea level.

The Abia State University Teaching and Research farm Umuahia Campus is located on Latitude 5^0 25N and Longitude 7^0 35E in the ecological zone of South eastern Nigeria at about 122 m above sea level.

The study areas have most dry humid tropics with fairly even and uniform temperature throughout the two seasons (dry and rainy) each year. However, the mean annual rainfall of the area is between 1,000-2,000 mm, while rainfall distribution is biomodal [29]. Also, the mean annual maximum temperature is between 30^0c to 33^0c, whereas, the mean annual minimum temperature ranges from 21^0c to 29^0c [13]. In addition, the vegetation of the study area is tropical rainforest.

Fig. 1. Map of Abia State showing Umuahia, and Ikwuano Project Sites: Cocoa Research Institute of Nigeria, Ibeku Substation. Umuahia and Abia State University, Umuahia Campus, Nigeria

The soil associated with this experimental site is classified as ultisols (USDA) classification, [14]. These soils have a number of soil related constraint to agricultural productivity such as low inherent fertility, soil acidity, low clay, low organic matter content, low nutrient and water holding capacities, poor structural stability and high susceptibility to soil erosion and drought stress [32].

Selected Tress for the Study

Four trees were used for the study as follows;
Cacao (*Theobroma Cacao* L.*)* - Ca
Bread fruit (*Triculia africana*) - Br
Mango (*Mangifera indica*) - Ma
Avocado pear (*Persea americana*) - Av
The cacao was selected from the Cacao Research Institute of Nigeria (CRIN) Ibeku substation, Umuahia, Nigeria. While breadfruit, mango and avocado pear were selected from the Abia State University Umuahia Campus Teaching and Research Farm, Umudike, Umuahia, Nigeria.

Species Description

Mango (*Mangifera indica*) is one of the most important tropical fruits in Nigeria today. It is an indigenous to southern Asia and probably originates from the Indo-Burma region [7]. Cultivation of mango in Nigeria dates back over several decades and the trees flourish in many parts of the country. Worldwide, the major mango producing nations are India, Mexico, and Brazil, while the leading world export markets for fresh fruit include the United Kingdom, France, and Holland, [20]. Estimates show that up to 50,000 hectares with a corresponding yield of 625,000 tonnes of assorted mangoes are being grown in the states of Borno, Niger, Plateau, Oyo, Benue, and Kogi. The crop is grown by peasant growers and professional horticulturists on homestead gardens, and small, intermediate and large-scale plantations [22].

Cacao (*Theobroma cacao* L*)* developed in the upper Amazon region of Latin America. In classical Mexican mythology, cacao, one of the foods of the gods originated in the garden of life. Cacao was introduced into Nigeria from Fernando Po by Chief Saviss Ibanningo in 1874. The generic name *Theobroma* which means "drink" (broma) of the "god"; (theo) emphasize the high regard India native in its land of origin attach to the crop. The word "*Theorborma*" is derived from the Greek words meaning 'food for the gods'. Cacao belongs to the family of the sterculiaceae over 20 species of *Theobroma* are recognized. All cacao cultivated for the international market belongs to the single species *Theobroma cacao* (*L*). Other *Theobroma species* are locally exploited by the indigenous populations either for making refreshing drinking from the sweatens or for making a type of chocolate from the cotyledons. Cacao is cultivated in tropical lowlands, 20^0N and S of the equator, but the main belt in 10^0N and S from sea level up to 500m, with rainfall range of between 1,800 and 2,000 mm. Cacao thrives in diverse soils. In Nigeria, cacao is grown mainly in the southern states of Ogun, Oyo, Ondo, Ekiti, Edo, Delta, Cross River, Abia and Akwa Ibom.

Cacao seeds are the source of commercial cocoa, chocolate and cacao butter. Cacao beans contain about 50% fat, 12% protein and other minerals. The most important food products from cocoa are chocolate products. The non food products include pure industrial alcohol, components of skin cream etc.

Avocado pear (*Persea americana*) is a tree (native to central Mexico) it is classified in the flowering plant family (Lauraceae) along with the cinnamon. However, avocado or alligator pear is classified as fruit and botanically also, as large berry that contains a single seed.

Avocados are commercially valuable and are cultivated in tropical and Mediterranean climates throughout the world. In Latin America, the leaves are both beneficial in medicine, to the soil and for its culinary uses. Avocado leaves are prepared as tea and make it as tonic every day; it is referred to as miraculous because its effect could not be illustrated by some doctors.

The Breadfruit (*Treculia africana*)

Breadfruit (*Treculia africana*) in Africa is cultivated by its seed. It is propagated through building, cutting and shielding, grafting, using scions. Budded trees have produce fruit with viable seeds within 2-4 years.

According to [2] breadfruit is underutilized especially in African Continental, Europe and United States of America where it is being newly introduced as ornamental trees. Treculia Africana seeds are sources of edible food which are rich in protein and fat [16]. They are commonly roasted, cooked, mashed and consumed either directly as snacks food or as flour for use in soup thickening and cake. The major part of fruit consists of 75-90% water [17].

Data Analysis

Significant differences in soil gravimetric moisture content, total porosity, bulk density, aggregate stability and particle size among the tree types were identified using ANOVA at 5% probability level. However, the treatment means were compared using Duncan's New Multiple Range Test [DNMRT]. Also, analysis of variance ANOVA were performed using linear model with means separated using the technique of [34] to assess the effect of trees on gravimetric moisture content, total porosity, bulk density, water stable aggregate and particle size as well as activities of earthworms. Significance was reported at [$P < 0.05$].

Laboratory Studies

Soil samples were randomly collected using four undisturbed cores under the canopy of individual trees and those in the surroundings without a tree cover (Adjacent open land) at different depths (0-15, and 15-30cm). The dimensions of the core were 5.0cm (height) and 5.7cm (internal diameter). The core soil samples were used to measure soil moisture retention, bulk density, total porosity, water-stable aggregates and particle size analysis.

Also under each tree canopy and its adjacent open land a quadrant of 1m x 1m in dimension were demarcated. In the quadrant, the numbers of earthworm casts were determined from 0-15 and 15-30 cm soil depth. The earthworm population was determined, by hand sorting method.

The procedures for soil analyses were outlined below.

Particle Size Analysis

Particle size analysis was determined on the soil sample using Bouyoucos hydrometer method. The technique used was the dispersion of sample with calgon (Sodium hexameta - phosphate). In this method, soil samples were soaked in calgon for 24hrs and later transferred into volumetric flask and was stirred for mechanical agitation before the hydrometer test.

Soil Moisture Retention

Also, disturbed soil samples were collected from the tree plot and 30g of each was weighed into robber bands (rings). This was used to determine the water content of the soil at 1.5 MPa (0.1 bar), using the pressure plate apparatus [36]. In each case the samples were placed on ceramic plate. Soil was soaked with water for 24hours. The plates with the samples were placed in the pressure chamber and were subjected to the different suctions until water ceased to drain out from the soil samples. The samples were weighed and over dry at 105^0C for 24hours.

Calculation

The field capacity was calculated, that is 0.01MPa suction, which simply entails the maximum amount of water the soil can hold after it has freely drained for 2-3days, and the saturation was followed without evapotranspiration occurring during the period.

Wilting point, this value was as lower limit of plant available water. It was equivalent to

the soil water content with at least 1.5MPa (15bar) water potential. Equation is stated below:

$$\theta = \frac{\text{wet soil [g]-dry soil [g]}}{\text{Dry soil [g]}} \times \frac{100}{1}$$

Bulk Density

Bulk density (D_b) was the apparent density of the field soil and was calculated by dividing the mass of the soil that were dried in the oven.

$$D_b = \frac{Ms}{V} \quad g/cm^3$$

where

D_b = bulk density

M_s = Mass of soil samples

V = Volume of soil sample (equals volume of core)

Total Porosity

The total porosity was defined as the volume of the sample that is not occupied by solid materials and this was expressed as percentage of the sample volume [35].

This was calculated from the values obtained from bulk density. The calculation was the relationship between bulk density and particle density as well as on the assumption of particle density of 2.65mg m^{-3} for mineral soils.

The formula is

$$\frac{1\text{-Bd}}{pd} \text{ or } \frac{pd - bd}{pd} \times \frac{100}{1}$$

$$\frac{1 - \text{Bulk density}}{\text{Particle density}}$$

$$St = \frac{(1 - Dd)}{Dp} \times \frac{100}{1}$$

where;

S_t = total porosity (%)

D_b = bulk density (mg m^{-3})

D_p = Particle density (mg m^{-3})

Water Stable Aggregates (WSA)

This was sieved in order to sieve wet aggregate. This was carried out for 2 minutes at one oscillation per second after which the sieves were removed from water and then the oven dry weight of the materials was determined. Mean weight diameter were determined. The materials were used in the following relationship:

$MWD = \Sigma X_1 W_1$

MWD = Mean weight diameter

$\bar{X}$ = Mean diameter of each size fraction (mm)

W = The proportion of the total sample weight occurring in the corresponding size component.

RESULTS AND DISCUSSIONS

The physical properties of soils under some indigenous trees and its adjacent sites at various soil depths

Tables 1, 2, 3 and 4 summarized the physical properties of soils under some indigenous trees namely: Cacao (*Theobroma cacao* L.*)*, Avocado pear (*Persea americana*), Mango (*Mangifera indica*) and Breadfruit (*Treculiar africana*) as well as their adjacent sites at Umuahia, Nigeria. Generally, the performance show that the values of gravimetric moisture content, bulk density, total porosity and water stable aggregates obtained under trees were better than those of the adjacent soils. Example, the gravimetric moisture values of 13.05, 12.30, 12.75 and 13.15% for cacao, avocado pear, breadfruit and mango, respectively gave significantly higher values than their adjacent soils of 9.85, 9.40, 8.38 and 9. 67%, which were ten (10) meters away from cacao, avocado, breadfruit and mango, respectively at soil depth of 0 - 15cm. In addition, the results of 15-30cm soil depth followed the same trend as in 0 – 15 cm. Also the Tables revealed that the results obtained under the trees at both 0-15cm and 15-30cm soil depths had significantly ($P < 0.05$) lower bulk density, higher total porosity and higher water stable aggregates values than those of the adjacent soils. Also, the soils of cacao and mango trees were clay loam and loam in texture, respectively, while breadfruit and avocado were sandy loam

Further evidence of the effects of trees on soils was obtained by comparing the physical properties under the tree canopy of individual

trees with those in the surroundings without a tree cover by [39]. He observed cases of 50-100% increase in water holding capacity, total porosity and infiltration rate under tree canopies. Similar observations were made by [17], [1], [3]. The removal of the vegetative cover from the soil according to [30], generally results in an increase in bulk density, a decrease in porosity and a reduction in infiltration rate. This is also similar to the findings of [38] under bush fallow at Iwo, who reported, however, that the infiltration capacity and infiltration obtained were 118.9 and 21.1cm hr^{-1}, respectively. Also, at Oba, the infiltration capacity as well as rate were 107.7 and 25.4cm $hr-^{1}$, respectively.

Table 1. Some physical properties of soils under cacao tree and its adjacent site at different soil depth

Soil Depth (cm)		**Particle size analysis**			**Textual class**	**Bulk Density Mgm^{-3}**	**Total Porosity (%)**	**GMC (%)**	**WSA (%)**
		Total sand %	Silt %	Clay %					
0 - 15	Under	79.87	8.80	11.33	SL	1.38	57.01	13.50	64.49
15 - 30	Tree	70.49	14.11	15.40	SL	1.62	38.99	18.48	46.90
0 - 15		75.80	6.80	17.40	SL	1.67	37.98	9.85	48.67
15 - 30	Adjacent	65.80	12.80	21.40	SCL	1.73	34.50	12.72	41.52
F-LSD$_{0.05}$	Site	6.1*	3.4*	4.2*		0.15*	10.1*	3.5*	9.8*

SCL= Sandy clay loam, SL = Sandy loam, GMC = Gravimetric moisture content, WSA = Water stable aggregate, * = Significant at P< 0.05
Source: Own results.

Table 2. Some physical properties of soils under Avocado tree and its adjacent site at different soil depth

Soil Depth (cm)		**Particle size analysis**			**Textual class**	**Bulk Density Mgm^{-3}**	**Total Porosity (%)**	**GMC (%)**	**WSA (%)**
		Total sand %	Silt %	Clay %					
0 - 15	Under	78.80	7.13	13.07	SL	1.50	48.13	12.30	64.41
15 - 30	Tree	75.80	8.80	15.40	SL	1.59	39.87	18.47	58.08
0 - 15		84.47	6.13	9.40	SL	1.62	38.86	9.40	57.59
15 - 30	Adjacent	79.80	8.80	11.40	SL	1.71	35.34	12.11	50.49
F-LSD$_{0.05}$	Site	3.5*	1.3*	2.5*		0.08*	5.4*	3.8*	5.6*

SCL= Sandy clay loam, SL = Sandy loam, GMC = Gravimetric moisture content, WSA = Water stable aggregate, * = Significant at P< 0.05
Source: Own results.

Some physical properties of soils under Breadfruit tree and its adjacent site at different soil depth are shown in Table 3.

Table 3. Some physical properties of soils under Breadfruit tree and its adjacent site at different soil depth

Soil Depth (cm)		**Particle size analysis**			**Textual class**	**Bulk Density Mgm^{-3}**	**Total Porosity (%)**	**GMC (%)**	**WSA (%)**
		Total sand %	Silt %	Clay %					
0 - 15	Under	75.80	11.47	12.73	SL	1.51	43.01	12.75	60.39
15 - 30	Tree	69.80	3.13	17.07	SL	1.66	37.48	18.47	50.35
0 - 15		79.80	10.80	9.40	SL	1.68	36.60	8.38	53.16
15 - 30	Adjacent	74.47	15.13	10.40	SL	1.74	34.46	11.68	49.22
F-LSD$_{0.05}$	Site	4.1*	5.0*	3.4*		0.08*	3.1*	4.2*	4.3*

SCL= Sandy clay loam, SL = Sandy loam, GMC = Gravimetric moisture content, WSA = Water stable aggregate, * = Significant at P< 0.05
Source: Own results.

Some physical properties of soils under Mango tree and its adjacent site at different soil depth are presented in Table 4.

Table 4. Some physical properties of soils under Mango tree and its adjacent site at different soil depth

Soil Depth (cm)		Particle size analysis			Textual class	Bulk Density Mgm^{-3}	Total Porosity (%)	GMC (%)	WSA (%)
		Total sand %	Silt %	Clay %					
0 - 15	Under	77.80	8.13	14.07	SL	1.48	44.27	13.51	54.24
15 - 30	Tree	66.49	14.13	19.40	SL	1.58	40.25	19.08	50.12
0 - 15		64.47	10.13	25.40	SCL	1.65	37.73	9.67	46.49
15 - 30	Adjacent	59.80	10.80	29.40	SCL	1.74	34.46	12.07	40.29
F-$LSD_{0.05}$	Site	6.6*	2.1*	5.8*		0.09*	3.5*	3.4*	5.1*

SCL= Sandy clay loam, SL = Sandy loam, GMC = Gravimetric moisture content, WSA = Water stable aggregate, * = Significant at P< 0.05
Source: Own results.

Comparison of the physical properties of soils under some indigenous trees and their adjacent sites at 0 – 15 and 15 - 30 soil depths

The textures of the soils under trees and their adjacent sites were affected significantly and gave statistically different results at various soil depths (0 – 15 and 15 – 30) (Table 5). In Fig. 2, it is shown that the clay contents of soils under cacao tree at various soil depths gave significantly the least values than other trees.

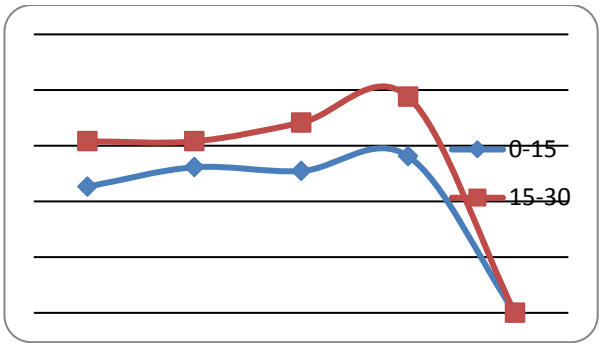

Fig. 2. Effect of the indigenous trees on the clay content of the soils
Source: Own design.

Table 5. Comparison of particle size distribution of soils under some indigenous trees and their adjacent sites at 0 – 15 and 15 - 30 soil depths

Soil Depth	Treatment	Sand %		Silt %		Clay %		TC	
		Particle size analysis							
0 - 15		Und	Adj	Und	Adj	Und	Adj	Und	Adj
	Cacao	79.87	75.80	8.80	6.80	11.33	17.40	SL	SL
	Avocado pear	78.80	84.47	7.13	6.13	13.07	9.40	SL	SL
	Breadfruit	75.80	79.80	11.47	10.80	12.73	9.40	SL	SL
	Mango	77.80	64.47	8.13	10.13	14.07	25.40	SL	SCL
	F-$LSD_{0.05}$	1.7*	8.5*	1.8*	2.0*	0.9*	6.6*		
15 - 30		Und	Adj	Und	Adj	Und	Adj	Und	Adj
	Cacao	70.49	65.80	14.11	12.80	15.40	21.40	SL	SCL
	Avocado pear	75.80	79.80	8.80	8.80	15.40	11.40	SL	SL
	Breadfruit	69.80	74.47	3.13	15.13	17.07	10.40	SCL	SL
	Mango	66.49	59.80	14.13	10.80	19.40	29.40	SL	SCL
	F-$LSD_{0.05}$	3.2*	7.7*	4.5*	2.3*	1.6*	7.7*		

TC = Textural class, BD = Bulk density, TP = Total porosity, HC = Hydraulic conductivity, SCL = Sandy clay loam, GMC = Gravimetric moisture content, NS = Not significant, * = Significant at P = 0.05, Und = Under tree canopy, Adj = Adjacent bush fallow
Source: Own results.

The results show that there were significant differences in dry bulk density among the indigenous tree species ($P < 0.05$) at 0 – 15 cm soil depth (Table 6).

Table 6. Comparison of some physical properties of soils under some economic trees and their adjacent sites, at soil depths of 0 – 15 and 15 – 30cm

Soil Depth	Treatment	GMC (%)		BD (Mg m^{-1})		TP(%)		WSA (%)	
0-15		Und	Adj	Und	Adj	Und	Adj	Und	Adj
	Cacao	13.50	9.85	1.38	1.67	57.01	37.98	64.49	48.67
	Avocado pear	12.30	9.40	1.50	1.62	48.13	38.86	64.41	57.59
	Breadfruit	12.75	8.38	1.51	1.68	43.01	36.60	53.16	60.39
	Mango	13.51	9.67	1.48	1.65	44.27	37.73	54.24	46.49
	F-LSD$_{0.05}$	0.5*	0.5*	0.01*	0.02*	2.0*	2.3*	5.3*	5.8*
15-30		Und	Adj	Und	Adj	Und	Adj	Und	Adj
	Cacao	18.48	12.72	1.59	1.73	38.99	34.50	46.94	41.52
	Avocado pear	18.47	12.11	1.62	1.71	39.87	35.34	58.08	50.49
	Breadfruit	18.47	11.68	1.66	1.74	37.48	34.46	49.22	50.35
	Mango	19.08	12.07	1.58	1.74	40.25	34.46	50.12	40.29
	F-LSD$_{0.05}$	0.2*	0.3*	0.03*	0.01*	1.0*	0.3*	4.1*	4.7*

TC = Textural class, BD = Bulk density, TP = Total porosity, HC = Hydraulic conductivity, SCL = Sandy clay loam, GMC = Gravimetric moisture content, NS = Not significant, * = Significant at P = 0.05, Und = Under tree canopy, Adj = Adjacent bush fallow

Source: Own results.

In addition, the trees decreased the dry bulk density relative to their open adjacent sites. Also, at 0 -15 cm depth, Cacao (1.38 Mg m^{-3}) gave significantly ($P < 0.05$) least bulk density value than Mango (1.48 Mg m^{-3}), Avocado pear (1.50 Mg m^{-3}) and Breadfruit (1.51 Mg m^{-3}) in the following order : Cacao < Mango < Avocado pear < Breadfruit. At 15 – 30 cm Breadfruit gave significantly higher dry bulk density value than the statistically similar values of Cacao, Mango and Avocado pear (Table 6).

The higher bulk density values were obtained at 15 -30 cm soil depth than the corresponding 0 – 15 cm soil depth which may be attributed to the high values of clay associated with the lower part of the soil (Table 6).

Also, the bulk density values under trees were lower than their corresponding adjacent sites. This may be because of the exposure of the bare soil to erosion. Also, dry bulk density increases with time after tillage as a result of trafficking during field operations as well as other natural factors like the alternate wetting and drying cycles that cause large " stresses", in a tropical climate. Dry bulk density is a soil physical parameter used extensively to quantify soil compactness which has a very influential effect on root growth as well as proliferation which are both 'indicators', of soil productivity[1]. The gravimetric moisture content of the soil was significantly ($P < 0.05$) influenced by the tree canopies. The values of the moisture content of soils under trees at 0 – 15 and 15 – 30 cm depth were higher than those of their corresponding open adjacent sites. Therefore, this could be as a result of the exposure of the top soil by erosion or other human factors. Also, at 0 – 15 cm depth, cacao (13.50%) and Mango (13.51%) under tree with statistically similar moisture content values were significantly higher than the similar values of Avocado pear (12.30%) as well as Breadfruit (12.75%). However, soil depth of 15 -30 cm followed the same trend. The significant improvement is in the order : Mango = Cacao > Breadfruit = Avocado pear (Table 6).

Also, the results in Table 6 at both 0 – 15 and 15 -30 cm soil depth show that total porosity increased ($P < 0.05$) under tree canopies more than their corresponding adjacent sites. Table 6 also shows that Cacao (57.01%) had significantly higher total porosity value than Avocado pear (48.13%), whereas Breadfruit (43.01%) and Mango (44.27%) had statistically ($P < 0.05$) similar values. The trend in increasing total porosity is Cacao > Avocado pear > Mango > Breadfruit.

The data obtained in Table 6 indicate that the values of water stable aggregate content under tree canopies was significantly ($P < 0.05$) higher than their corresponding adjacent sites. The results show statistical difference in water stable aggregate between the soils under the trees at both 0 – 15 and 15 – 30cm depth.

Generally, the results obtained show that Cacao gave significantly lower results of dry bulk density and higher values of gravimetric moisture content, total porosity as well as water stable aggregate than breadfruit, avocado pear and mango. Highest values obtained with cacao could be attributed to the highest earthworm population and casts associated with it. Further evidence of the effects of trees on earthworm activities under canopy of individual trees was compared with those in the surroundings without tree cover by [25]. The authors reported that earthworms under tree influence the establishment and conservation of soil structure. Also the organic matter building through the leaf litter helps to multiply earthworms under such tree canopies by feeding on the leaves. [26] made similar observations.

Effect of some Indigenous Trees on Earthworm Population

Figures 3 and 4 summarized the effect of some indigenous trees on earthworm population at different soil depths 0-15 and 15 – 30 cm, respectively, under tree canopies (cacao, mango, bread fruit and avocado pear) and their adjacent soils in Umuahia, Nigeria. At 0-15cm soil depth, the number of earthworms per square meter in the soils under tree canopies were significantly (p = 0.05) higher than those of the adjacent sites. The mean values of 14.00, 9.67, 5.00 and 8.00 were obtained for cacao, breadfruit, mango and avocado pear under tree canopies, while the lower values of 10.67, 7.00, 3.33 and 5.00 were obtained at the adjacent soils (10 meters away) of the various tree canopies, respectively. Also, the mean values of 15 – 30 cm soil depth had significantly similar trend with those of 0 – 15 cm. Generally, soils under cacao (14.00) had significantly higher (P = 0.05) mean values of earthworm population than the mean values of mango (5.00), breadfruit (9.67) and avocado pear (8.00) m^{-1}. They were in the following significant decreasing magnitude: Cacao > Breadfruit > Avocado > Mango. However, mango gave significantly (P = 0.05) the least mean values of earthworm population. Therefore, significant differences were observed among the trees. Similarly, the results of earthworm population outside the tree canopies followed the same trend in the following significant order Cacao > Breadfruit > Avocado > Mango.

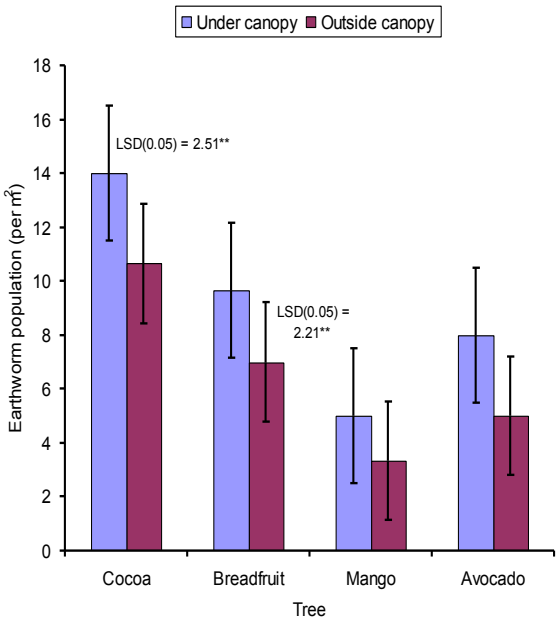

Fig. 3. Effect of trees on earthworms' population (per m^2) of an Ultisol at 0 – 15 cm depth at Umudike.
Source: Own results

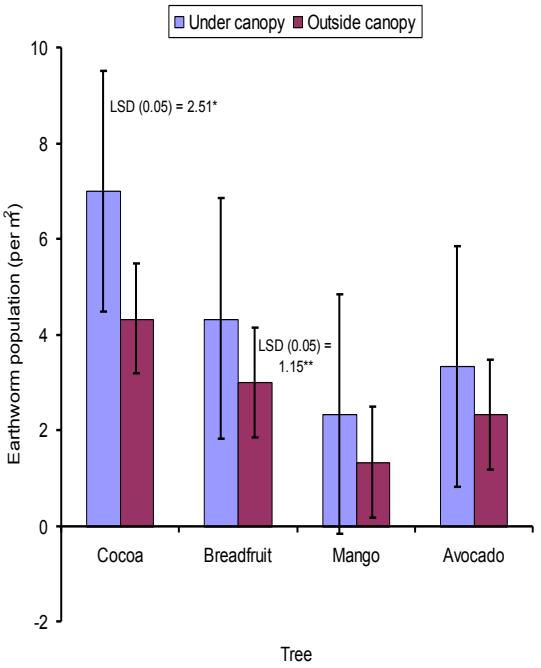

Fig. 4. Effect of tree on earthworm population (per m^2) of an Ultisol at 15 – 30 cm depth at Umudike
Source: Own results

Further evidence of the effects of trees on earthworm activities under canopy of individual trees was compared with those in the surroundings without tree cover by [24]. The authors reported that earthworms under tree influence the establishment and conservation of soil structure. Also the organic matter building through the leaf litter helps to multiply earthworms under such tree canopies by feeding on the leaves. [26] made similar observations. [19] added that tree plantation influence earthworm abundance by altering the physical and chemical properties of the soil. Also, [37] concluded that tree affect earthworms positively through litter inputs thereby promoting the establishment of earthworms.

Effect of Indigenous Trees on Earthworm Casts

Figure 5 summarized the effect of trees on earthworm casts at Umuahia, Nigeria. However, at 15-30 cm soil depth, no earthworm cast was observed. At 0 - 15cm depth, the number of earthworm casts under the canopies (cacao, breadfruit, avocado and mango) were significantly (P = 0.05) higher than those of the adjacent open sites.

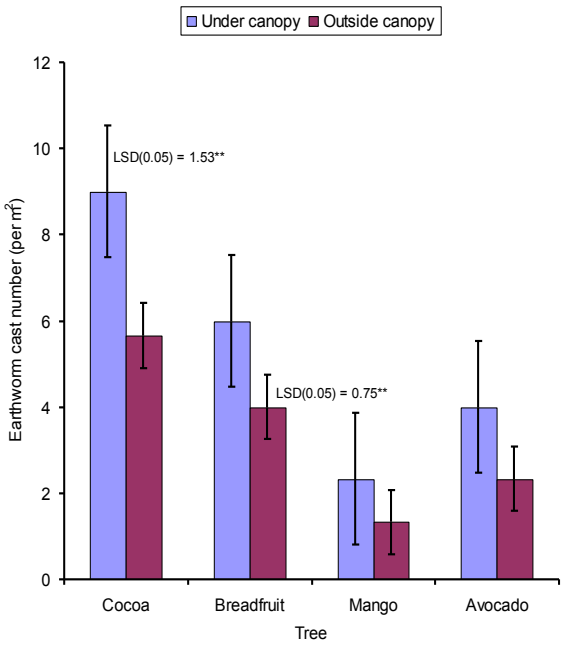

Fig. 5. Effect of tree on the earthworm cast number (per m^2) of an Ultisol at 0 – 15 cm depth at Umudike
Source: Own results

The results show that the mean values of 9.00, 6.00, 2.33 and 4.00 were obtained for cacao, breadfruit, mango and avocado, respectively which were significantly higher than the lower values of adjacent open sites of cacao (5.67) breadfruit (4,00), mango (7.33) and avocado (2.33). Also, there were significant differences existing between the earthworm casts under the tree canopies as well as the open adjacent soils.

The results obtained in Fig. 3 show that the number of earthworm casts under cacao canopy was significantly (P = 0.05) higher than those of breadfruit, avocado and mango in the following significant order: Cacao > Breadfruit > Avocado > Mango. However, mango had the least number of earthworm casts. The results of the member of earthworm casts outside the tree canopies (10 meters away) followed the same trend. The number of earthworms will, therefore, influence the number of casts. Hence, as the tree canopies enhance earthworm population, consequently this will also increase the number of casts. [5] stated that earthworm burrows can make up 5% of the total soil volume, and observed that high earthworm population enhances soil aeration, drainage and infiltration. [27] noted that earthworms bring to the soil surface casts of about 2 - 5.8 t/ha on agricultural land, 15 t/ha in temperate woodland and about 50 t/ha in tropical forest.

CONCLUSIONS

This research has documented basic information about the effect of trees on the physical properties of soils as well as earthworm population and casts in Umuahia southeastern Nigeria. The study has shown that soils under tree canopies at various soil depths (0 – 15 and 15 – 30 cm) had higher total porosity, water stable aggregates and lower bulk density than their open adjacent sites. Also, the study revealed that there were increase earthworm population and casts under the tree canopies (cacao, breadfruit, avocado and mango) than their adjacent sites. The results also pointed to the fact that leaf litter from trees especially cacao improved the soil physical properties, and increased

earthworm population and casts.

Recommendations

(i)It is recommended that farmers should plant cacao or breadfruit trees along the contour bunds or boundaries as alley, prune them periodically or allow the leaves to fall and decay to improve the structure of the soils.

(ii)It is hoped that these trees if established on soils that are prone to erosion could help improve the soil aggregates, reduce the rate of runoff and encourage infiltration.

(iii)Farmers should be advised to stop deforestation and adopt the method of tree planting.

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ASSESSMENT OF SOIL PROPERTIES AS AFFECTED BY FOUR LAND USE TYPES IN EGBEADA, SOUTH - EAST NIGERIA

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Abstract

The study was conducted to ascertain the influence of four land use types [plantain plantation (PP), cassava farm (CF), whistling pine forest (WPF) and fallow land (FL)] on soil properties of Egbeada in South-east, Nigeria. Stratified sampling technique was used in the collection of soil samples from the land-uses. Composite samples were collected from each land-use for routine and selected special laboratory analyses. Data generated were analyzed statistically using analysis of variance. Sand particles had a mean of 85.20 %, 85.80 %, 83.60 % and 78.80 % for soils under PP, CF, WPF, and FL, respectively. The pH(H_2O) had mean of 6.35, 6.42, 5.36 and 5.81 soils under PP, CF, WPF, and FL while organic matter had mean of 2.94 % for PP and FL, 1.47 % for CF and 2.79 % for WPF. However, available Zn of the studied soils had mean of 8.7 mg kg^{-1}, 6.8 mg kg^{-1}, 5.3 mg kg^{-1} and 4.9 mg kg^{-1} in decreasing order of fallow land > whistling pine forest > plantain plantation > cassava farm, respectively. The organic matter under soils of cassava farm differed significantly (P = 0.05) with that of plantain plantation, whistling pine forest, and fallow land. The available Zn and Cu differed non-significantly among soils of the various land-uses. However, the result obtained from the study indicated that the different land-uses have affected the soils at a various rate.

Key words**:** *assessment, Egbeada, free survey, land use types, soil properties*

INTRODUCTION

Sustainable land-use practice is a rapidly growing field aiming at producing food security, nutrition security, bio-safety and environmental health. Poor land-use practices result to decline in soil physical and chemical properties. The soil properties are important factors to be considered in order to find a sustainable use of soil resources.

Land use types affect the soil properties through addition and removal of the nutrient element in the soil. [6] also stated that changes in soil properties such as the contents of availability of macro and micro nutrients have been altered by land use types. Land sustainability requires a periodical evaluation of soil fertility status and quality as it offers quality knowledge of factors which impose serious constraints to increased crop production and soil productivity under different land use types and for the adoption of suitable environmental friendly land management practices.

According to [22] knowledge about an up-to-date status of soil physical and chemical properties of different land use types plays a vital role in enhancing production and productivity of the agricultural sectors on a sustainable basis. However, practically oriented basic information on the status and management of soil physico-chemical properties as well as their effect on soil quality to give recommendations for optimal and sustainable utilization of land resources has been poorly implemented.

Every effort should be directed to maintain the physical, biological and socio-economic environment for the production of food crops, livestock, wood and other products through sustainable land-use practices. The optimum productivity of any land-use types depends on

soil properties to adequately supply nutrient elements in required quantity and rate. When the soil does not supply sufficient nutrients for normal plant development and optimum productivity, application of supplemental nutrients and good soil management practices are required. There is every need to determine the soil properties under different land-use types in other to identify the associated problems and make recommendations for soil management best practices. Hence, this study was to ascertain soil properties as affected by four agricultural land-use types in Egbeada, South-East Nigeria.

MATERIALS AND METHODS

Study area

The study was conducted at Egbeada in Mbaitoli local government area of Imo State South-east, Nigeria. It lies on latitude 04^o 45' N and 7^o 15′ N and longitude 06^o 50′ E and 07^o 26' E. A greater proportion of the land surface of Imo State is of near flat topography [28]. Egbeada has a humid tropical climate with mean annual rainfall of about 2500 mm and mean monthly temperature which varies from 30 ^{o}C to 32 ^{o}C while, the relative humidity ranges from 50 % to 65 % [25].

Site location

The studied sites under the different land-use types are whistling pine plantation, cassava farm, plantain plantation and the fallow land. These land-use types were geographically associated. The whistling pine plantation is located at latitude 5^o 3' 44.2" N and longitude 7^o 0' 5.4" E with an elevation of 47 m above the mean sea level. The area of the WPF is 1 acre. The whistling pine was established 26 years ago by Imo State Agricultural Development Programme (ADP).

The cassava farm is located on latitude 5^o 31' 45.5" N and longitude 7^o 0' 51.1" E, with an elevation of 80 m above mean sea level. The area of the CF is 1 acre. The area had been continuously cropped with cassava for 4 years.

The plantain plantation is located at latitude 5^o 31' 51.6" N and longitude 7^o 0' 51.1" E, with an elevation of 71 m. The plantain farm was established 20 years ago and it is thickly populated. It occupies an area of about 1 acre.

The fallow land which will serve as a control is located at latitude 5^o 31' 46.5" N and longitude 7^o 0' 55.6" E with an elevation of 74 m. It covers an area of about 1 acre. The land had been fallowed for four years. The area is densely covered with mixed vegetation consisting of guinea grass (*Panicum maximum Jacq.*), goat weed *(Ageratum conyzoids Linn.)*, oil palm *(Elaeis guineensis Jacq.),* oil bean tree (*Penthclethra macrophylla Benth.*), cassava (*Manihot esculenta* Crantz), broom weed (*Sida acuta Burm.f.*), Siam weed (*Chromolaeana odorate L.) R.M.King and H.Rob.*),

Field studies

The land use types were divided into 25 strata. Five surface soil samples were collected from each stratum to form a composite. Five composite soil samples were collected from each land use making a total of 20 composite soil samples for the research. The samples were collected at a depth of 0 – 15 cm using an auger. The collected soil samples were prepared for routine and special laboratory analyses.

Laboratory analyses

Particle size distribution was determined by hydrometer method [16]. Soil pH was determined using 1:2.5 soil–water ratio using a pH meter [35]. Organic carbon was determined by wet digestion method [24]. Total nitrogen was determined by micro-Kjeldahl digestion technique [10]. Available phosphorus was determined using Bray II method [27]. Exchangeable acidity was gotten by the method described by [23]. Exchangeable bases were determined by neutral ammonium acetate procedure buffered at pH 7.0 [34]. The trace elements (Zn, Cu) content of the soils were extracted using the procedures of [30] and Atomic Absorption Spectrophotometer (AAS) (Buck Scientific model 210 VGP USA) was used to determine the amount of the individual trace element in the soil solution.

Data analysis

The data generated were analyzed statistically using the completely randomized design of

analysis of variance (ANOVA) at 5 % level of probability.

RESULTS AND DISCUSSIONS

The results of the particle size distribution of the soils under different land-use types were shown in Table 1. The result indicated that percent sand ranged from 82.4 – 86.4 % for soil under plantain plantation (PP), 78.4 – 90.4 % for soil under cassava farm (CF), 74.4 – 86.4 % for soil under whistling pine forest (WPF) and 76.4 – 80.4 % for soil under fallow land (FL). Generally, the land-uses have high sand particle compared to other fine earth fractions. This could be attributed to parent materials, climate, and land-use. These factors influence pedogenesis and properties of soils ([40]; [31]). It is also in agreement with the findings of [15] and [29] that sandy nature of the soils reflects the parent material from which they were formed, which is coastal plain sand. Sandiness of soils suggests low cation exchange capacity and high infiltration. Sand particle under PP and CF land-uses had differed significantly (p= 0.05) with that of FL while it differed non-significantly among PP, CF and WPF land-uses. The significant difference could be associated with soil management practices and runoff. The silt particle as arranged in an increasing order WPF< FL< CF< PP with mean values of 3.2 %, 3.6 %, 4 % and 4.8 %, respectively. The silt particle was low, which is an indication that most of the silt has been weathered into clay. The soil under PP land-use had the highest percentage silt when compared with soils of other land-uses. Comparing the soils under the various land-uses with the rating (< 1) of [21], it would be observed that the soils are highly weathered and pedologically mature due to low silt content. This is in conformity with the findings of [1] that high weatherability leads to the formation of coarse textured soils. Silt under PP land use differed significantly (p= 0.05) with silt under WPF land use and non-significantly with silt under CF and FL land use. The clay had a mean of 10 %, 10.40 %, 13.20 % and 17.60 % for soils under PP, CF, WPF and FL land uses, respectively. These values are similar to the findings of [38] on soils of southeastern Nigeria. The clay under FL land use differed significantly (p= 0.05) with that of PP and CF land use while it had no significant difference with that of WPF land use. This shows that vegetation cover may have reduced the rate of water movement into the soil, thus the reduction in the amount of clay translocation in the soil.

Table 1. Physical properties of soil under the studied land use types

Land use	Rep	Sand %	Silt %	Clay %	SCR	TC
Plantain	1	86.4	4	9.6	0.42	LS
Plantation	2	86.4	4	9.6	0.42	LS
(PP)	3	86.4	6	7.6	0.79	LS
	4	84.4	4	11.6	0.35	SL
	5	82.4	6	11.6	0.52	SL
Mean		**85.2^{a}**	**4.8^{a}**	**10.0^{b}**	**0.50^{a}**	
Cassava	1	88.4	4	7.6	0.53	S
Farm	2	90.4	4	5.6	0.71	S
(CF)	3	88.4	4	7.6	0.53	S
	4	78.4	4	17.6	0.23	SL
	5	83.4	4	13.6	0.29	SL
Mean		**85.8^{a}**	**4.0^{ab}**	**10.4^{b}**	**0.46^{ab}**	
Whistling	1	86.4	4	9.6	0.42	LS
Pine	2	84.4	2	13.6	0.15	SL
Forest	3	74.4	4	21.6	0.19	SCL
(WPF)	4	86.4	4	9.6	0.42	LS
	5	86.4	2	11.6	0.17	SL
Mean		**83.6^{ab}**	**3.2^{b}**	**13.2^{ab}**	**0.27^{bc}**	
Fallow	1	80.4	2	17.6	0.11	SL
Land	2	78.4	2	19.6	0.10	SL
(FL)	3	80.4	4	15.6	0.26	SL
	4	78.4	4	17.6	0.23	SL
	5	76.4	6	17.6	0.34	SL
Mean		**78.8^{b}**	**3.6^{ab}**	**17.6^{a}**	**0.21^{c}**	
LSD $_{0.05}$		**5.061**	**1.529**	**4.963**	**0.209**	

Rep= replicate, LSD= least significant difference, SCR= silt clay ratio, LS= loamy sand, SL= sandy loam, S= Sand, SCL=sand clay loam
Source: Own results.

The silt-clay ratio had mean of 0.50, 0.46, 0.27 and 0.21 for soil under PP, CF, WPF, and FL land use types. However, the silt clay ratio is greater than 0.15, hence this indicates that the soils were formed from young parent material according to the findings of [7]. This shows that soil under FL land use has the oldest parent material among the studied land use types. Silt-clay ratio for soil under PP land-use differed significantly with that of soil under WPF and FL land uses. However, silt-clay ratio for soil under CF land use had no significant difference with that of WPF land use while it differed significantly with silt clay ratio for soil under FL land use.

Table 2 showed that the results of the soil pH(H_2O) of the land-use types were generally acidic according to the rating of [33]. The mean values indicated that CF (6.42) and PP (6.35) were weakly acidic while WPF (5.36) and FL (5.81) were moderately acidic. The level of soil pH(H_2O) in WPF and FL could be attributed to organic acids released by litter decomposition and deposit of chemical fertilizer earlier used on the land. This is in conformity with the findings of ([8]; [19]). Soil pH of FL land use type had no significant difference with soil pH of PP and CF land uses while soil pH of WPF land use differed significantly with soil pH of PP and CF land uses. The significant difference could be associated to the impact of climatic factors and acidic level of the litter deposit on each land use.

Organic matter (OM) was generally low when compared with the rating of [4] on soils of eastern Nigeria. The amount of OM in soil under FL and PP land uses could be attributed to the quantity of litter deposit. The OM of soils under CF land use differed significantly (p= 0.05) with that under PP, WPF and FL land-use types while OM of soils under PP, WPF and FL land-use types differs non-significantly. The significant difference is not unconnected with the level of organic material deposit and plant uptake. [2] stated that for most low activity clay of the tropical soils, the OM is the major exchange site for the basic nutrient cations in the soil. Organic matter has been reported to have a significant positive influence on soil pH, cation exchange capacity, base saturation and water holding capacity [3].

Total nitrogen (TN) content of the studied soils was low when compared with critical values (1.5 – 2.0) % for tropical soils according to [15] and [21]. [18] observed that the main cause of N deficiency in tropical soils is intense leaching and erosion due to the high tropical rainfall. The least total nitrogen value recorded in soil CF land use may be attributed to the intense cultivation of the soils which normally increase the rate of mineralization of the organic matter. Available phosphorus (Av P) of the studied soils ranged from 2.18 – 8.83 mg/kg. According to the ratings of [21] available P was medium for soil under PP and FL land use, low for soils under WPF land use and very low for soils under CF land use. The available P for soils under cassava farm differed significantly (p= 0.05) with that of soils under PP and FL land use while available P of soils under PP, WPF and FL land uses differed non-significantly.

Table 2.The results of soil pH, organic matter (OM), total nitrogen (TN) and available phosphorus (Av P) under the studied land use types

Land-use	Rep	pH H_2O	OM (%)	TN (%)	Av.P (mg/kg)
Plantain Plantation (PP)	1	6.35	1.17	0.05	10.20
	2	6.32	3.55	0.17	9.00
	3	6.33	4.00	0.20	6.93
	4	6.58	3.00	0.15	7.52
	5	6.19	3.00	0.15	10.5
Mean		**6.35^{a}**	**2.94^{a}**	**0.14^{a}**	**8.83^{a}**
Cassava Farm (CF)	1	6.71	1.17	0.05	0.82
	2	6.13	1.13	0.05	2.45
	3	6.14	1.34	0.06	2.54
	4	6.21	1.41	0.07	1.50
	5	6.90	2.31	0.11	3.60
Mean		**6.42^{a}**	**1.47^{b}**	**0.07^{b}**	**2.18^{b}**
Whistling Pine Forest (WPF)	1	4.80	2.89	0.14	1.45
	2	5.83	2.58	0.12	4.93
	3	4.95	2.75	0.13	3.85
	4	4.94	2.72	0.13	10.40
	5	6.28	3.03	0.15	7.65
Mean		**5.36^{b}**	**2.79^{a}**	**0.13^{a}**	**5.66^{ab}**
Fallow Land (FL)	1	5.88	3.48	0.17	11.10
	2	6.10	3.34	0.16	5.10
	3	6.43	3.20	0.16	11.80
	4	5.46	2.86	0.14	6.25
	5	5.17	1.82	0.09	3.10
Mean		**5.81^{ab}**	**2.94^{a}**	**0.14^{a}**	**7.47^{a}**
LSD $_{0.05}$		**0.612**	**0.916**	**0.047**	**3.682**

Rep= replication, BS= base saturation, OM= organic matter, TN= total nitrogen, Av.P= available phosphorus, LSD= least significant difference
Source: Own results.

The significant difference among available phosphorus in soils under the different land-uses could be attributed to organic material deposit, the rate of mineralization and leaching. Several researchers ([6]; [12]) have reported high P deficiency for tropical soils. According to [11], the causes of P deficiencies have been attributed to high weatherability of the soils, clay type, leaching by intense

rainfall and adsorption reaction by soil constituents.

Table 3 showed the mean of Ca, Mg, K and Na, respectively (2.44, 1.36, 0.256 and 0.16) cmol/kg for soils under PP land use, (1.92, 1.04, 0.182 and 0.18) cmol/kg for soils under CF land use, (1.56, 0.80, 0.162 and 0.19) cmol/kg for soils under WPF land use and (2.48, 1.52, 0.140 and 0.12) cmol/kg for soil under FL land use. Critical values of basic cations as reported by [21] and [17] showed that soils under study have very low to medium basic cations at various land-uses. Thus, Ca was very low in soils under CF and WPF land uses but low in PP and FL land uses. Mg was medium in soils under PP, CF, and FL land uses but low in WPF land use. K was low in soils under PP land use but very low in CF, WPF and FL land uses. Na was low in soils under PP, CF, WPF and FL land uses. Low values of basic cations, have however been reported for most Nigerian soils [4] and could be attributed to leaching and erosion losses by the high tropical rainfall as well as low content in the parent materials.

Table 3. The results of soil Calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na), Aluminium (Al), Hydrogen (H), Cation exchange capacity (CEC), Zinc (Zn), Copper (Cu) under the studied land use types

Land-use	Rep	Ca cmol/kg	Mg cmol/kg	K cmol/kg	Na cmol/kg	Al cmol/kg	H cmol/kg	CEC cmol/kg	Zn mg/kg	Cu mg/kg
Plantain	1	3.4	1.8	0.19	0.10	0.3	0.1	5.89	5.507	0.018
Plantation	2	2.8	1.4	0.20	0.20	0.7	0.1	5.40	-	0.037
(PP)	3	0.8	0.8	0.22	0.10	0.3	0.2	2.42	8.615	0.017
Mean	4	2.8	1.2	0.40	0.20	0.2	0.2	4.70	8.072	0.006
	5	2.4	1.6	0.27	0.20	0.3	0.1	4.87	4.146	0.049
		2.44^{ab}	**1.36^{ab}**	**0.26^{a}**	**0.16**	**0.36**	**0.14**	**4.66**	**5.268**	**0.025**
Cassava	1	1.6	0.8	0.13	0.07	0.3	0.2	3.10	2.986	0.051
Farm	2	1.6	0.8	0.24	0.30	0.4	0.1	3.44	10.610	0.006
(CF)	3	2.0	1.2	0.20	0.30	0.3	0.2	4.20	0.009	0.009
Mean	4	1.8	1.2	0.16	0.15	0.3	0.3	3.91	3.105	-
	5	2.6	1.2	0.18	0.10	0.2	0.1	4.38	7.878	-
		1.92^{ab}	**1.04^{bc}**	**0.18^{ab}**	**0.18**	**0.3**	**0.18**	**3.81**	**4.918**	**0.013**
Whistling	1	2.2	1.4	0.20	0.10	0.6	0.2	4.70	3.911	0.026
Pine	2	1.0	0.4	0.12	0.09	0.4	0.2	2.21	14.770	0.020
Forest	3	1.4	0.8	0.15	0.30	0.8	0.3	3.75	0.936	0.043
(WPF)	4	1.6	1.0	0.14	0.20	0.4	-	3.34	2.825	0.021
Mean	5	1.6	0.4	0.20	0.25	0.1	0.3	3.85	11.360	-
		1.56^{b}	**0.80^{c}**	**0.16^{b}**	**0.19**	**0.46**	**0.25**	**3.57**	**6.760**	**0.022**
Fallow	1	2.6	1.6	0.18	0.17	0.3	0.2	5.05	11.090	-
Land	2	2.0	1.2	0.21	0.14	0.4	0.2	4.15	4.710	-
(FL)	3	2.8	1.6	0.09	0.12	0.4	-	5.01	1.864	0.027
	4	1.6	1.2	0.10	0.08	0.3	0.4	3.68	11.640	0.027
Mean	5	3.4	2.0	0.12	0.10	0.3	0.5	6.42	14.240	0.016
		2.48^{a}	**1.52^{a}**	**0.14^{b}**	**0.12**	**0.34**	**0.26**	**4.86**	**8.709**	**0.014**
LSD $_{0.05}$		**0.904**	**0.468**	**0.077**	**0.105^{NS}**	**0.226^{NS}**	**0.156^{NS}**	**1.338^{NS}**	**6.460^{NS}**	**0.023^{NS}**

Rep= replication, CEC= cation exchange capacity, LSD= least significant difference.
Source: Own results.

Cation exchange capacity (CEC) had mean of 4.66 cmol/kg, 3.81 cmol/kg, 3.57 cmol/kg and 4.86 cmol/kg for soil under PP, CF, WPF and FL land use types. CEC of the studied soils under the different land uses were generally low when compared with the ranking (<8 cmol/kg) of [21]. He also stated that low CEC indicates the inability of the soils to retain nutrient and water. However, CEC had no significant difference among soils under the studied land-use types. The CEC level of the studied soils was similar to the findings of [37] in soils of south-east Nigeria.

The low CEC of the studied soils can be an index of low chemical weathering activity of the soil [26] and level of soil pH. However, the quantity of cations that a soil can retain against leaching is determined by the magnitude of the cation exchange capacity of the soil. According to [8] nutrient leaching results not only in declining soil fertility but also in environmental problems caused by the

accumulation of nutrients in the groundwater and the eutrophication of River. Low level of cation exchange capacity in soils could be associated with tidal imports, runoff, and seepage [39].

The available Zinc (Table 3) had means of 8.709 mg kg^{-1}, 6.760 mg kg^{-1}, 5.268 mg kg^{-1}, 4.918 mg kg^{-1} been a decreasing order of FL> WPF> PP> CF. Available zinc had no significant difference (p= 0.05) among the soils of the land-use types. Using critical available Zn level of 0.8 mg kg^{-1} [20] or critical range of 0.2 – 2.0 mg kg^{-1}, Zinc deficiency was not a problem in the soil as having been reported for most Nigeria soils [20]. Zinc had been reported to be generally of low mobility in soils [13] and has a tendency of being adsorbed on clay size particles ([32]; [5]). The results obtained referred that the soils under the land use types possess adequate available Zn.

However, Cu content differed non-significantly among the soils under the land-uses. Cu was below the critical level (1-2 mg kg^{-1}) reported by [32] and (1.0 – 3.0 mg kg^{-1}) [14]; [36].

This also reflects deficiencies of Cu in the study sites are common in sandy soils. This is in conformity with the findings of [15] on tropical soils.

However, parent material, soil texture, and organic matter are factors that defer the availability of copper [9] and also the disparity observed among the studied soil under the different land-uses.

CONCLUSIONS

After due examination of the soil, it was observed that the different land-use types have influenced the soil physical and chemical properties at a different level. However, soils under FL and PP recorded high level of OC, total nitrogen, available P and CEC over soils under WPF and CF. WPF soils were the most acidic among the land-uses. The FL had higher clay content and available Zn while CF is the most sandy. FL has more soil quality attributes than other land-uses which resulted from a high content of organic materials, a dense vegetative cover which mitigates erosion effects.

However, use of improved management practices on soil resources for sustainable agricultural use would be one of the most useful strategies that could help to protect biological diversity from agricultural land expansion. Practices such as improved composting, biomass transfer and also use of chemical and organic fertilizer and techniques complemented with strong land-use policy should be integrated into a strategy for sustainable agricultural development in the area.

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ANALYZING THE EFFECTIVE FACTORS IN REDUCING APPLE WASTES IN WEST AZARBAIJAN PROVINCE

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Abstract

Apple crop is one of the most important products in exports and foreign currency arrival. In addition, this crop has very high value added inside the country in processing terms. Therefore, studying apple wastes and analyzing wastes reducing methods will have special importance. Therefore; the present research was conducted in descriptive-survey methodology to study the effective factors on lowering apple wastes in West Azarbaijan Province in Iran. The statistical population of the research included all apple growers in West Azarbaijan Province (N=35,000). The size of samples in the research has been assessed in Cochran formula (n=149). The samples were taken in classes and simple random type. The field information in the research was collected by questionnaires. The validity of questionnaire was confirmed by the supervisor and advisor professors and the relevant field experts. The reliability of the questionnaire was confirmed by Cronbach Alfa coefficient (83%). The data was analyzed by using descriptive and inferential methods (percent, mean, correlation coefficient and regression analysis) by using SPSS statistical software. Findings showed significant relations with one percent error level between reducing apple wastes and educational, technical, transportation, support-governmental, marketing and production factors variables. The results of regression analysis showed the sum of educational, technical, transportation, support-governmental, marketing and production factors variables constituted approximately 46 percent of the research dependent variable; that is, reducing apple wastes.

Key words: *wastes reduction, factors, apple, orchard owners, farmers, West Azarbaijan province*

INTRODUCTION

Agriculture in general plays major role in economy. Therefore, using suitable methods for high productivity in this sector might be able to eliminate many economic, and social limitations.

Currently, foodstuffs wastes have changed into one of the challenging techniques in the economic policies of the countries. This problem has questioned the foodstuffs security, social and economic welfare in world. On the other hand, large amount of resources are lost due to increase in wastes and have been led to great harms to the countries' economy [24]. In the process of developing agriculture sector, due to increasing rate of population growth and limitations in resources, the necessity of optimized use of resources and promoting the production factors as well as productivity have become greatly important; as by this approach, agricultural sector, in addition to meeting the increasing demand to food products, can perform its other duties in sustained development as well [17] .

Fruits and vegetables are the most important garden fruits and crops that play an important role in meeting food demand and human health. Due to high contents of moisture, this group of agricultural products is easily spoiled and a major portion of them (between 5 to 50 %) is lost after cultivation. This rate of loss in some cases reaches 80 % [21].

A review on economic indexes shows tree apple has a high share in non-oil exports of the country. The high quality of Iranian apple, long period before spoilage, and low price are the most important advantages of our country in producing apples.

West Azarbaijan Province has been keeping first place among tree apple growing regions of Iran in producing tree apple in the past 20 years. Studies show, for many reasons, that this region has a great potential in growing this fruit. The suitable quality of the soil,

mountainous condition of the region, and cheap work force have introduced this province as the main center of tree apple production in the country [7].

From the viewpoint of FAO and environmental plan, any changes in the quality which lead to the inaccessibility of the product and emergence of unsafe product, and ultimately, making agriculture products unusable for human consumption are considered as foods wastes [12].

There are many developing countries which do possess the capability of producing large amount of fruits and vegetables in high quality; however, due to absence of market information, lack of necessary relationship between producer and buyer; and absence of suitable, fast and relative facilities to have the products reached by consumer, suffer from large amounts of wastes [26].

The World Food Conference – Rome 1974 was the first international gathering which paid attention to the importance of reducing the post- harvest wastes of foodstuffs. It has been claimed that lack of attention to post - harvest maintenance has played an important part in agricultural project failures around the world in the past 50 years. There are many factors including technical, economic and social factors involved in agricultural products wastes.

Azizi (2009) emphasizes that different factors such as technical factors in production process (durability of product and mechanization), technical market factors (transportation, storage and packaging), economic factors (price risk in market and government's support coefficient) and social factors (type of marketing agricultural products, absence of packaging and sorting) cause wastes in products [6].

On this matter, Rezaei (2011) also believes factors such as light intensity, irrigation procedures, nutrition management, harvest time, pre-cold treatments, controlling pathologic features, warehousing technology, products packaging and handling technology effective in increasing wastes in agricultural products. [21]

Goletti (2003) paid attention to all elements of producer to consumer's chains helps developing countries to gain more profits from their orchards. In these regards, [8] sees orchards maintenance management improvement including optimized nutrition, pest and plant disease control and optimized use of chemical fertilizers and poisons effective in reducing wastes and improving productivity in agricultural products. Packaging and sorting fruits as per consumer's demand in production place or before delivery to the consumer market are also effective in these regards [9, 21]. Also, they emphasize that to increase production and meeting human consumption need, various approaches such as increase in cultivation area, increase in performance per area unit, achieving superior varieties, managing farming operations including pest and disease control, irrigation, nutrition, trimming, etc. In fact, maintaining and sustainment in agricultural yields products proportion to consumption market requires serious management in suitable cultivation model, developing cold storages, processing industries and marketing in order to be introduced as an exceptional opportunity in production, productivity, investment, employment creation and increasing in value added and exports. In the meantime, planning to teach producers and distributors is another issue which should be put in the country's priority. Supervision on fruits and vegetables health is highly necessary and if there will be investments on this line too, its effects on man and community will be significant; and at the same time, it could prove to be highly valuable for the country due to preparing better grounds for exports.

Apple is one of the most important products both in exports and foreign currency promotion. On the other hand, this product contains very high value added inside the country in processing terms. Therefore, studying apple in terms of wastes is very important. Since agricultural yields, particularly apple wastes in West Azarbaijan Province affects large percent of products; and due to its impact on gross domestic product and agricultural self-reliance; it is necessary to seek effective and essential approaches to reduce it. In this respect, identifying different

and effective factors in reducing apple wastes seems necessary.
For this reason, the present research tries to identify and study different factors and present suitable approaches for reducing apple wastes. This research can help farmers and orchard owners in increasing their income; in addition, it will be helpful to managers of cold storage, production industries, scientific and university centers and they benefits from the results of this research as well.

MATERIALS AND METHODS

This research is applied in terms of goal and descriptive in research methodology. The statistics population of this research included 35,000 apple orchard owners in West Azarbaijan Province. The sample size of this research, according to Cochran formula is assessed to be 149. Questionnaires were used to collect the field data. The questionnaire of this research contained three sections, 93 closed end question and one open question. The questionnaire was developed by the author to draw up and complete the structures and items, the views of supervisor professor, advisor professor and experts in this business were used too.
The questions were arranged in 5-degree Likert scales of (1= very little, 2= little, 3= average, 4= high, and 5= very high). The questions validity was confirmed by the advisor professor. 25 of the questionnaires were distributed, completed, collected and checked via SPSS software for measuring the reliability; and, the results were studied by using Cronbach Alfa. The average reliability of questions was assessed to be 83%. Thus, the questionnaire had acceptable validity and reliability. The data for the research was collected by using two conventional methods; i.e., literature review and field survey. In literature review, the journals, books, papers, dissertations and virtual bases were studied for building theoretical literature and research records. In field method, also the items designed by author-made questionnaire were used to answer the research goals and questions. The findings were described by using descriptive statistics such as percent, mean, criteria deviation, for describing findings, inferential methods such as correlation coefficient, and if necessary. To study the relationship among variables and their effects, regression analysis was used.

RESULTS AND DISCUSSIONS

Pearson correlation coefficient was used for calculating and studying the relationship among research variables.
As it can be seen in Table 1, there is significant relationship between reducing apple product wastes, and the educational factors variable, with 0.570 correlation coefficient, technical factors (0.652), transportation factors (0.697), support-governmental factors (0.773), market factors (0.646) and production value (0.791) in one percent error margin.

Table 1. Correlation coefficients found between reducing apple products and independent variables

Variables	Correlation coef. (r)	Significant level (p)
Variables	0.570**	0.000
Educational factors	0.652**	0.000
Technical factors	0.697**	0.000
Support-governmental factor	0.773**	0.000
Marketing factors	0.646**	0.000
Productive factors	0.792	0.894

**significance level 0.01
Source: Own findings.

To determine the share of any of the independent variables (educational factors, technical factors, transportation factors, support-governmental factors, marketing factors and productive factors), the multi-regression in Enter method was used. The results in Table 2 show around 46 percent of changes related to the dependent variable (reducing apple products wastes) took place by the mentioned variables ($p<0.001$).

Table 2.Summary of regression model in Enter method

Multi-correlation Coef.	Determining factor	Modified determined coef.	Criteria error	F
0.679	0.460	0.412	1.694	9.529

Source: Own findings.

By considering the existing coefficients, according to Table 3, the final multi regression model in this research based on B coefficients significance is as follows:

$$Y=60.598+1.226\ X_1+0.693X_2-1.506X_5$$

Table 3. Variables coefficients included in multi-variable regression equation

Multi-correlation coefficient	B	Std.Error	beta	t	Sig
Educational factors (X1)	1.226	0.338	0.350	3.624	0.001
Technical factors (X2)	0.693	0.177	0.360	3.904	0.000
Transportation factors (X3)	0.820	0.467	0.177	1.755	0.084
Support-governmental factors (X4)	0.066	0.178	0.035	0.373	0.711
Marketing factor (X5)	-1.506	0.344	0.412	4.376	0.000
Production factor (X6)	0.347	0.345	0.095	1.006	0.318
Constant value	60.598	22.796	-	2.650	0.010

Source: Own findings

On the share of each one of the independent variables which included in regression line equation in determining the independent variables, it can be admitted, as calculated by attention to Beta values, the variables of educational factors, technical factors and market factors had the highest share and role in determining the mentioned variables than other variables; and other variables were lacked of any significant effects on reducing apple production.

As most of the orchard owners participated in the educational- improvement classes, they have therefore relative familiarity with educational and improvement factors effective in reducing apple wastes; and by using their findings, they can prevent apple loss and wastes. As the average of number of orchard farmers' tools, which is about 3, and the average area of their orchard, which is 4 hectares, the tools seem suitable with respect to the orchard garden. Most major orchard owners have stated factors such as insects and no on time pesticide as the main factors of wastes.

With respect to the prioritization of educational factors items effective on reducing apple wastes, the three items of training farmers to transport, improving the orchard owners' skills in apple harvest and eliminating the existing inefficiencies in storage, converting and distributing product had high priorities and were in agreement with the research results of Khoshnoudifar and Asadi (2010), Gholifar et al., (2009), Atefi (2003), Ahmadi (2010), Moradi (2010) and Malek-Mohammadi (2006) [1, 5, 13, 17, 19, 20]. Teaching and improving agriculture as one of the most important foundation and pillars of modern agriculture can play effective role in productivity and reducing agriculture wastes; and in sum, improving the farmers' living conditions.

In view of the results of prioritizing the items of technical factors effective in reducing apple wastes, the three items of suitable packaging of the product, type of packaging box and availability of agricultural tools to orchard owners were high priorities and the most important items. This finding is in agreement with the research results of Saeidirad *et al* (2012), Rezaei (2011), Khoshnoudifar and Asadi (2010), AfkariSayyah and Minaei (2009), Moradi (2010), Asiedu (2003), Dixit (2008) and Kader and Rolle (2004), Kader (2005). [2, 4, 11, 15, 16, 17, 20, 21, 22].

By employing the available technical factors and technologies, it is possible to reduce the wastes percent of agriculture sector; however, usually, due to not observing technical and scientific principles from production place to final consumption, unrecoverable damages occur to agricultural sector.

In view of the results of prioritization of transportation factors items effective on reducing apple wastes, the three items of using suitable transportation technology by orchard keepers, identifying the climate and environment conditions and lowering the time delays resulted from harvesting time to deliver to the warehouse or factor were in high priorities as the most important items; and showed to be in agreement with the results of the research conducted by Saeidirad et al (2012), Rezaei (2011), Afkari, Sayyah and Minaei (2009), Moradi (2010), Asiedu (2003), Dixit (2008) and Kader and Rolle (2004). [2, 4, 11, 15, 20, 21, 22]

The absence of sufficient knowledge on the scientific principles on foodstuffs

transportation should be recognized among major and effective factors in foods products wastes. Suitable transportation controls damages to the orchard fruit yields.

With respect to the results of prioritizing the items of support-government factors effective on reducing apple waste, the three items of lowering the cargo exchange costs in agriculture sector, supporting farmers in increasing the yield productivity and sorting, and checking the products were in high priorities as the most important items; and are in agreement with the researches carried out by Rezaei (2011), ZhalehRajabi (2011), Kohansal *et al* (2007), Shadan and Mahinkhah (2004), Moradi (2010), Alston and Tokoze (2007), and Saurundara and Gaush (2009). [3, 18, 20, 21, 23, 25, 27,] In order to reduce apple wastes, it is necessary to lower exchange costs through improving the status of infrastructures, specially developing suitable roads via the relevant agencies and distance of producers to sale market, improve the producers' information in market and production cargoes; and take necessary measures for suitable productivity in terms of sorting, controlling and quality of product. By attention to the results of prioritizing the items of effective marketing factors on reducing apple wastes, the three items; namely, stability and improvement of foodstuffs production and supply chain, attention to apple exports, reducing exports tariffs, and attention to the customers' demands had highest priorities as the most important items; and were in agreement with the results of the researches conducted by Shadan and Mahinkhah (2004), Curic et al (2008), and Saurundara and Gaush (2009). [10, 23, 25]. Suitable marketing for agricultural products is one of the important categories in reducing agricultural products wastes; as, inaccurate analysis of market demands leads to wastes in agricultural products.

In view of the prioritizations results of the effective factors items in reducing apple wastes, the three items; controlling pests and insects, optimized use of chemical fertilizers and poisons and suitable production management were in high priority as the most important items; and were in agreement with the results of researches carried out by Rezaei (2011), and Alston and Tokoze (2007). [3, 21] Controlling pests and insects will be suitable in reducing apple wastes only when the chemical fertilizers and poisons on time and through suitable administration. In view of the results of prioritizing the apple products wastes reduction items, the three items of improving the traditional productivity and marketing systems, establishing suitable cold storage and suitable coordination between the orchard keepers and transportation agents were in high priorities as the most important items; and were in agreement with the research results of Rezaei (2011), Afkari Sayyah and Minaei (2009), Moradi (2010), Asiedu (2003), Kader and Rolle (2004) and Saurundara and Gaush (2009). [2, 4, 20, 21, 23].

Processing is a suitable method in reducing post-harvest wastes of agricultural products. Product processing leads to wastes reduction, increase in farmer and orchard keeper's income and consumers' benefits.

Results of Pierson coordination coefficient, which was used for analyzing correlation among the variables (educational factors, technical factors, transportation factors, support-governmental factors, marketing factors and production factors) and reducing apple wastes showed significant relationship between reducing apple wastes and the variables of educational factors in correlation coefficient (0.570), technical factors (0.652), transportation factors (0.697), support-governmental factors (0.773), marketing factors (0.646) and production factors (0.792) in one percent error margin. That is, each one of these factors plays roles in reducing apple yield wastes. The findings of the research are in agreement with the researches of Khoshnoudifar and Gholifar *et al* (2009), Atefi (2003), Ahmadi (2010), Moradi (2010), Asiedu (2003), Dixit (2008), Saeidirad et al (2012), Rezaei (2011), Kohansal *et al* (2007), Shadan and Mahinkhah (2004), and Alston and Tokoze (2007) [1,3, 4, 5, 11, 13, 18, 20, 21, 22, 25].

Different factors, including the educational, technical factors, economic factors, social factors, marketing, production factors and

support factors are involved in agricultural products wastes. Lack of information or poor planning in each one of the factors cause wastes.

According to the results gained through regression analysis in Enter method, the determining coefficient (R2) which was 0.682 indicates the sum of the variables namely educational, technical, transportation, support-governmental, marketing and production factors defined around 46 percent of the dependent variable of the research; that is, reducing apple wastes. In another word, those results showed approximately 46 percent of changes took place to the dependent variable (reducing apple products wastes) through the mentioned variables ($p<0.001$).

CONCLUSIONS

According to the results, among the variables: educational factors, technical factors, transportation factors, support-governmental factors, marketing factors and production factors, the dependent variables: marketing factors, technical factors and educational factors have the highest share and impact. The other variables are lacked of significant effects on reducing apple products wastes. Based on the information gained by regression analysis, it can be seen the marketing factors, due to high Beta coefficient, which pointed out the most effective variable with impacts on reducing apple wastes. In fact, as the marketing factors are reinforced more, they will have more effects in reducing apple products.

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TOURISM IMPACT ACTIVITY OVER THE LABOUR MARKET IN THE ROMANIA DANUBE REGION COUNTY'S

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Abstract

According to the concept of efficient economic growth, it is important that the sustainable development strategy in Romania take into account the constantly changing economic and social factors, both at national and international level. Unfortunately, taking into consideration the Danube region in Romania, we find several obstacles like the low level of the growth regarding the infrastructure in the area, the psycho-social characteristics of the population, the professional training degree, the crisis economic, superficiality in the work done by certain local public administrations. Of course, the factors enumerated above influence among other economic activities and the tourism activity in the area of interest. Being one of the important sources of income for the Danube population in Romania, both traditional and industrial tourism affect the labor market, with phenomena such as population migration or high unemployment rate. This paper present the current trend in tourism and labor market in counties such as Braila, Constanta, Tulcea, Galati, Ialomiţa, using the online statistical databases. We will also analyze, using different statistical indicators, the degree of impact and the correlations existing between the economic tourism activity and the characteristics of the labor market.

Key words**:** *labour market, Danube region, tourism, chi-square, contingency coefficient*

INTRODUCTION

In the literature, tourism is defined as an important source of income, a job generator, an opportunity to improve lifestyle. In Romania, tourism is considered a priority for economic growth, both at national and local level.[3]

Due to the fact that tourism is becoming increasingly important for communities around the world, the need for sustainable tourism development is also becoming a major concern. The population represents for tourism both a primary resource on which it depends, because the folk presence in a certain area can justify the development of tourism itself at some point. The population in a certain area can influence the demand on the tourism market, considering that tourists are interested in observing and to live a few days like the residents of the area they are visiting.[5]

Among the factors that contributed to the modernization of tourism are: increasing the demand for health tourism due to the demographic characteristics of the tourists, significant climate change, which has led to even greater concern regarding environmental protection, changes in the behavior of consumption of tourists, especially those with a younger age, technological progress and improvements in digital techniques that have led to an improvement in service quality and diversity. In particular, industrial tourism can provide opportunities both for companies in the area of interest and for the regions in which they operate. Therefore, tourism development influences various adjacent economic structures, including labor market dynamics. [1]

In the context of the major importance of tourism, under its various forms, the European Union Strategy for the Danube Region (EUSDR) includes, under the coordination of Romania and Bulgaria, priority number 3 on culture and tourism.[4]

On the Romania territory, the Danube runs 1075 km, respectively 4 of the 8 regions, 12 of the 41 counties, forming at the Black Sea Danube Delta. For Romania, the Danube is an

important transport axis and a great tourist and economic potential. [2]

The counties of Romania crossed by the Danube are: Brăila, Constanţa, Galati, Tulcea, Calarasi, Giurgiu, Ialomita, Teleorman, Ilfov, Dolj, Mehedinti, Olt and Caras - Severin. These areas will be the subject of this research, analyzing economic indicators related to the labor market on the one hand, and on the other hand indicators referring to the tourism activity in the mentioned areas.

Thus, taking into account the recorded statistical data, we can formulate the following hypotheses of this research:

-H1: The development of tourist capacity in a county significantly influences the population's choice of working or not in this field;

-H2: Increasing the tourism capacity in a county significantly influences the recorded unemployment rate;

-H3: The level of the income of the population registered by the county, in hotels and restaurants sector, influences the population's decision to work or not in this field;

-H4: Tourism demand influences the registered offer;

-H5: The tourism demand influences the level of income of the population in this field.

MATERIALS AND METHODS

In order to accomplish this paper, three main working methods will be used, such as:

(i)dissemination of existing information in specialized, native and international literature of interest;

(ii)quantitative and comparative account, regarding the data from INSSE database about: labor market in the Danube region, the indicators related to tourism activity in the areas of interest;

(iii)analyzing and interpreting data using the SPSS statistical program by producing the following outputs:

-value of chi square test and contingency coefficient: *(Analyze – Descriptive Statistics – Crosstabs – Statistics – Chi-square/ Contingency coefficient)*;

-Scatter plot representation (*Secţiunea Graphs – Chart Builder – Scatter/Dot*).

RESULTS AND DISCUSSIONS

The characterization of the labor force available to a market segment may include a number of factors, depending on the specificity. However, there are some general criteria for defining the labor market, self-dependent of the field to which it refers, such as: active population, employed population, unemployment rate, gross or net income, and others. Of course these characteristics could depend on the social or demographic factors that the population own.

Figure 1 shows the statistics on the occupied population (thousands of people), according to the counties of interest for the work, between 2010-2016.

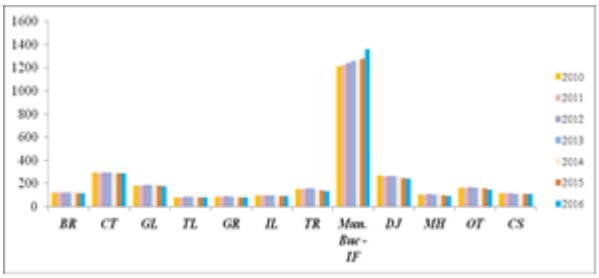

Fig. 1. Occupied population distribution according to the county

Source: TEMPO-Online time series, www.insse.ro [6]

Thus, we observe that, by far, the highest concentration of the occupied population is located in the Bucharest-Ilfov region, which is to be expected given the high degree of industrialization and development of the capital compared to the other analyzed counties. There is a distribution of the busiest population in the counties: Constanta, Dolj, Galati. On the opposite side there are the counties of Tulcea, Giurgiu and Ialomita.

Figure 2 shows the statistical data on occupied population (thousands of people), with activity in hotels and restaurants, depending on the county, between 2010-2016.

Also, in this case, the largest share of the population with activity in hotels and restaurants is found in Bucharest.

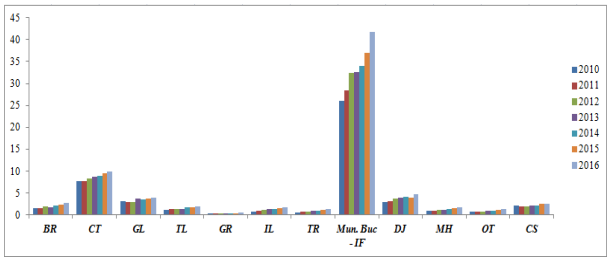

Fig. 2. Occupied population distribution (restaurants and hotels) according to the county
Source: TEMPO-Online time series, www.insse.ro [6]

The hierarchy of counties is maintained as in Figure 1, as regards the more developed counties in terms of active, active population. The counties with the lowest number of employees are Giurgiu, Teleorman, Olt and Ialomita.
In Table 1 we present the share that the population working in the hotel domain holds in the number of people working, regardless of the field, taking as a reference the interval 2010 - 2016.

Tabel 1. Share of occupied population (hotels, restaurants) in the total occupied population (regardless of the field), taking as reference the interval 2010 - 2016

County	Share occupied population (hotels and restaurants)
BR	1.65%
CT	3.00%
GL	1.89%
TL	1.84%
GR	0.46%
IL	1.33%
TR	0.61%
Mun. Buc - IF	2.63%
DJ	1.47%
MH	1.25%
OT	0.61%
CS	1.95%

Source: Own calculation.

We observe that in Constanta County we have the highest share of people working in the field of tourism, followed by Bucharest, Caraş Severin, Galati and Tulcea. The counties of Giurgiu, Teleorman and Olt are located at the opposite pole, these counties having basic activities like agriculture and fishing.
As far as that goes the unemployment rate identified in the 12 counties, we can state that the lowest level was registered in Bucharest, Ilfov, Caras Severin, Constanta. Surprising is the changes of the unemployment rate identified in the territory of Caraş Severin county, this amount reaching 9% in 2010 and only 2.2% in 2016, a decrease of almost 7 percentage points. High unemployment rates were recorded in Teleorman, Dolj, Mehedinţi and Olt. (Figure 3).

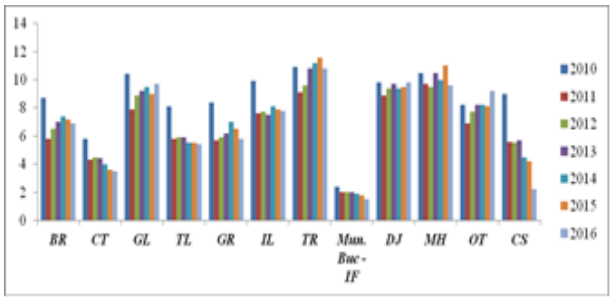

Fig. 3. Unemployment rate according to county
Source: TEMPO-Online time series, www.insse.ro [6]

In Figure 4 we graphically represent the nominal monthly net salary, according to the county. It is noticed that the lowest salary recorded in hotels and restaurants is recorded in the Giurgiu, Olt, Tulcea and Mehedinti counties. The highest salaries in this area were collected on the territory of the counties of Bucharest, Constanta, Galati and Teleorman.

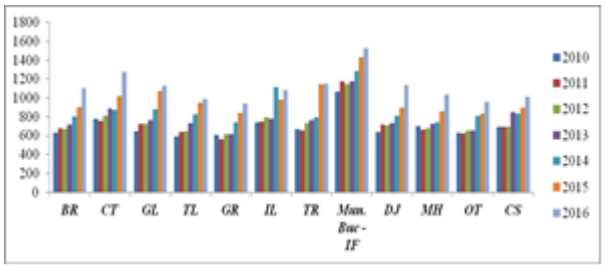

Fig. 4. Net nominal monthly salary by county
Source: TEMPO-Online time series, www.insse.ro [6]

For all counties analyzed, there is an upward trend in salary during the reference period 2010-2016.
If we have analyzed the labor market indicators so far, we will analyze indicators related to the tourism activity. In Table 2, we present the rate of occupation of tourist capacity on the territory of the counties of interest for the present research in the period 2010-2017.
Thus, we notice that, on average, the highest rate of occupation of tourist capacity was recorded in Bucharest, Galati, Tulcea and the lowest value was recorded in Teleorman County.

Table 2. Share of tourism capacity (hotels and restaurant) in total types of tourist accommodation structures

County	Tourist capacity occupancy rate (hotels and restaurants) %							
	2010	2011	2012	2013	2014	2015	2016	2017
BR	9.60	10.48	9.46	8.61	8.70	11.10	11.34	12.34
CT	8.06	7.46	8.94	8.61	8.32	9.24	11.46	11.83
GL	12.87	14.45	14.71	15.37	12.45	11.76	11.80	13.70
TL	12.46	14.40	13.68	12.29	11.51	12.33	12.05	14.86
GR	11.91	11.74	10.18	8.96	10.98	11.63	11.24	9.85
IL	6.36	6.96	6.46	7.17	7.07	7.35	8.21	8.13
TR	5.07	5.12	6.10	4.74	4.12	4.82	4.16	4.76
Mun. Buc - IF	14.02	16.78	17.57	18.91	21.58	23.42	25.49	26.37
DJ	4.85	8.13	9.90	11.08	11.87	12.58	11.14	12.12
MH	10.81	10.95	9.77	9.12	8.68	12.25	12.82	13.99
OT	7.33	10.81	12.43	11.73	11.02	10.77	11.35	11.19
CS	6.09	6.75	6.05	6.41	6.47	8.41	8.34	8.92

Source: Own calculation.

Once the statistical data is presented, we will present the results obtained with SPSS, obtained on the five hypotheses elaborated in the introduction.
Thus, in Table 3, we present the results obtained from the SPSS questionnaire on the link between the existing tourism capacity and the population's option to work in tourism.

Table 3. Tourism capacity - employees in tourism correlation

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.816	.020
N of Valid Cases		12	

Source: Results obtained with SPSS.

The chi square test value, lower than 0.050, (0.020) shows a representative connection between the tourism capacity and the number of employees in tourism. The contingency coefficient value (0.816) shows that the link is strong, significant intensity.

Table 4. Tourist capacity - unemployment rate correlation

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.773	.021
N of Valid Cases		12	

Source: Results obtained with SPSS.

In Table 4, we present the results obtained from the SPSS questionnaire on the link between the existing tourist capacity and the registered unemployment rate.
The chi square test value, lower than 0.050, (0.021) shows a representative connection between the tourism capacity and the level of unemployment rate. The contingency coefficient value (0.773) shows that the link is strong, significant intensity.
In Table 5, we present the results obtained from the interrogation in the SPSS program on the link between the net monthly salary level and the population's decision to work in the field of tourism.

Table 5. Correlation of net earnings - employed tourism

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.755	.014
N of Valid Cases		12	

Source: Results obtained with SPSS.

The chi square test value, lower than 0.050 (0.014) shows a representative connection between the net salary level and the number of employees in tourism. The contingency coefficient value (0.755) shows that the link is strong, significant intensity.
In Table 6, we present the results obtained from the SPSS questionnaire on the link between the demand on the tourism market and the existing tourist offer.

Table 6. Tourism demand - touristic offer correlation

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.808	.032
N of Valid Cases		12	

Source: Results obtained with SPSS.

The chi square test value, lower than 0.050 (0.032) shows a representative connection between the tourism demand and the touristic offer. The contingency coefficient value

(0.808) shows that the link is strong, significant intensity.

In Table 7, we present the results obtained from the interrogation in the SPSS program, regarding the link between the demand registered on the tourism market and the level of registered earnings.

Table 7. Correlation of net earnings - tourist demand

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.617	.289
N of Valid Cases		12	

Source: Results obtained with SPSS.

The chi square test value, bigger than 0.050 (0.617) shows that there is no significant relationship between the two variables analyzed.

CONCLUSIONS

In the first part of this paper I presented theoretical aspects taken from the literature, both national and international, on tourism and its importance in a healthy economy, the force work and various links highlighted between them. I also described the Romanian Danube area and the counties included in this area, those of interest for the present work.

Analyzing the statistical data on the descriptive indicators for the labor market (total population, tourism working population, unemployment rate, monthly net earnings), as well as tourism indicators of the areas of interest (existing tourist capacity, number of tourists arrivals), we highlighted their dynamics and the degree of development of each county.

It is noted that, taking into account the above-mentioned aspects, the Bucharest/ Ilfov region is remotely the most increased area, with the highest percentage of the active population present, in general, the lowest unemployment rate and the highest rate of occupying tourist capacity. This is explicable because Bucharest is a european capital, it is normal that the values analyzed are higher in its territory. Another county that is close to the values registered in the first analyzed region is Constanta. It is known that in this county is found the seaside area of our country, which attracted a number of approximately 1 235 542 tourists in 2017, a growing number. Caraş Severin county presents an interesting situation as well as proof that a more developed tourism segment can have positive effects on the people living standard. The identified unemployment rate was 2.2% in 2016, compared with 9% (2010) or 4.2% (2015). This is due to a touristic activity, in the year 2017 a number of 191 968 people visited this county, almost double the value recorded in Tulcea county, a county which is still representative for the Danube area of our country.

In the last part of the paper, we presented the results obtained in the SPSS program, as a result of codification, introducing and analyzing them, elaborating five hypotheses regarding the obtained results. Following the results of the chi square test and the coefficients of the contingency coefficient, we state the following:

-An increased tourism capacity can affect the number of people who are working in the tourism domain; (hypothesis 1 confirmed)

-An increased tourism capacity can affect the unemployment rate; (hypothesis 2 confirmed)

-The net salary amount of the employees in the tourism sector influences the population's decision to work or not in this field; (hypothesis 3 confirmed)

-The demand registered for tourism influences the registered offer; (hypothesis 4 confirmed)

-Tourism demand does not affect the wage earning of the population in this area. (hypothesis 5 denied).

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TOURIST ARRIVALS CONCENTRATION - A CASE STUDY IN ROMANIA'S CENTRAL AREA

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Abstract

The paper analyzed the degree of concentration of tourist arrivals in Romania's Central Area, using the data provided by the National Institute of Statistics for the period 2007-2016. In this purpose, Herfindhal-Hirschman Index, Gini-Struck Coefficient, and Concentration coefficient have been calculated and explained. In 2016, tourist arrivals reached 2,585,938, being almost double than in 2007. For tourist arrivals, the Central Area comes on the 1st position in the country, with a share of 23.5 % of total arrivals. The tourism density in the Centre Region is 1.1 tourists/inhabitant, almost double compared to 0.56 tourists/capita at the country level. Tourist arrivals are mainly concentrated in three counties: Brasov, Mures and Sibiu, which absorb about over two thirds of tourist arrivals in the Centre Region (83%). Harghita, Alba and Covasna counties have receive less tourists. In the analyzed period, it was noticed a slight decline of the values of the indicators characterizing the concentration degree. The Herfindhal-Hirschman Index varied between 0.2923 and 0.2742, the values of Gini-Struck Coefficient ranged between 0.3902 and 0.3590 and the Concentration coefficient varied between 0.4682 and 0.4308. All these figures reflect a relatively high concentration of tourism demand in terms of tourist arrivals in the Centre Region.

Key words: *tourist arrivals, Herfindhal-Hirschman Index, Gini-Struck Coefficient, Concentration coefficient, Centre Region, Romania*

INTRODUCTION

Tourism development in a sustainable way involves as the efforts of all the decision makers to be focused on the establishment of a long-term strategy destined to preserve, develop and promote Romania's beautiful landscapes, historical and cultural heritage [8].

Romania's tourism is continuously developing year by year as the country attracts more and more visitors. This is due to its geographical position on the map of Europe, the variety of its relief including one third mountains, one third hills areas and one third plains, but also the Black Sea coastal area, the Danube river and Delta. The whole country is full of interesting historical and cultural places representing by archaeological sites reflecting the old Dacian, Greek and Roman civilizations, medieval cities, fortresses, castles, palaces, museums, memorial houses, traditional villages where customs are well preserved. [6].

In 2016, Romania registered more than 11 million tourist arrivals in the accommodation structures of which about 23 % belonged to foreign visitors [14, 15].

The intensification of tourist traffic should be under control, tourist settlements should be prepared to be good hosts and the offer of tourism products should more diversified to meet tourism demand. All these aspects involves the development of new forms of tourism deeply integrated in the environment like rural tourism. [9].

Rural tourism in Romania has started in the central part of Romania, more exactly in the Brasov area, mainly in Bran and Moeciu communes, for which tourist demand was higher and higher due to the attractiveness of the landscapes, the large range of facilities in terms of housing, boarding, cultural events, the presence of Barn Castle (nicknamed Dracula Castle), the local gastronomy and hospitality of the local hosts. [7].

Besides eco-tourism, agro-tourism has become more and more important for the local

communities and farmers who are interested to offer accommodation in farm houses and their fresh products achieved in the farm to tourists, who in their turn are keen to discover rural life, to eat healthy meals and spend a wonderful time in the middle of nature. [10].

The Central Region of Romania has a high importance in Romania's tourism because of its marvelous sceneries in the mountain and hilly areas, the rich and diverse patrimony of cultural and historical attractions (medieval cities, fortified churches, fortresses, museums, authentic folk traditions), the large variety of tourism forms which could be practiced. This is why it is situated on the top position regarding the number of tourists arrivals [1].

About 54 % of the tourism resources of Romania are in Transylvania's counties. The natural and man-made resources have the highest quota in this part of the country [2].

The Central Region offers a large variety of tourism forms such as: cultural, religious, mountainous, sport, spa, rural, agro-tourism, eco-tourism, which are of high attraction for various types of visitors. Traditions are well preserved reflecting the harmonious combination between the spirituality of the Romanian, German and Hungarian communities. Folk traditions in terms of music, dance, costumes, habits and customs, architectural style of the houses have increased the importance of rural areas in the tourism practiced in this part of Romania [5].

The Central region is the highest number of arrivals and night stays [16]. The density of tourism is also the highest [3].

Approximately 30.8 % of accommodation units are situated in the Central part of Romania. And this a reason to note the strong connection between tourist arrivals and accommodation capacity in terms of units. From this point of view, the Central Area has the highest correlation coefficient, 0.966 [13]. But, concerning the number of places, the Central Area is situated on 2nd position after the South Eastern Region of Romania [16].

The most preferred period by tourists to visit the Central Region is summer season, except Brasov county which is visited both in summer and winter time. Therefore, the region is facing the tourism seasonality which affects the coverage degree of the accommodation capacity [10].

In the industry economics, it is used a large variety of methods to analyze tourism activity. Among them, Gini-Struck coefficient and also Herfindhal and Hirschman Index is largely used for assessing the degree of market concentration [18].

Despite that there are many aspects which could be approached, in this study it was analyzed only the concentration degree of arrivals in the Central Area of Romania for the reference interval 2007-2016 using Herfindhal-Hirschman Index, Gini-Struck Coefficient and Concentration Coefficient.

MATERIALS AND METHODS

In order to set up this study, there were used the official data for the last decade provided by Tempo online Data Base.

The data refer both to the Centre Region as a whole and to each component county: Alba County (AB), Brasov County (BV), Covasna County (CV), Harghita County (HR), Mures County (MS) and Sibiu County (SB).

The following methods have been used in order to process the data:

Index Method, based on Fixed basis index having the formula $I_{FB}= (X_n/ X_1)*100$, where: X = the variable taken into consideration, namely tourist arrivals in the years n= 1,2,3...i, of the chronological series. The year 2007 was considered the reference term (2007=100).

Structural Index= $S_{\%}= X_{ij}/\sum X_{ij}$, or X_{ij}/X_j where X_{ij} represents arrivals in the county i of the central part of the country j, $\sum X_{ij}$ or X_j represents arrivals in the area j. The index of structure reflects the arrivals weight in each county in the Central Area arrivals.

Herfindhal-Hirschman Index (HHI) is a measure of the concentration degree of the market in a specific economic industry. In this case, it is used to measure the tourist market, more exactly the tourism demand in terms of tourist arrivals in the Central Region of Romania, a region which is situated in the top from this point of view.

The calculation formula is simple and consists of the squared sum of the share of each county

in the total arrivals in the Centre Region, according to the formula:

$$HHI_j = \sum_{i=1}^{n} (g_{ij})^2 \quad (1)$$

where: HHI_j = HHI of the arrivals geographical concentration in the central part j, g_{ij} is the share of the county i in the region j, where i= 6, respectively: AB, BV, CV, HR, MS and SB.
g_{ij} was determined with the formula:

$$g_{ij} = X_{ij}/X_j. \quad (2)$$

The values of the HHi ϵ [0,1]. The HHI may be interpreted as follows: H < 0.01 reflects a high uniformity among the counties concerning tourist arrivals; HHI < 0.15 shows an unconcentrated status of tourist arrivals; 0.15 > HHI < 0.25 indicates a moderate concentration; HHI > 0.25 reflects a relative high concentration and HHI > 0.50 shows a high concentration of tourist arrivals in a few counties, and HHI = 1 indicates that all the tourist arrivals are concentrated in only one county, or, in other words, a perfect concentration. HHI = 0 indicates a perfect uniformity of tourist arrivals among counties [4].
Taking into account that practically it is impossible as in each county to be the same number of tourists, it is considered that 1/n represents the lowest level of concentration of tourism demand, in this case 1/n=1/6=0.16. Therefore, HHI_j could vary between 0.16 and 1.
The Normalized Herfindhal-Hirschman Index (HHI^N) is also used in order to enlarge the HHI variation between 0 and 1. The formula for HHI^N is the following one:

$$HHI^N = \frac{HHI_j - \frac{1}{n}}{1 - \frac{1}{n}} \quad (3)$$

Gini-Struck Coefficient (GSC) was used to measure the disparities regarding tourist arrivals in the Centre Region, based on the formula which takes into account the values of HHI_j and the number of counties, n.

$$GSC_j = \sqrt{\frac{\sum_{i=1}^{n}(g_{ij})^2 - 1}{n-1}} = \sqrt{\frac{n\,HHI_{ij} - 1}{n-1}} \quad (4)$$

The values of GSC ϵ [0,1]. GSC= 0 reflects a perfect equity among counties regarding tourist arrivals. GSC > 0.3 means a relative concentration degree, GSC > 0.5 reflects a high concentration and GSC =1 means a perfect inequity or a huge inequality among counties [11, 17].
Concentration Coefficient (CC) has the purpose to use GSC in an adjusted alternative taken into consideration the number of counties. The specific formula for this coefficient is:

$$CC_j = \frac{n}{n-1} GSC_j \quad (4)$$

The obtained results were included in tables, illustrated in graphics and interpreted. Finally, the corresponding conclusions were drawn regarding the analysis of the concentration degree of the tourism demand in the Centre Region of Romania.

RESULTS AND DISCUSSIONS

The dynamics of arrivals in the Central Area. In the studied interval, the number of arrivals grew up accounting for 2,585,938 in 2016, by 94.34% more than in 2007.
This growth rate was more dynamic than the growth rate achieved at the country level, which accounted for 57.81 %. In the same year, Romania carried out 11,002,522 tourists in comparison with 6,971,925 in the 1st year. Consequently, the weight of arrivals in the Central Area went up reaching 23.50 % in the last year of the research period compared to 19.07 % in the 1st one (Table 1).
Within the tourist arrivals, the highest weight belongs to Romanian tourists. The Central Area registered 8,521,698 visitors in 2016 by 57.19 % more than in 2007. As a consequence, the weight of visitors of the central part in the total number of arrivals in the country raised from 18.96 % to 24.58 % in the last decade.

Table 1. The tourist arrivals in the Centre Region and component counties in Romania in the period 2007-2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2016/2007 %
AB	54,054	51,264	44,271	47,838	78,496	95,918	101,869	107,271	154,210	167,970	310.74
BV	556,816	581,983	451,683	510,196	642,829	737,810	834,979	865,689	997,601	1,114,395	200.13
CV	52,458	62,642	62,406	60,937	91,365	79,135	83,468	89,236	88,800	99,117	188.94
HR	85,285	76,984	69,405	76,871	100,276	103,398	114,717	124,224	157,659	183,725	215.42
MS	253,454	231,538	200,312	202,850	259,121	353,459	394,834	410,904	495,481	517,111	204.02
SB	327,925	287,103	244,708	228,195	263,684	285,136	329,986	355,698	438,611	503,620	153.57
Centre Region	1,329,992	1,291,514	1,072,785	1,126,887	1,435,771	1,654,856	1,859,853	1,953,022	2,332,362	2,585,938	194.43
Romania	6,971,925	7,125,307	6,141,135	6,072,757	7,031,606	7,686,489	7,943,153	8,465,909	9,921,874	11,002,522	157.81
Share of Centre Region %	19.07	18.12	17.46	18.55	20.41	21.52	23.41	23.06	23.50	23.50	-

Source: Own calculation based on the data provided by [12].

The evolution of tourist arrivals by county in the Centre Region.

Brasov is on the 1st position recording the most numerous visitors whose number was doubled in the studied interval (1,114,395 tourists in 2016 vs. 556,816 in 2007).

Mures is ranked the 2nd with 517,111 tourists in 2016, a double figure than in 2007.

The 3rd position belongs to Sibiu where 503,620 arrivals were noticed in 2016 (+53.57 %).

The 4th rank is occupied by Harghita which achieved 85,285 tourists in 2016 (+115.42 %) in comparison with 2007

With 167,970 arrivals in 2016, Alba County is situated on the 5th position. Compared to 2007, it achieved 3.1 times more visitors than at the beginning of the interval, reflecting the highest growth rate in the period taken into consideration.

Covasna received 99,117 tourists (+88.94 %) compared to 2007, being situated on the 6th rank (Table 1).

The structure of tourist arrivals in the Centre Region.

In 2016, the results were the following ones in the decreasing order: Brasov 43 %, Mures 19.9 %, Sibiu 19.8 %, Harghita 7.1 %, Alba 6.4 % and Covasna 3.8 %.

The fluctuation of arrivals had a deep impact on each county market share. While the weight of visitors in Brasov, Mures, Harghita and Alba counties raised, in Covasna and especially in Sibiu decreased (Fig.1.)

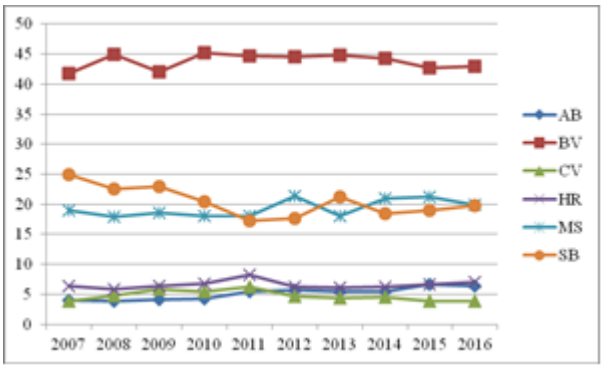

Fig.1.The market share of visitors by county in the Central Area, 2007-2016 (%)
Source: Own design using the data from [12].

The number of tourist arrivals per inhabitant or **tourism density** also reflects the concentration of tourism demand.

Table 2.Tourism density by county in the Centre Region of Romania in the year 2016 (tourist arrivals/inhabitant)

	Tourism density (tourist arrivals/inhabitant)	Position of the county
AB	0.50	5
BV	2.02	1
CV	0.48	6
HR	0.60	4
MS	0.95	3
SB	1.26	2
Centre Region	1.10	-
Romania	0.56	-

Source: Own calculation using the empirical data from [12].

In 2016, the highest number of tourist arrivals/inhabitant was in Brasov county (2.02), Sibiu (1.26), Mures (0.95), Harghita (0.6), Alba (0.5) and Covasna (0.48).

The average level of density in the Centre Region is 1.1 tourist arrivals/inhabitant. It is double than 0.56 arrivals/capita at the country level. In case of the Centre Region, four counties: Brasov, Sibiu, Mures and Harghita exceed the average arrivals density in the country (Table 2).

The Index of concentration (HHI) in the Central Area varied between 0.2936 in the year 2007, the maximum value, and 0.2734, the minimum value in 2015. The values reflect a relatively high visitors concentration in the counties (HHI > 0.25). It was noticed a descending trend from the year to another in the research period (Table 3).

Table 3. The calculation of HHI in the Centre Region of Romania based on the sum of squared shares of the counties for tourist arrivals $(gij)^2$

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AB	0.0016	0.0015	0.0016	0.0017	0.0029	0.0032	0.0029	0.0030	0.0043	0.0040
BV	0.1746	0.2025	0.1772	0.2043	0.1998	0.1980	0.2007	0.1962	0.1823	0.1849
CV	0.0152	0.0023	0.0033	0.0029	0.0039	0.0022	0.0019	0.0020	0.0014	0.0014
HR	0.0040	0.0034	0.0040	0.0046	0.0068	0.0038	0.0037	0.0034	0.0044	0.0050
MS	0.0361	0.0320	0.0345	0.0324	0.0324	0.0453	0.0327	0.0441	0.0449	0.0396
SB	0.0620	0.0506	0.0529	0.0299	0.0299	0.0309	0.0449	0.0338	0.0361	0.0392
HHI_j	0.2936	0.2923	0.2735	0.2875	0.2757	0.2834	0.2868	0.2825	0.2734	0.2741

Source: Own calculation utilizing the data collected from [12].

The evolution of Herfindhal-Hirschman Index is also graphically illustrated in Fig.2.

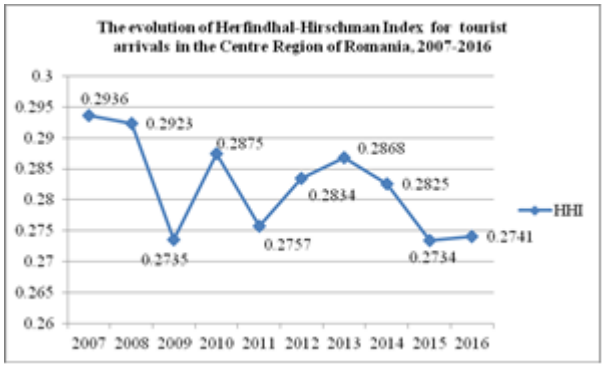

Fig.2.The dynamics of Herfindhal-Hirschman Index for arrivals in the Central Romania, 2007-2016 (%)
Source: Own design using the data achieved from [12].

The dynamics of the values of Herfindhal-Hirschman Normalized Index.

The highest value was 0.1523 (2007) and the lowest one 0.1281 (2015).
This index had the same decreasing trend like the classic HHI (Fig.3).

The Coefficient Gini-Struck slightly declined in this interval from 0.3902 in 2007 to 0.3590 in 2016.
The maximum level of GSC was noticed in 2007, and the minimum level 0.3578 in 2015. GSC > 0.3 shows a relative high concentration degree of tourist arrivals. It is true, as the empirical data showed that in Brasov, Mures and Sibiu it was registered the highest number of tourists accounting for 83.5 % in total arrivals in the Central Area. Therefore, tourist demand in relatively concentrated in these three counties of the Central Romania (Fig.4.).

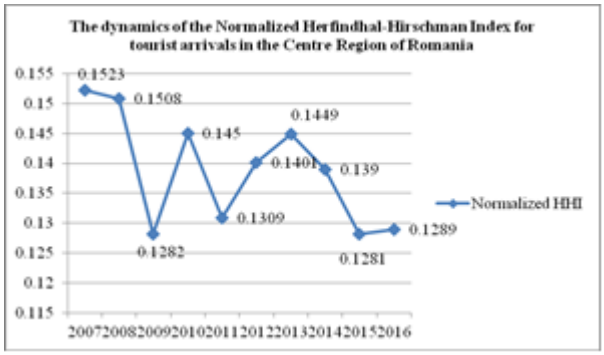

Fig.3.The dynamics of the Normalized Herfindhal-Hirschman Index for arrivals in the Central part of Romania, 2007-2016 (%)
Source: Own design, the data were offered by [12].

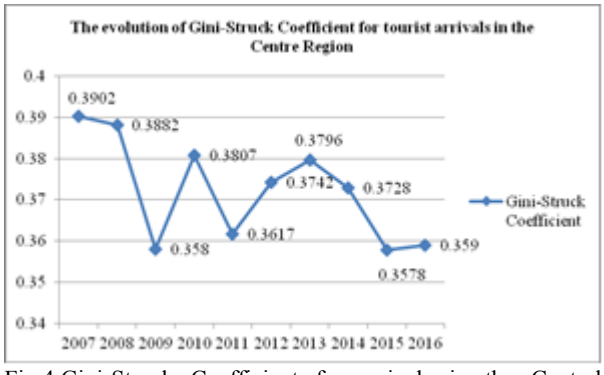

Fig.4.Gini-Struck Coefficient for arrivals in the Central Romania, 2007-2016 (%)
Source: Own design, data source [12].

The concentration coefficient

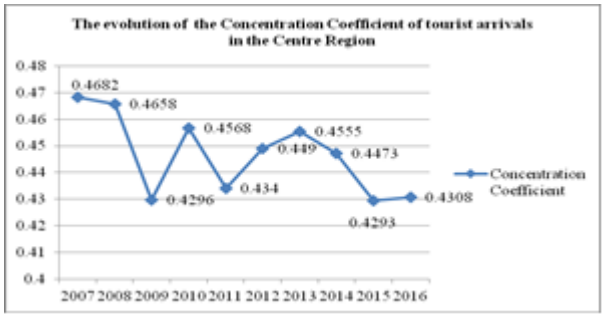

Fig.5.Coefficient of concentration for tourist arrivals in the Central Region of Romania, 2007-2016 (%)
Source: Own design, using the data taken from [12].

The coefficient of concentration reflected a trend of diminishing the concentration degree from 0.4682, the highest level recorded in 2007 to 0.4308 in 2016. The year 2015 registeredthe minimum value as shown in Fig.5.

The evolution of Herfindhal-Hirschman Index, Normalized Herfindhal-Hirschman Index, Gini-Struck Coefficient and Concentration Coefficient is comparatively presented in Fig.6.

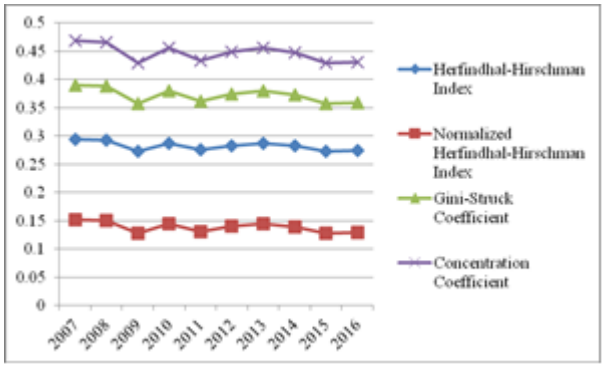

Fig.6.The comparative illustration of the main concentration indicators of tourist arrivals, Romania, 2007-2016 (%)
Source: Own design, the data were picked up from [12].

CONCLUSIONS

The study of arrivals concentration In Romania in its central part in the last decade has emphasized the following aspects:

The central part of Romania benefits of the highest tourism demand, being on the top for tourist arrivals.

The counties Brasov, Mures and Sibiu are the most visited areas of the region, while Harghita, Alba and Covasna absorb just about 17 % of tourist arrivals.

Therefore, it is a relatively high concentration of arrivals in Brasov, Mures and Sibiu counties than in the other counties.

The average tourists/capita in the Central Area is 1.1, almost double compared to 0.56 the mean in Romania. Four counties Brasov, Sibiu, Mures and Harghita exceed the average tourism density in the country.

In the analyzed period, it was noticed a relatively descending trend of all the indicators reflecting the concentration degree of tourist arrivals: Herfindhal-Hirschman Index, Normalized Herfindhal-Hirschman Index, Gini-Struck coefficient and Concentration coefficient from the year 2007 to the year 2016.

The values of Herfindhal-Hirschman Index varied between 0.2923 and 0.2742, the values of the normalized Herfindhal-Hirschman Index ranged between 0.1523 and 0.1289, the levels of Gini-Struck Coefficient varied between 0.3902 and 0.3590 and of CC between 0.4682 and 0.4308.

As a conclusion, the Centre Region of Romania is facing a high tourism demand concentration degree in terms of tourist arrivals, all the counties being visited by more and more tourists year by year, but the most visited counties remain Brasov, Mures, Sibiu and Harghita.

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MAIZE AND WHEAT - TOP AGRICULTURAL PRODUCTS PRODUCED, EXPORTED AND IMPORTED BY ROMANIA

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Abstract

The paper analyzed wheat and maize production, export and import in Romania in the period 2007-2016 in order to point out the main trends and factors which sustain the position of the country in the international trade. Index method, comparison method, export/production ratio, export/import ratio, gross exchange index have been determined to characterize efficiency of external trade. Maize and wheat production increased 2.8 times during the last decade, representing 50 % and respectively 38.5 % in cereal production. Romania comes on the 2nd position for maize and on the 5th position for wheat in the EU production. The production growth is due mainly to the large cultivated surface, 4.7 million ha, for these two cereals which represent 85 % of the cultivated area in Romania. But, with 4.1 tonnes maize and 3.9 tonnes wheat per ha, yield is by 42.39 % and respectively 26.22 % lower than the EU average. Romania exported 11 times more maize and 34 times more wheat during the last decade. Also, it imported less maize but more wheat mainly for re-export. Export/Production ratio increased from reached 0.32 for maize and 0.82 for wheat, and Export/Import ratio reached 7.78 for maize and 5.83 for wheat. Export and import value also had a high growth rate, while import had a decline, resulting a positive balance, and this under the decline of export price and increase of import price. As a conclusion, the production growth contributed to the development of export with a benefic effect on the trade balance and Romania's prestige and position as a cereal producer and exporter. To increase yield level, investments are required in new technologies (machinery, irrigations, high production value hybrids and varieties, fertilization and plant protection). Also, farm size should be increased by joining in associative forms for a more efficient use of capital and human resources and increase economic efficiency.

Key words: *maize, wheat, production, export, import, trade balance, Romania*

INTRODUCTION

Even thou its existence dates back in the early 7,000 and even in the pre-historic era, till nowadays wheat cropping has been developed very much [21]. Today, wheat is cultivated on the largest surface than any other crop in the world and it is the most traded grain worldwide [5]. Wheat is "the king of cereals" because it is a great grain deal being easy to cultivate, store and process [7].

Wheat has a high content in protein (12-16%), gluten, carbohydrates, lysine, minerals (Ca, P, Fe etc), A and D vitamins, lipids etc. For this reason, it is the most used cereal for human nutrition but also for as animal feed especially in the years with rains when harvest is unsuitable for bakery. For human consumption the most important wheat species are *Triticum Durum or Turgidum* (L) and *Triticum Aestivum* (L). The both species are cultivated in many countries in the world from Asia, Europe, Middle East, Africa and America [9].

In Romania, wheat was cultivated 3000 years ago and Getae-Dacians had a flourishing trade in the Black Sea area. Across the centuries, wheat cropping has been rapidly developed in the Romanian Countries, and at the beginning of the 19th century, Romania was considered "the granary of Europe". Wheat crop was affected by the two world wars, but after that it has recovered and increased due to the technical endowment, the extend of high potential varieties and good cropping technologies [14].

Maize (*Zea mays*) has its origin in the Latin America, more exactly in Mexico, dating from 10,000 years back. From there, its cropping was spread in all the Americas, Europe, Asia

and Africa. It is considered the most productive crop, and together with wheat is accounts for 80 % of world cereal production [17].

In Romania, maize was brought about 300 years ago to replace the old plantations of millet which was an important crop till that time. Maize has been the most important cereal for Romanians for about 200 years, but from the beginning of the 20th century, they have been more oriented to wheat, as bread has become an important food. Maize is also successfully used in animal feeding, for producing ethanol and for other purposes [2, 3, 15].

Maize grains contain 13.3 % water, 10 % protein, 4.7 % lipids, 59 % starch, sugars 2.2 %, dextrin 2.4 %, pentosan 4.3 %, 1.4 % minerals (K, Ca, Si etc), (A, B, E and PP vitamins), cellulose 2.2 % and pigments [23].

About 77 kg maize flour, 44 l alcohol, 71 kg glucose, 1.8-2.7 l oil and 3.6 kg cakes could be obtained from 100 kg maize grains as mentioned by Zamfirescu *et al* (1963), as cited in "Cultura porumbului-Maize crop"). [5].

In 2017, the world grains production accounted for 2,460.41 million metric tonnes, of which maize 1,033.74 million metric tonnes (42.01 %) and wheat 757.92 Million metric tonnes (30.8 %), the difference belonging to rice, barley, oats and rye [30].

The main wheat producers are EU, China, India, Russia, USA, Canada, France, Ukraine, Pakistan and Germany [13], while the main maize producers are USA, China, Brazil, Argentina, Ukraine, Mexico, Indonesia, France and South Africa [20].

The EU-28 is an important "player" in the cereals market. In 2016, it achieved 301.3 million tonnes cereals, of which wheat 134.5 million tonnes (44.6%) and 62.7 million tonnes maize (20.8 %) [10,11].

Romania is one of the most important producers of maize and wheat in Europe and in the world. Its performance in maize and wheat cropping is based on the use of high potential varieties and hybrids, plant resistance to diseases and pests and grain quality required for processing [17, 25, 27, 28].

In this context, the purpose of the paper was to comparatively analyze the situation of production, export and import for maize and wheat, the main cereals cultivated in Romania and top agricultural products in production performance and international trade. The period of reference was 2007-2016 for which available official empirical data were updated at the date of the present study.

MATERIALS AND METHODS

The study was focused on the following indicators in order to characterize the competition between maize and wheat in production, export and import. In this purpose, there were analyzed: production of maize and wheat, cultivated area, yield, exported and imported quantities of maize and wheat, export and import value, trade balance, the share of export and import values of maize and wheat in the agro-food export and import value, average export FOB price and average import CIF price for maize and wheat, the ratio between the average export and import price, and gross exchange index.

Also, in this study was presented Romania's position in terms of market share regarding maize and wheat production, export and import among the EU countries and also at the world level.

The data were collected for the period 2007-2016 from FAOSTAT Data base, 2018 and Tempo online Data Base, 2018 of the National Institute of Statistics [12, 19].

The following methods have been used in order to process the data:

Index Method, in its variant of the Index with fixed basis whose formula is: $I_{FB}= (X_n/ X_1)*100$,

Graphical Method used to illustrate the dynamics of each indicators and to allow comparisons between maize and wheat.

Gross Exchange Index (GEI) was used to reflect the purchasing power of maize compared to wheat. GEI was determined as the ratio between the average export price and the average import price, according to the mathematical formula:

$$GEI = \frac{I^E_{p0}}{I^I_{p0}} x100 = \frac{\frac{\sum_{q1p0} xE}{\sum_{q0p0}}}{\frac{\sum_{q1p0} xI}{\sum_{q0p0}}} x100$$

where:
GEI= Gross Exchange Index
I^E_{p0}= the index of the average export price in the basic period p_0
I^I_{p0}= the index of the average import price in the basic period p_0
q_1= the quantity of exported goods, and respectively, the quantity of imported goods in the current period
q_0= the quantity of exported goods, and respectively, the quantity of imported goods in the basic period
p_0= export price and, respectively import price in the basic period.
If GEI > 1, the both goods have a higher purchasing power as when we export them we get a higher price than the price at which these goods are bought. This is a favorable exchange index.
If GEI < 1, the goods have a low purchasing power, as they are sold at a price smaller than the price at which they are imported. This index reflects an unfavorable exchange between export and import with a negative consequence on the trade balance [24].
The results were presented in tables and the necessary comments and interpretations were made.

RESULTS AND DISCUSSIONS

Productions. Romania's cereal production has known a fast dynamics after 2007, so that in 2016, it accounted for 21.8 million tonnes, being by 2.79 times higher than in the 1st year of study.
Maize and wheat are the main cereal crops cultivated in Romania. *Maize production* increased from 3.9 million tonnes in 2007 to 10.7 million tonnes, so that in 2016 it was 2.74 times higher than in the 1st year of study. *Wheat production* accounted for 8.4 million tonnes in 2016 compared to 3 million tonnes in 2007. Therefore, in the analyzed period, it increased 2.8 times.
In the analyzed period, the weight of maize and wheat in the cereal production remained relatively constant at about 50 % in case of maize and at about 38.5 % in case of wheat (Fig.1.)

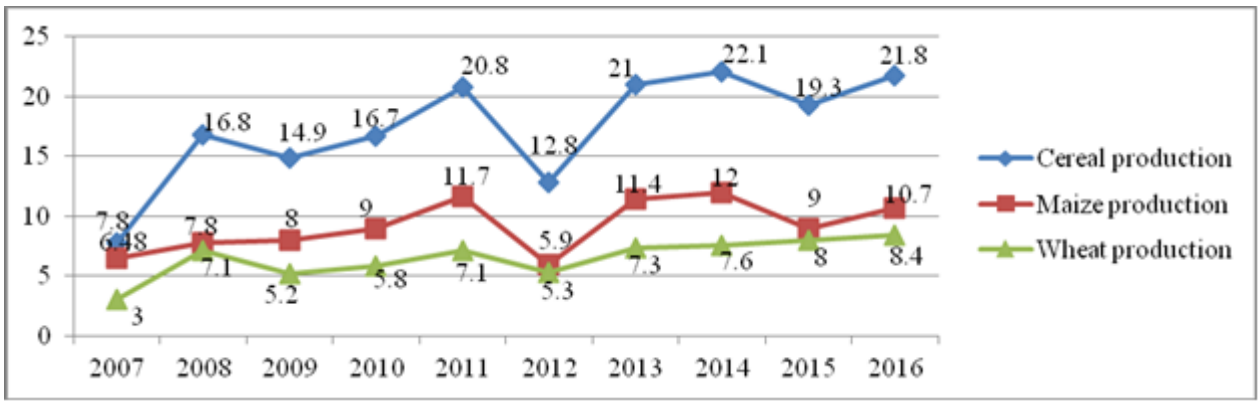

Fig.1.Evolution of cereals, maize and wheat production in Romania, 2007-2016 (Million tonnes)
Source: Own design based on the data of [12, 19].

The average, standard deviation and the variation coefficient for cereal, maize and wheat productions are presented in Table 1. The variation coefficient varied between 20 % and 30 % reflecting that production levels were relatively heterogeneous.

Table 1. The average, standard deviation and variation coefficient of the production of cereals, maize and wheat in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Cereal production	17.4	4.59	26.37
Maize production	8.94	2.18	24.38
Wheat production	6.18	1.68	27.18

Source: Own calculation based on the data of [12, 19].

Romania is among the first top producers of cereals in the EU [18]. In 2016, it achieved 10,746 thousand tonnes grain maize and 8,406 thousand tonnes wheat. For this performance, Romania came on the 2nd position for grain maize and corn-cob mix (6.9 %) after France (19 %) and on the 5th position for wheat and spelt production (6.2 %) after France (20.5 %), Germany (18 %), United Kingdom (10.7 %), and Poland (8 %) [10].

At the world level, Romania is situated on the 18th position for wheat production and on the 12th position for maize production.

During the last decade, maize and wheat are in competition to occupy the 1st position among the top agricultural products produced, exported and imported by Romania (Table 2). These two products are followed by cow fresh milk, potatoes, sunflower seeds, barley, rapeseed, sugar beet, cabbage and grapes in a different order depending on the year [12].

Table 2. Position occupied by maize and wheat in production, export and import quantity, Romania, 2007-2016

	Position for production		Position in exported quantity		Position for imported quantity	
	Maize	Wheat	Maize	Wheat	Maize	Wheat
2007	2	4 (after milk, maize and potatoes)	2 (after sunflower seeds)	4 (after sunflower seeds, maize and rapeseed)	1	2 (after maize)
2008	1	2	2 (after wheat)	1	1	2 (after maize)
2009	1	2	2 (after wheat)	2 (after maize)	1	2 (after maize)
2010	1	2	2 (after wheat)	1	3 (after wheat and soybeans cake)	1
2011	1	2	1	2 (after maize)	4 (after wheat, soybeans cake and raw sugar)	1
2012	1	2	2 (after wheat)	1	1	1
2013	1	2	2 (after wheat)	1	4 (after wheat, soybeans cake and raw sugar)	1
2014	1	2	2 (after wheat)	2 (after maize)	2 (after wheat)	1
2015	1	2	1	2 (after maize)	1	1
2016	1	2	2 (after wheat)	1	2 (after wheat)	1

Source: Own determination based on the data from [12].

Cultivated area with cereals, mainly with maize and wheat is the first important factor with a deep influence on production**.** The empirical data reflect that the surface cultivated with cereals has slightly increased from 5.1 million ha in 2007 to 5.5 million ha in 2016 (+7.8%). The cultivated area with maize accounted for 2.6 million ha in 2016, being by 4 % larger than in 2007. The surface cultivated with wheat increased by 5 % from 2 million ha in 2007 to 2.1 million ha in 2016 (Fig.2.

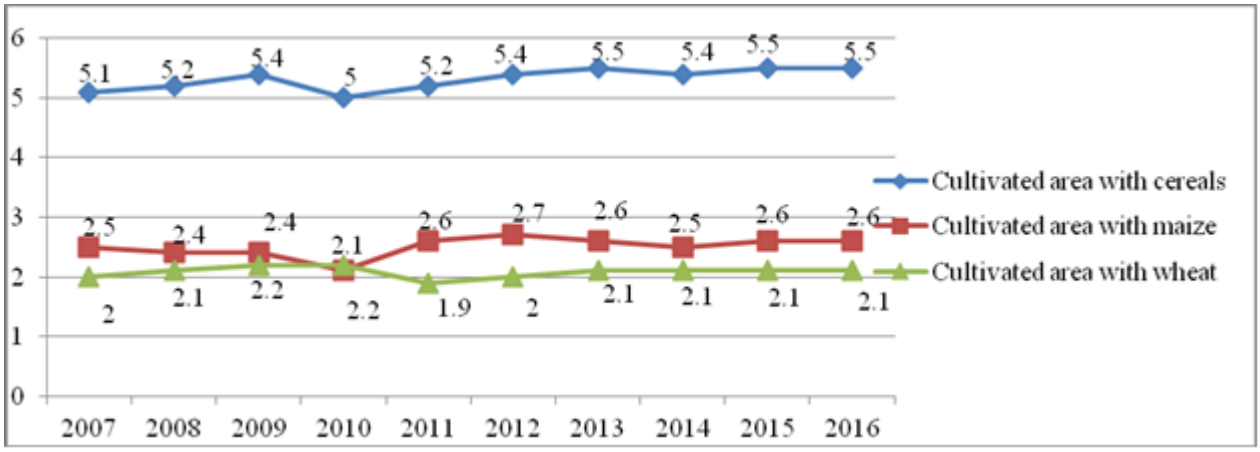

Fig.2.Evolution of the cultivated area with cereals, maize and wheat in Romania, 2007-2016 (Million ha)
Source: Own design based on the data from [12, 19].

The average, standard deviation and the variation coefficient for cereal, maize and wheat cultivated areas are shown in Table 3. The values of the coefficient of variation were lower than 10% showing that cultivated area did not varied too much and remained relatively homogeneous.

Table 3. The average, standard deviation and variation coefficient of the cultivated area with cereals, maize and wheat in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Cultivated area with cereals	5.32	0.18	3.38
Cultivated area with maize	2.5	0.16	6.4
Cultivated area with wheat	2.08	0.09	4.3

Source: Own calculation based on the data from [12, 19].

In 2016, of the 14.4 million ha utilized agricultural surface in Romania, the cultivated area with cereals represented 38.19 %, the cultivated area with maize 18.05 % and the surface cultivated with wheat 14.5 %. Therefore, maize and wheat all together have a share of 85.45 % in the cultivated area with cereals and 32.6 % in the utilized agricultural land.

In the same year, Romania's weight in the EU cultivated area with cereals was 9.08 %, bringing the country on the 5th position after France (16.3 %), Poland (13.3 %), Germany (11%) and Spain (10.5%). All these 5 countries together cultivate cereals on 60.18 % of the EU cultivated agricultural land [10, 29].

Yields. Besides the cultivated area, which is an extensive factor of development**,** the growth of production is also influenced by yield or the obtained amount of grain per surface unit, which is an intensive factor of production.

In the studied period, the average production of cereals increased from 1,524 kg/ha in 2007 to 3,971 kg/ha in 2017.

Maize yield increased 2.72 times from 1,526 kg/ha in 2017 to 4,163 kg/ha in 2016, while wheat yield increased from 1,541 kg/ha in the 1st year of the analysis to 3,944 kg/ha in the last year (Fig.3).

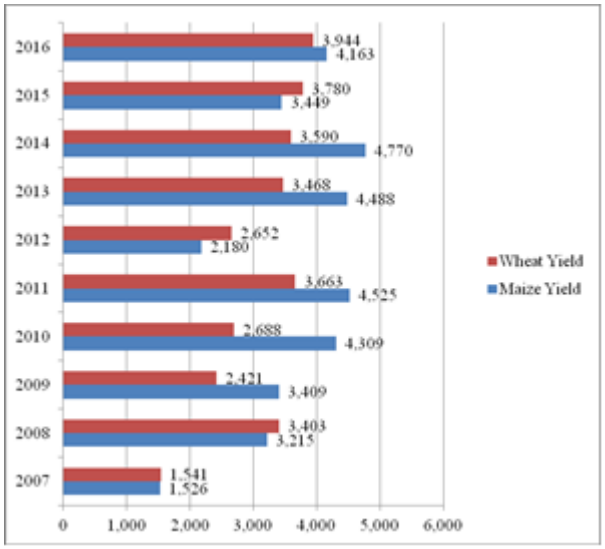

Fig.3.Evolution of maize and wheat yields in Romania, 2007-2016 (kg/ha)
Source: Own design based on the data from [19]

The average, standard deviation and the variation coefficient for maize and wheat yield are presented in Table 4. The figures for the coefficient of variation are over 20%, but lower than 30%, meaning maize and wheat yield values are relatively heterogeneous.

Table 4. The average, standard deviation and variation coefficient for maize and what yield in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Maize yield	3,603.4	1,072.79	29.77
Wheat yield	3,115	761.48	24.44

Source: Own calculation based on the data from [19].

The average production is influenced by a large range of factors such as: farm size, crop variety, soil conditions, fertilization level, climate (rainfalls, drought, extreme phenomena), irrigation, plant protection, moment and quality of agricultural works, farmer training level and experience etc.

Farm size in Romania is a restraining factor for production level. The average surface of a farm is about 3.7 ha, far away from 17 ha/holding in the EU. About 75 % farms have less than 2 ha, 18.8 % between 5 and 10 ha and 4.7 % between 10 and 50 ha. Only 1.5 % of farms are larger than 50 ha. And, just 0.5 % of the number of holdings have over 100 ha and utilize 49 % of the agricultural land.

Therefore, in Romania, the smallest farms are dominant, representing 98 % of the total number of holdings and they utilize about 40 % of the agricultural surface. This is a real impediment in the application of the modern technologies in cereal cropping and not only. In addition, the lack of co-operatives or other associative forms does not allow the existing subsistence and semi subsistence farms to perform better due to the distribution of agricultural land in small plots. More than this the lack of material and financial resources and the low training level of the farmers are other restraining factors in the development of cereal cropping in Romania.

During the last decade, the effects of climate change are more and more visible. In the years 2007 and 2012, the production per surface unit have been very much affected by drought. The non sufficient irrigation systems in Romania are also a cause of the low yield level.

The lack of financial resources and the lack of attractiveness of the credit system are other factors which do not allow production growth.

However, the highest maize yield was 4,770 kg/ha carried out in the year 2014 and the highest wheat yield was 3,944 kg/ha recorded in the year 2016.

Unfortunately, cereal yield in Romania is still very low compared to the records in other EU countries [16].

In 2016, for 3,971 kg/ha cereal grains, Romania came on the 17th position in the EU-28. This performance was similar to the world yield (3,967 kg/ha). But, in the EU, higher cereal yields were achieved by the Netherlands, Germany, France, Austria, United Kingdom, Belgium, Croatia, Slovenia, Czech Republic, Denmark, Sweden, Hungary, Bulgaria, Malta, Norway and Poland.

As many Romanian farmers are mainly oriented to cereal cropping, in the year when production is high, cereal price at the harvest moment is very low on the domestic market, obliging the farmers to sell their grains on the external market to get a higher price and cover the production cost. The lack of stores is also a cause of this decision, because farmers have not the possibility to keep their grain production and sell it when the demand is higher and price is more attractive.

Romania's share in the EU and in the world maize and wheat production, cultivated area and yield.

In 2016, Romania carried out 1.1 % of the world wheat production and 0.99 % of the world maize production. In the same year, its contribution to the EU-28 production was 5.77 % for wheat and 17.28 % for maize.

Romania's cultivated area with wheat and the one cultivated with maize represented 0.94 % and respectively 1.39 % in the world cultivated area with these two cereals. In the EU-28 cultivated area, Romania's share is 7.7 % for wheat and 30.33 % for maize.

Wheat yield achieved by Romania is by 16.56 % higher than the average yield in the world, but by 26.22 % lower compared to the EU average.

Maize yield carried out by Romania is by 28 % lower than the world average and by 42.39 % lower than the EU average (Table 5).

Table 5. Romania's share in the EU and in the world for wheat and maize production, cultivated area and yield in 2016

	Production (Million Metric Tonnes)		Cultivated area (Million ha)		Yield (Metric Tonnes/ha)	
	Wheat	Maize	Wheat	Maize	Wheat	Maize
World	752.08	1,078.31	222.21	186.91	3.38	5.77
EU-28	145.37	61.89	27.23	8.57	5.34	7.22
Romania	8.4	10.7	2.1	2.6	3.94	4.16
-Share of Romania in the World (%)	1.1	0.99	0.94	1.39	116.56	72.09
-Share of Romania in the EU (%)	5.77	17.28	7.7	30.33	73.78	57.61

Source: Own calculation based on the data from [31]

Exported quantity. As mentioned above in Table 2, maize and wheat are competitors for the top position, not only regarding production, but also exported and imported amounts.

The exported quantity of maize increased in a very fast manner from 312.3 thousand tonnes in 2007 to 1,101.2 thousand tonnes in 2016. Therefore, it was 11 times higher in the last year of the analysis. *Wheat export* accounted for 206.6 thousand tonnes in 2007, but in 2016 it was 6,994 thousand tonnes, 33.8 times higher than in the first year of the analysis (Fig.4).

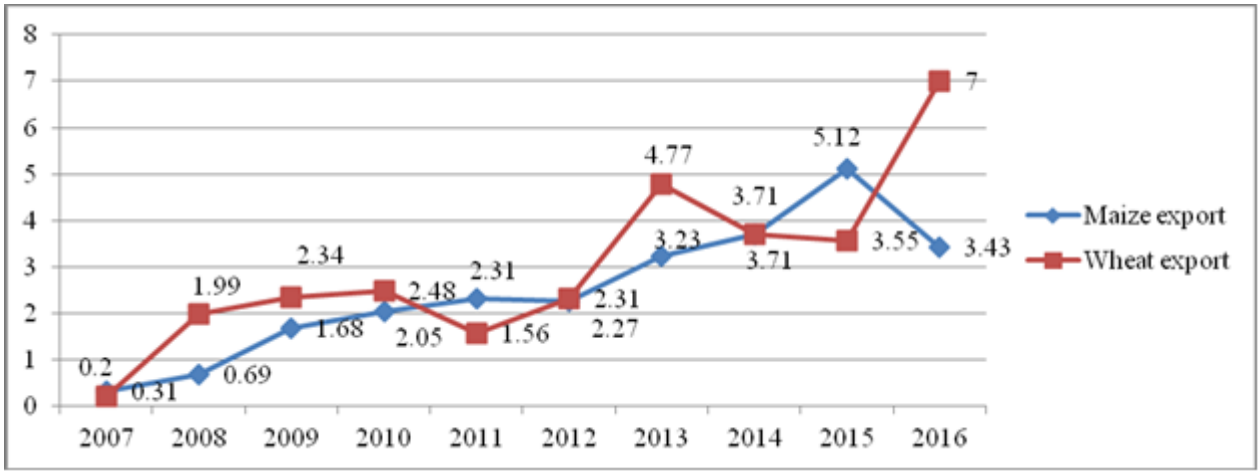

Fig.4.Evolution of maize and wheat exported quantities by Romania, 2007-2016 (Million tonnes)
Source: Own design based on the data from [12]

Table 6. The average, standard deviation and variation coefficient for maize and what exported amounts in the period 2007-2016

	Mean	Std. Deviation	Coefficient of variation (%)
Maize export	2.48	1.44	58.06
Wheat export	2.99	1.88	62.87

Source: Own calculation based on the data from [12].

The average, standard deviation and variation coefficient for maize and what exported quantities are shown in Table 6. The variation coefficient was very high in this case, over 30 %, reflecting that the amount of exported maize and wheat was heterogeneous.

The main partners for wheat export are: Egypt, Spain, Jordan, Libya, Italy, Turkey, Tunisia, Israel, Bangladesh, and the principal beneficiaries for maize export are: Spain, the

Netherlands, South Korea, Turkey, Egypt, Italy, Portugal, Iran, Israel, Lebanon, Syria, Lybia, Algeria [8].

Imported quantity. Maize and wheat are also subject of import, despite that Romania is a large producer and exporter. The imported amount of maize varied from a year to another depending on the obtained production, but mainly due to commercial a commercial reason- re-export.

In 2016, Romania imported 583.4 thousand tonnes maize, by 11.7 % less than in 2007. The year with the highest imported amount, 813.2 thousand tonnes, was 2015. In case of wheat, it was registered a general ascending trend of imports, from 587.5 thousand tonnes in 2007 to 1,200 thousand tonnes in 2016. Therefore, wheat import was double in the last year of the study (Fig.5).

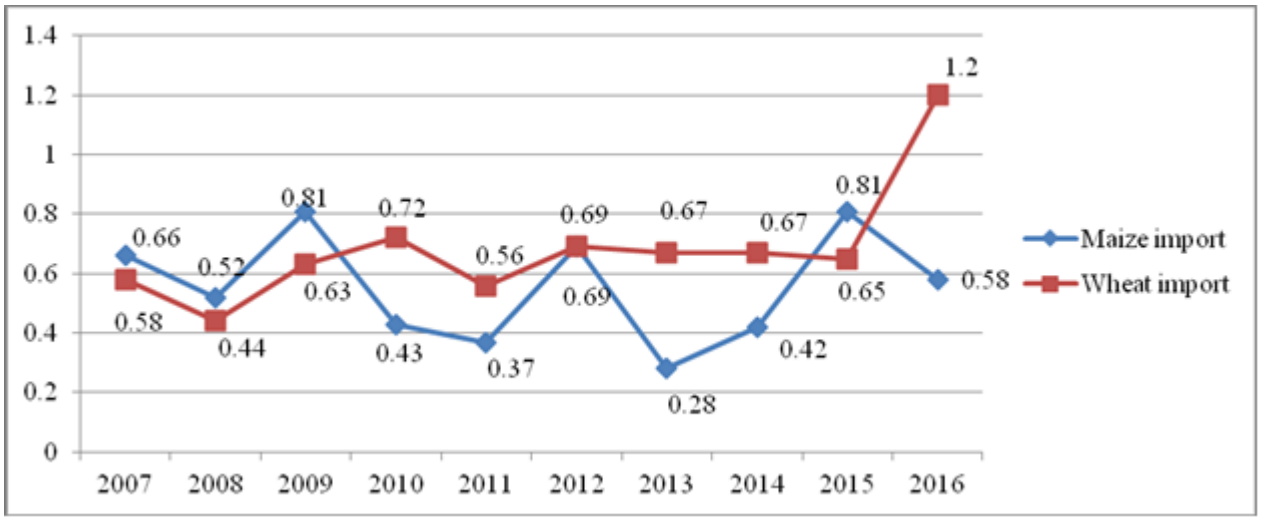

Fig.5.Dynamics of maize and wheat imported amounts by Romania, 2007-2016 (Million tonnes)
Source: Own design based on the data from [12]

In Table 7 are shown the values for average, standard deviation and variation coefficient for maize and what imported quantities. In case of maize import, the variation coefficient was very high, over 30 %, reflecting heterogeneous data in the analyzed period. But, in case of wheat, the variation coefficient was lower than 30%, reflecting relatively heterogeneous data.

Table 7. The average, standard deviation and variation coefficient for maize and what imported amounts in the period 2007-2016

	Mean	Std. Deviation	Coefficient of variation (%)
Maize import	0.55	0.18	32.72
Wheat import	0.68	0.20	29.41

Source: Own calculation based on the data from [12].

The main commercial partners for cereal import are Hungary, Bulgaria and Slovakia.

However, the imported cereals, especially of wheat, are not used in most of cases in Romania, but reoriented to other markets [26].

Export/Production Ratio. In the analyzed period, due to the increased production, but also due to the development of export, the export/production ratio registered an increasing trend. In 2016, in case of maize, export/production ratio accounted for 0.32, being 4 times higher than in 2007. In case of wheat, export/production ratio was 6.42 times higher in 2016, accounting for 0.82 compared to 0.07 in the year 2007 (Fig.6).

In 2011, this ratio was almost similar meaning that both export and import had the same weight in total production of maize and, respectively of wheat as shown in Fig.6.

However, in 2016, the share of wheat in wheat production was 2.5 times higher than the share of corn in corn production.

Export/Import ratio has recorded the highest dynamics. In 2016, its level was 7.78 in case

of maize and 5.82 in case of wheat, being over 1.6 times higher than in 2007.

This was due to the expand of export in a larger proportion than the import growth rate (Fig.7.)

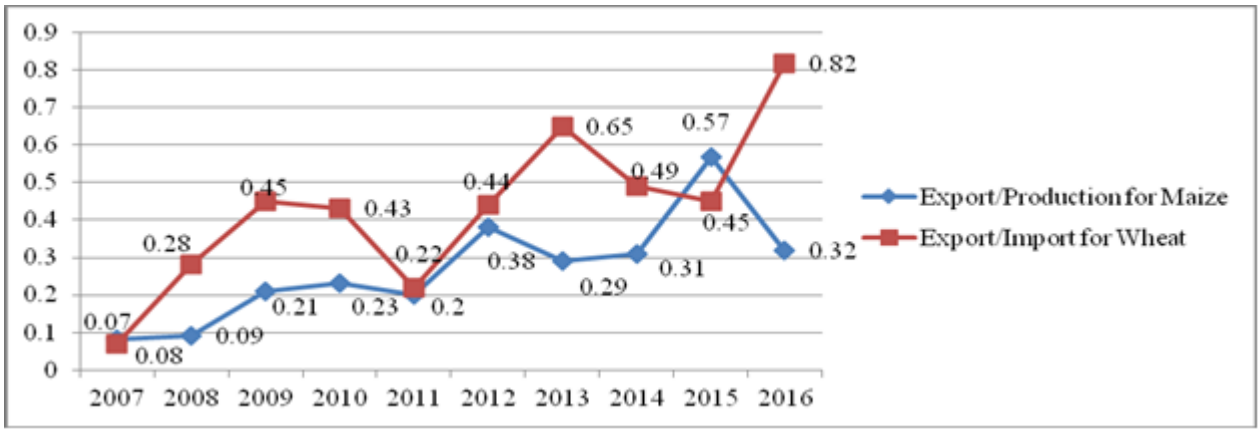

Fig.6.Dynamics of maize and wheat export/production ratio, Romania, 2007-2016
Source: Own design based on the data provided by FAOSTAT, 2018 [12]

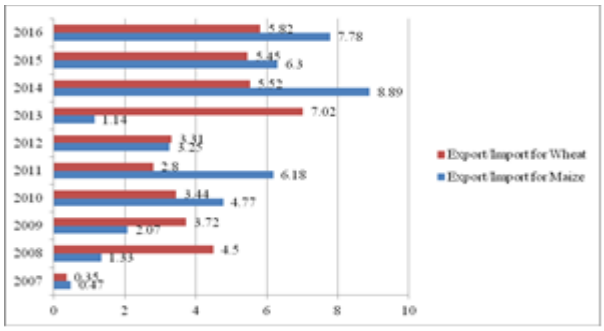

Fig.7.Dynamics of maize and wheat export/import ratio, Romania, 2007-2016
Source: Own design based on the data from [12]

Export and import value and trade balance. In the analyzed period**,** the maize export value increased 9.48 times, while the wheat export value raised 24.9 times. In 2006, maize export accounted for Euro Million 722.1 compared to import value which was Euro Million 147.8. As export value had a higher growth rate compared to import value, the maize trade balance has become positive after 2009. In 2016, it accounted for Euro Million 574.3.

The export value of wheat was much higher compared to maize export value. In 2016, the value of exported wheat accounted for Euro Million 1,160.7, being 24.9 times higher than in 2007.

The wheat import value reached Euro Million 337.3 in the year 2016, being 3.03 times higher than the level of the first analyzed year (Table 8, Fig.8).

Table 8.Maize and wheat export value, Romania, 2007-2016 (Euro Million)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2016/2007 %
MAIZE											
Export value	76.1	138.5	254.7	396.2	606.7	608.2	744.3	772.9	982.6	722.1	948.88
Import value	130.2	138.9	133.6	92.9	127.6	193.6	126.4	126.6	298.7	147.8	113.5
Trade balance	-54.1	-0.4	121.1	303.3	479.1	414.6	617.9	646.3	683.9	574.3	-
WHEAT											
Export value	46.5	385.2	304.7	378.0	313.0	548.5	989.6	963.2	700.5	1,160.7	2,496.12
Import value	111.1	99.3	80.9	115.9	117.0	121.9	127.6	120.0	120.7	337.3	303.6
Trade balance	-64.6	285.9	223.8	262.1	196	426.6	862	843.2	579.8	823.4	-

Source: Own calculations based on the data from [19].

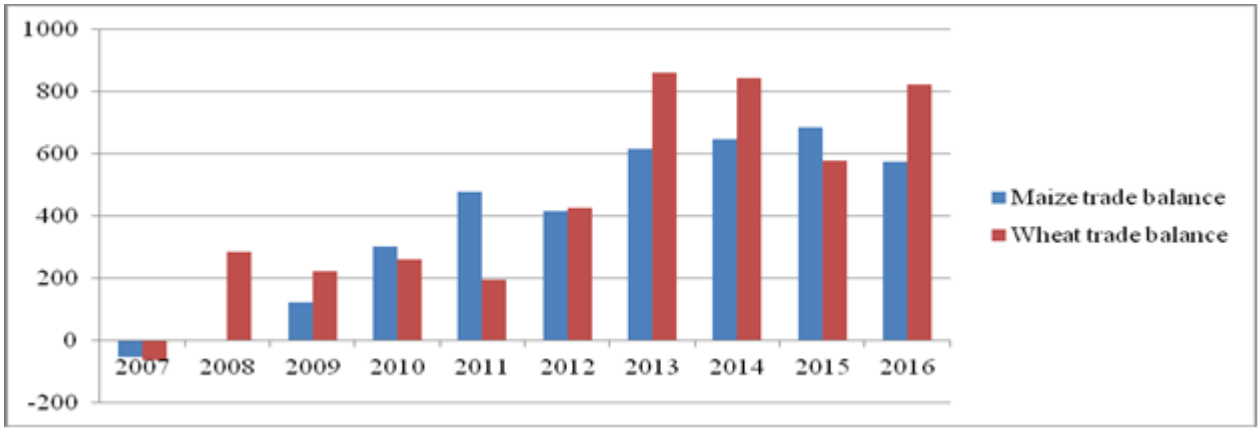

Fig.8.Dynamics of maize and wheat trade balance, Romania, 2007-2016
Source: Own design based on the data from [19]

The trade balance was deeply influenced not only by the exported and imported amounts, but also by export and import price.

The share of export value for maize and wheat in the agro-food export value. The weight of maize export value in agro-food export value ranged between 4.15 % in 2007 and 19.1 % in the year 2016, reflecting how important is this cereal in Romania's export of agro-food products.

The share of wheat export value varied between 6.7 % in 2007 and 11.7 % in 2016, with a peak of 16.6 % in the year 2015. Therefore, wheat is a main item in Romania's agro-food export.

All together, maize and wheat, represented 30.8 % of agro-food export value, compared to only 10.85 % in the year 2007 (Table 9).

Table 9. The share of maize and wheat export values in Romania's agro-food export value, 2007-2016 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	6.7	6.4	11.3	12.7	15.0	15.0	140	13.8	16.6	11.7
Wheat	4.15	17.8	13.6	12.1	7.7	13.5	18.7	17.2	11,8	19.1
All together	10.85	24.2	24.9	24.8	22.7	28.5	32.7	31.0	28.4	30.8

Source: Own calculations based on the data from [19]

Also, in the cereals export value, wheat export value represented 30.7 % in 2007 and 55.3 % in 2016, while maize export value accounted for 50.2 % in 2007 and 34.4 % in 2016.

The share of import value for maize and wheat in the agro-food import value. The weight of maize import value in Romania's agro-food import value had different levels during the analyzed period, varying between 3.8% in 2007 and 2.2 % in 2016. However, the highest level was 4.9 % registered in the year 2015. Regarding wheat, its export value represented 3.2 % in 2007 and 4.9 % in 2016 in Romania's import value of agro-food products. Taking into consideration the both cereals, their share in agro-food import value accounted for 7 % in 2007 and 7.1 % in 2016, but in the other years their weight was a little lower, with the minimum value 4.8 % in the year 2014. (Table 10).

Table 10. The share of maize and wheat import values in Romania's agro-food import value, 2007-2016 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	3.8	3.2	3.5	2.4	2.4	4.0	2.5	2.5	4.9	2.2
Wheat	3.2	2.3	2.1	2.9	2.6	2.5	2.6	2.3	2.0	4.9
All together	7.0	5.5	5.6	5.3	5.5	6.5	5.1	4.8	6.9	7.1

Source: Own calculations based on the data from [19]

The figures show the contribution of maize and wheat to the value of agro-food import in Romania.

In the import value of cereals, wheat represented 41 % in 2007 and higher weight, 56.9 % in the last year of the analysis, while the share of maize declined from 48 % in 2007 to 24.9 % in 2016.

Average export price. The both prices had various levels in the external market depending on offer/demand ratio, grains quality and other factors. Maize price varied between Euro 243.7 per tonne in 2007 and Euro 209.9 in the year 2016. The highest FOB price for maize was Euro 267.5 per tonne registered in the year 2012. Wheat price ranged between Euro 225.4 in 2007 and 165.9 per tonne in 2016, with the highest level Euro 259.7 carried out in 2014.(Table 11).

Table 11. Average export and import price of maize and wheat, Romania, 2007-2016 (Euro/tonne)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Average export price										
Maize	243.7	199.4	151.0	192.8	262.5	267.5	230.2	208.3	191.7	209.9
Wheat	225.4	193.6	130.1	152.4	199.5	236.9	207.3	259.7	197.0	165.9
Average import price										
Maize	197.1	266.6	164.3	215.8	341.4	277.2	444.9	303.4	367.4	253.3
Wheat	189.2	224.9	128.6	161.0	209.4	174.5	187.8	178.8	185.0	281.1

Source: Own calculation using the data from [12, 19]

The export price reflects the major trends in the world cereal market, regarding demand/offer ratio and quotations on the stock exchange. the major problems in Romania's export with cereals is linked to climate change and Romanian agriculture is highly dependent on the meteorological conditions as long irrigation systems are operating on a small surface. The nonsufficient storage capacity is also a problem which determine farmers to sell their grains immediately after harvesting and to get a low price [1].

Average import price. In case of maize, it varied between Euro 197.1 in the year 2007 and Euro 253.3 per tonne in 2016. The highest maize import price accounted for Euro 444.9 in the year 2013.

In case of wheat, its average import price varied from Euro 189.2 in 2007 and Euro 281.1 per tonne in 2016. The lowest import price was noticed in 2009, accounting for Euro 128.6 for wheat and for Euro 164.3 per tonne for maize (Table 11).

The ratio between the average export price and the average import price. In case of wheat, this ratio registered higher levels than 1 in many years, except 2008, 2010, 2011 and 2016. In these four years, this ratio reflects that wheat was imported at a higher price than the export price, and this had a negative influence on the wheat trade balance. In case of maize, the export/import price ratio was unfavorable in most of the years, except 2007. Therefore, maize was sold at a lower average price than the import average price, resulting a negative impact of maize trade balance (Table 12).

Table 12. The ratio between export price/import price for maize and wheat, Romania, 2007-2018

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	1.23	0.74	0.91	0.89	0.76	0.96	0.51	0.68	0.50	0.82
Wheat	1.19	0.86	1.01	0.94	0.95	1.35	1.10	1.45	1.06	0.59

Source: Own calculations based on the data from [12, 19]

Gross Exchange Index (GEI) between average export price and average import price had the value 1.03 for 2016/2015. This value shows that for maize and wheat, the ratio between the average export price and the average import price was over unity, GEI>1, reflecting that the two agricultural products have a high purchasing power.

CONCLUSIONS

Maize and wheat productions increased 2.8 times in the analyzed period, accounting for 10.7 million tonnes and, respectively, 8.4 million tonnes in 2016. Maize represent 50 % and wheat 38.5 % of cereal production of Romania.

Based on production level, Romania occupies the 2nd position for grain maize and the 5th position for wheat in the EU, while at the world level, it is situated on the 18th position for wheat and on the 12th position for maize.

The production performance is due mainly to the large surfaces cultivated with these cereals, in 2016, accounting for 2.6 million ha maize and 2.1 million ha wheat, representing 18.5 % and, respectively, 14.5 % of the cultivated area in Romania. The both crops totalize 85.45 % of the cereals cultivated area.

In 2016, maize yield and wheat yield reached 4,163 kg/ha and, respectively 3,944 kg/ha, much more than in 2007. Despite that these yields are higher than in 2007, yield performance in Romania is still very low. In case of wheat, yield level is by 16.56 % higher than the world average and by 26.22 % smaller compared to the EU average. In case of maize, yield carried out by Romania is by 28 % smaller than the world average and by 42.39 % smaller than the average in the EU.

An important growth was noticed regarding export of maize and wheat. In 2016, Romania exported 1,101.2 thousand tonnes maize, 11 times more than in 2007 and 6,994 thousand tonnes wheat, 34 times more. Export increase is justified first by the effort to assure a good grain quality for covering the EU market needs and, secondly, by the need to satisfy the demand in some countries from the Middle East and Africa.

In 2016, Romania imported 583.4 thousand tonnes maize and 1,200 thousand tonnes wheat. While maize import is lower, wheat import is much higher than 10 years ago.

In country like Romania, an important producer of cereals, import of wheat and maize is justified only in the years affected by meteorological phenomena when production is low. But, during the last years, it was noticed a practice among traders to import these cereals especially from Hungary and Bulgaria in order to re-export them to other destinations.

Export/Production ratio in terms of quantity registered an ascending trend mainly in case of wheat. In 2016, it accounted for 0.32 in case of maize and 0.82 in case of wheat.

Export/Import ratio in terms of quantity also registered a positive evolution reaching 7.78 in case of maize and 5.82 in case of wheat in the year 2016.

Export value increased 9.48 times in case of maize and 24.9 times in case of wheat. Import value registered a lower increase in the both cases, which resulted in a positive trade balance. This reflect an intensified effort of Romania in the international trade with wheat and maize, as a consequence of the increased production performance.

As a result, in 2016, the share of maize and wheat all together in Romania's agro-food export value accounted for 30.8 % of agro-food export value, being 3 times higher than in 2007.

Average export price varied between Euro 243.7 and Euro 209.9 for maize and between Euro 225.4 and Euro 165.9 for wheat. Therefore, it is a descending trend in export price for these cereals.

The import price varied between Euro 197.1 and Euro 253.3 per tonne for maize, and between

Euro 189.2 and Euro 281.1 per tonne for wheat.

This increase of the import price had a negative influence on the ratio between export and import price. While wheat has a better situation with many years when export/import price ration was over 1, in case of maize in most of the years, this ratio was lower than 1.

As a final conclusion, the obtained results confirmed Romania's efforts to produce and export more maize and wheat. This has a benefic effect on the trade balance and for the country promotion among the most important producers and exporters of the EU. These two agricultural products are in a permanent competition for production performance and to conquer new markets. To reach this purpose, new efforts are needed to increase yield using high breeding value hybrids and

modern technologies. Investments are required in machinery and irrigations, and also fertilization and plant protection should be assured in a corresponding level. Joining in associative forms is compulsory to increase farm size, capital and human resources to better work the land and benefit of a higher productivity and economic efficiency.

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SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE WATERSHED MANAGEMENT PROJECTS IN DAM CATCHMENT

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Abstract

The purpose of this descriptive-correlation study was to investigate socio-economic and environmental impacts of the watershed management projects in Mahabad's dam catchment. The research instrument was structural questionnaire with close-ended questions which its validity and reliability was confirmed. The target population of this study consisted of all householders who lived in Mahabad's dam catchment (N=2,458) out of which, according to Cochran's formula, a number of 175 people were selected using cluster sampling in a simple randomization method (n=175). The descriptive results indicated the status of environmental, economic, and social impacts of watershed management in Mahabad's dam catchment were at nearly high, nearly appropriate, nearly and low levels, respectively. These results also showed the main economic, environmental, and social impacts of watershed management were changing dry farming into irrigated farming, controlling flood, and attracting rural people's participation, respectively. The results of Friedman test indicated environmental and social impacts were the most and the least amount of impacts of watershed management in Mahabad's dam catchment, respectively. The results of correlation coefficient showed that there was the significantly positive relationship between land under cultivation and number of respondents' household individual who participated in agricultural activities with impacts of watershed management in Mahabad's dam catchment.

Key words: *catchment, economic impact, environmental impact, social impact,, watershed management, Mahabad, Iran*

INTRODUCTION

It is an undeniable fact that any activity done by human effects on the environment In fact, these effects were landscape of human activities in the nature. And identify these effects can shows the weaknesses and strengths of the plans. The evaluation of watershed projects was implemented have an important tool for managers and executives to evaluate the effects of these projects. this evaluating process not only evaluate and progress of projects ,but shows and determined the effects of these projects on various groups such as villagers [3]. Watershed can be very large (e.g. draining thousands of square miles to a major river or lake or the ocean), or very small, such as a 20-acre watershed that drains to a pond. A small watershed that nests inside of a larger watershed is sometimes referred to as a sub watershed. In mountain upland areas, there are unique blends of climate, geology, hydrology, soils, and vegetation shaping the landscape, with waterways often cutting down steep slopes [13].

Watershed management is an adaptive, comprehensive, integrated multi-resource management planning process that seeks to balance healthy ecological, economic, and cultural/social conditions within a watershed. Watershed management serves to integrate planning for land and water; it takes into account both ground and surface water flow, recognizing and planning for the interaction of water, plants, animals and human land use found within the physical boundaries of a watershed [9]. Parizangeneh [8] with his colleagues were suggests that it is very essential determining the effects of watershed management projects. But it was ignored in most developing countries. Also, Hope [5] pointed to this subjects that evaluated the effects of watershed management projects was very essential to provide information about what actions (good design) for whom (effects)

and how (resource efficiency). Important of the Impacts of watershed management projects were caused that several studies have been done on this subject. The world must rely on family farms to grow the food it needs and to do so sustainably. For this to happen, family Farmers must have the knowledge and economic and policy incentives they need to provide key environmental services, including watershed protection, biodiversity conservation and carbon sequestration [4].

In the formulation of (watershed management) plans, both the attributes of the land and water resources and the socio-economic factors which affect the development of the human beings in the area in general, and land-use practices in particular, should be taken into account. Why is it important to know about these human activities and where they occur in the watershed? These human forces interact with the natural forces to directly shape the condition of the land and water. For example, increasing impervious surfaces in the urban areas leads to increased water and contaminant runoff; removing vegetation along drainage areas and increased storm flows lead to erosion of soils which can change the landscape to more arid conditions; increasing the velocity of the water and contaminants it contains can be lethal to living things or it can create health hazards, reducing our quality of life [13].

Drasana [2] investigated the effects of agronomic, economic - social and environmental effects of projects in Madagascar Watershed. The results showed that the project was successful in three dimensions. Drasana [2] believed people participation caused for reach to this successful and leads to the formation of trust between operators and villagers.

Also Parizangeneh et al [8] pointed that in Zanjan watershed projects has failed to attract rural participation, reduced migration, employment and the provision of water for irrigation. But in this condition watershed management project could increase agricultural production and income of rural people, increasing the size of agricultural lands, agricultural lands to control seasonal floods and increases price of cultivated lands.

Hope [5] in his research shows watershed projects in India can't cause to increase farmers' income and access to water. Furthermore, their research shows that these projects lead on the wages of workers and a reduction in time to collect water for the household. Ghanbari and Ghodousi [3] in a similar study in the Semirom Township showed that according the internal rate of return and net present value of agricultural production watershed project having a positive effect. Moreover, they were shown that watershed projects couldn't has played an important positive role on the employment for rural people and prevent rural migration.

Sadeghi et al [10] in a study in Tehran province Kshar sub watershed management, shows that practices have a positive effect in reducing the amount of water flowing. Qualitative assessment of the results of watershed management practices (in Keshar) caused to reducing the number of flooding and water pollution. According rural point's watershed projects in the production of crops, migration of people, the vast barren lands, respectively, 63%, 55% and 37% has been effective. Also it is not significant the effects of watershed management projects on production, migration, and the extent of barren land in the study area [11]. Mirdamadi et al [7] showed that there is a significant positive relationship found between participation rates of people at different stages of the design variables of the Tehran Province Hablehrud and social groups, increasing responsibility, rising household incomes, increasing production to obtain new credit, increasing the volume of water Extraction of protecting natural resources and preventing floods and soil erosion. Also in Mirdamadi et al [7] results shows that there is no significant positive relation found between people's participation in various stages of design of the Tehran Province Hablehrud and reduce rural-urban migration, improved facilities, creating social cohesion, access to new inputs, increase job opportunities and increasing the cultivated area revealed. Mansourian and Mohamadigolrang [6] showed that watershed

projects in the Khorasanrazavi province's hasn't any effects on reduce of rural migration and employment them in rural areas. They suggest that one of the major benefits of the project was reduce flooding in the area. Also these projects don't have any effects in improving forage and satisfaction of local people in the implement of projects.

MATERIALS AND METHODS

The methodology used in this research involved a combination of descriptive and quantitative research and included the use of correlation and descriptive analysis as data processing methods. The Main purpose of the paper was to study socio-economic and environmental impacts of the Watershed Management Projects in Mahabad's Dam Catchment.

The target population of this study consisted of all householders who lived in Mahabad's dam catchment (N=2,458) out of which, according to Cochran's formula [1] a number of 175 people were selected using cluster sampling in a simple randomization method (n=175).

This area is composed of two sub home as name Kavtar and Bytas. Also Mahabad Dam is covered 82 villages, 15,374 people (2,458 households) and 79,300 hectares. Annual precipitation of Mahabad dam laying around 1.8 million cubic meters of container per year and loss ratio of it is about 0.61 percent and at the critical situation in the country is located in the fifth dams [12]. Continue this process led to the irreparable damage and will cause damage to the local economy of rural people. Therefore in recent years some of the watershed projects like biological projects (transplant, grass lading, keeping pasture) and mechanical projects (construction sediment retention mortar, gabion dam) has been carried out in rural areas. Cronbach's Alpha coefficient was 0.85 which demonstrated that the questionnaire was highly reliable.

The questionnaire was an instrument to collect data. The data were coded and analysed by using the Statistical Package for the Social Science (SPSS 21) for windows. Descriptive statistics (frequencies, means, standard deviations, range, minimum, and maximum) were used to describe analysed data. Also in analysis statistics researcher used spearman coefficient, Freidman Test for analysing the data.

RESULTS AND DISCUSSIONS

The average age of respondents was 46 years, that the majority of them (n=85 or 48.60 %) ranged from 41 - 53 years old.

Table 1. Describe the demographic characteristics of respondents

Variables	Level of variable	Frequency	Percent	Mean	Standard Deviation	Min.	Max.
Age	28-40	52	29.7	45.82	8.22	28	66
	41-53	85	48.6				
	54-66	38	21.7				
Agricultural experience	3-17	62	35.4	23.65	12.40	3	46
	18-32	65	37.1				
	33-66	48	27.4				
Land under cultivated	2-13	102	58.3	7.12	4.31	2	27
	14-25	63	36				
	26-36	10	5.7				
Education level	Illiterate	55	31.4				
	Elementary	36	20.6				
	Guidance school	37	21.1	5.24	4.42	-	14
	High school	30	17.1				
	Diploma	10	5.7				
	University degree	7	4				

Source: Research Findings

Respondent's agricultural experience was 24 years, that the majority of them (n=65 or 37.10 %) ranged from 18 - 32 agricultural experience years. Also finding shows that the average cultivated land by respondents was 7 hectares. Also the average of respondent's education was 5 years; also 31.4 percent of

them were illiterate. Other results are shows in Table 1.

Table 2 shows the Mean, Standard division, Coefficient of variance and ranking of economic, socio and environments effects of watershed projects. Ordinary the average of economic, socio and environments effects of watershed projects were 2.35, 2.76 and 3.51. This findings show that the situation of watershed projects in environmental effects in high level, in social effects was in average level and in economic effects was in low level. These results were shows watershed implanted projects have successful more in environmental effects rather than economic and social effects.

Also, the irrigated of l lands was according to Parizangeneh et al [8] and this finding opposite with the Hope [5] findings. Prevention of floods was according to Mansourian and Muhammadigolrang [6]; Sadeghy et al (2005) [12]; Mirdamadi et al [7] and Parizangeneh et al [8]. And increased of people participation was according to Drasana [2] finding and opposite with Parizangeneh et al [8] findings. These effects were the main effect economic, environmental and social demission in Mahabad Dam catchment in watershed projects. For the explanation for this result could be said of many people, especially farmers has participation in some issues that prevented of soil erosion like construction sediment retention mortar, gabion dam. The increase of people occupation as economic impacts has been in the fifth rank (Table 2).

Ghanbari and Ghodousi [3] explain this Mather with that when start operations in the watershed needs to labour works. And temporary the project provides employment for the first and two years for rural people. But in later years, these actions do not attract usually rural people in the kind of tasks and activities to this type of operation.

Table 2. Prioritizing the economic, social and environments effects in Mahabad Dam catchment in watershed projects

Category	Variables	Mean	SD.	CV	Rank
Economic effects	Being irrigated arable land	3.45	0.93	0.369	1
	Increase crop production	3.80	1.11	0.292	2
	Increase in farm income	4.04	1.21	0.299	3
	Reduce costs of Farm	2.84	0.92	0.323	4
	Enhance the Employment levels in the region	2.62	1.13	0.431	5
	Increase the price of Farm lands	2.19	1.11	0.506	6
	Access to new credit	2.24	1.16	0.517	7
	Increase the Level of agricultural lands	2.07	1.12	0.541	8
	Increase forage	1.65	1.45	0.878	9
	Total	2.76	1.12	-	-
Environmental effects	Prevent floods	3.95	1.01	0.255	1
	Reduce soil erosion	3.86	0.99	0.256	2
	Rangeland Rehabilitation and prevent the destruction of pasture	3.6	1.14	0.316	3
	Probe aqueducts, wells and springs	3.26	1.42	0.435	4
	Reducing the water pollution	3.30	1.47	0.445	5
	Reducing water flowing	3.18	1.47	0.462	6
	Total	3.52	1.25	-	-
Social effects	Increasing people participation	3.85	0.92	0.238	1
	Enhance the rural quality rather than other villages	2.62	1.13	0.431	2
	Sustainability of the rural population and decrease the migration of them	2.95	1.34	0.454	3
	Creating social cohesion	1.78	1.24	0.696	4
	Gain new experience about conservation of natural resources	1.42	1.28	0.901	5
	Regional and me development	1.50	1.36	0.906	6
	Total	2.35	1.21	-	-

Source: Research Findings

The important point in this results should be considered: the relationship between the lower position to increase livestock forage (CV= 0.878) in the economic impact, the position of reducing soil erosion (CV=0.256) and reclamation and prevention of pastures (CV=0.316) as the environmental impacts and low status of migration (CV=0.454) and the

creation of social relation (CV=696) as the social impacts of watershed management projects implemented in a watershed area (Table 2).

For explain this issued must be pointed to some subjects, in recent years participation of rural people in some of the watershed projects like biological projects (transplant, grass lading, keeping pasture) and mechanical projects (construction sediment retention mortar, gabion dam) has been carried out in rural area caused to reduction and delete the use of natural resources by people. This paradox between cattle rancher's activities and conservation of natural resources by natural resource organization caused to re-education and prevent of use pasture for ranchers livestock. On the other hand, due to the rural people don't have another income activity they get to the illegal exploitation of pastures. In most subjects this material caused to they pay fines. In some cases ranchers was sold their livestock and migrate to the city. On the other hand, in some rural areas some rural volunteers exist that they are responsible for protection of natural resource? And if an individual is protected from grazing, report to the organization of Natural Resources. The same issue caused major tensions among the villagers and rural volunteers. In some cases, cause annoyance, fighting and thereby reduce the level of people's participation in such plans.

The Friedman test was used for deterring the deference's among economic, social and environmental effects of Mahabad Dam catchment watershed projects. The results shows that there is a significant differences was found among economic, social and environmental effects of Mahabad Dam catchment watershed projects ($p=0.000$; $x^2=121.120$).

Table 3. Ranking the economic, social and environmental effects of watershed projects

Effects	Mean rank	Rank	Classify
Environmental	2.66	1	A
Economic	1.95	2	B
Social	1.39	3	C

Source: Research Findings

The results shows that environmental effects with mean ranking (2.66) was the main effects of watershed projects and social effects by ranking mean (1.39) was the lowest effects of Mahabad Dam catchment watershed projects (Table 3).

The results of Spearman coefficient shows that there is no significant relation found between age of respondents, experience in agriculture activities and level of education with effects of watershed projects in Mahabad Dam catchment. Therefore, stating with 95% that the relationship between these variables and the effect of Mahabad Dam watershed projects, there is no significant relationship.

This status indicates that the respondents have same viewpoints about watershed projects effects.

Also finding shows there is a positive and significant relationship found between level of cultivated area ($p<0.01$; $r_s=0.402$); number of family member cooperated in agricultural activities ($p<0.05$; $r_s=0.301$) with level of watershed projects effects.

Table 4. Investigation relationship between variables and watershed projects effects

Variables	r_s	p
Age	0.078	0.347
Agricultural experience	0.318	0.145
Level of cultivated lands	0.402**	0.000
Number of family member cooperated in agricultural activities	0.301**	0.000
Level of Education	-0.153	0.064

Source: Research Findings

CONCLUSIONS

Watershed management is an adaptive, comprehensive, integrated multi-resource management planning process that seeks to balance healthy ecological, economic, and cultural/social conditions within a watershed. Watershed management serves to integrate planning for land and water; it takes into account both ground and surface water flow, recognizing and planning for the interaction of water, plants, animals and human land use found within the physical boundaries of a watershed. Watershed management provides a framework for integrated decision-making to

help: assess the nature and status of the watershed; identify watershed issues; define and re-evaluate short and long-term objectives, actions and goals; assess benefits and costs; and implement and evaluate actions. Mahabad Dam catchment area of economic and agricultural activities in rural areas is very important. And this catchment was known as one of the main arteries of the watersheds in the province of West Azerbaijan province in recent years, ie from 2008 onwards several watershed management plans as biologically and mechanical has been done in the rural areas. This study was conducted to answer the question what is the economic, social and environmental – impacts of watershed projects among rural people. The result shows that projects have a significant effect in the environment area. While in economic and social field has failed to achieve much success. Freedman's test results indicate the subject. The respondents believe that the effects of watershed management schemes is implemented in the area on issues such as attracting popular participation, flood control and irrigated agricultural lands. Unfortunately, these plans failed to have much success in employment, increase forage, migrate and establish correlations social unwillingness to play. Also, respondents with the age, history of agriculture and education, which have similar opinions, have about the effects of watershed management plan been implemented. This situation, while the increase in acreage and number of family members of respondents who are involved in agricultural activities. Their views on the effects of watershed management projects implemented in the area improved.

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SUSTAINABILITY, COMPETITIVITY AND FUTURE PERSPECTIVES FOR RURAL DEVELOPMENT TOWARDS BIOECONOMY - TULCEA COUNTY CASE STUDY

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Abstract

The present study aims to highlight the main features of economic activity in the Tulcea county, with specific interest in agriculture and the rural development sector. Regional goals for the revitalization of the rural area fostering sustainable development towards bioeconomy are based on the general aims of European strategies in this area. The settlement of regional bioeconomy in the Tulcea county and the neighboring areas, has great potential due to the high availability of the biologically based raw materials. Agriculture is well represented and it may become a cornerstone for food processing industry, boosting the economic progress. The paper employed a quantitative and a qualitative analysis using official strategy reports and statistical data in order to review the latest available data regarding the development of economic activities in Tulcea county. The statistical data were retrieved from the tempo on line data base.

Key words**:** *rural development, sustainability, Romanian coastal area, agriculture*

INTRODUCTION

To promote an efficient development and revitalization of rural area in Romania, the proper assessment of the current situation is needed. The challenge is to compare the sectors of bioeconomy while capturing their diversity.

Tulcea County is situated in the South-Eastern extremity of Romania, in Dobrogea region, being crossed by Parallel 45, to the west, to the north being bordered by the Danube and east of the Black Sea [7]. The structure of the land areas is diversified, being dominated by the reed-fishery and agricultural uses.

However, agriculture represents the major economic sector in the region, with high importance in bioeconomy area, fostering the establishment of the environment – economic development system [1].

In the Romanian coastal region, the agricultural sector accounts for 32 % of jobs (30 % in the whole country). Generally, the development strategy of this region, observes the Sustainable Development Strategy of UE, namely the overall objective to improve the management of natural resources and to avoid their excessive exploitation, to recognize the value of ecosystem services [8, 9].

At regional level, the goal should be to reach a superior valorization of the available biomass and agricultural land, and assuring in the same time a sustainable management of natural resources. For a future integration of rural development, it is vital to find a balance towards a new perspective on traditional and high-value production, as well as creating opportunities and jobs for farming, forestry, fisheries, aquaculture and industry.

This paper presents an overview of the most recent available data regarding the development of economic activities in Tulcea county, with impact on the rural development towards a circular bioeconomy of the coastal area situated within its boundaries.

MATERIALS AND METHODS

The data analysed was extracted from a wide range of statistical information provided by NIS database and MARD database. The research has a conceptual and a methodological dimension. The information was subjected to qualitative research methods,

processed through observation, analysis, assessment and comparison of data originating from official databases. The selective analysis of the specialised literature can lead to identification of current status and future trends, thus providing the necessary arguments for an objective conclusion, visualizing correlations between conceptual models.

From a methodological point of view, the technique of indirect research was used, with various articles and specialized studies published until now [2, 3]

The study aims to highlight the main features of economic activity in the Tulcea county, with specific interest in agriculture and the rural development sector.

RESULTS AND DISCUSSIONS

The current economy of Tulcea county is characterized by a diversified industry, a private-based farming, trade favoured by the existence of all categories of means of transport (road, rail, river, sea and air) as well as tourism accentuated by the valorisation of Danube Delta attractions [4].

As most of the county's surface is included in the Danube Delta Biosphere Reservation with most of Romanian coastline, there is an inevitable conflict between nature conservation, environmental protection and preservation and on the other hand, the need for economic development.

The county's surface is 8.499 km^2, representing 3.5% of the total area of Romania. The county comprises 51 administrative-territorial units, of which: Tulcea, the county residence - with one third of the population of the county, 4 towns, 46 communes (Table. 1).

From the population's point of view, according to NIS data (2016), over 240,000 people live in the Tulcea county, over 50% in rural area.

Tulcea county has the lowest populatin density of the country, due to the large water surface (Danube Delta and the Razim-Sinoe Lagoon Complex representing 40% of the area of the County).

Table 1. Tulcea County - Facts and figures

Basic facts	**Year 2016**
Area [km^2]	8,499
Population	243,419
• population density	28.6
• population by age (0-19 years)	48,057
• population by age (20-64 years)	159,343
• population by age (over 65 years)	36,019
Number of settlements /total/	51
Number of cities	4
Number of communes	46
Number of villages	133
No of person employment in agriculture	79,600
No of person employment in industry	22,400
Structure of companies according to the number of employees	
• Micro (0 – 9 persons)	4,152
• Small (10 – 49 persons)	435
• Medium (50 – 249 persons)	68
• Large (>250 persons)	10

Source: Own calculation on the basis of data from Tempo on line data base for 2016, NIS

Taking into consideration that almost 30% of the population is employed in the primary sector and an important share of the population is living in rural areas, it is widely recognized that farming activities hold a very important place in Romania's economy [3].

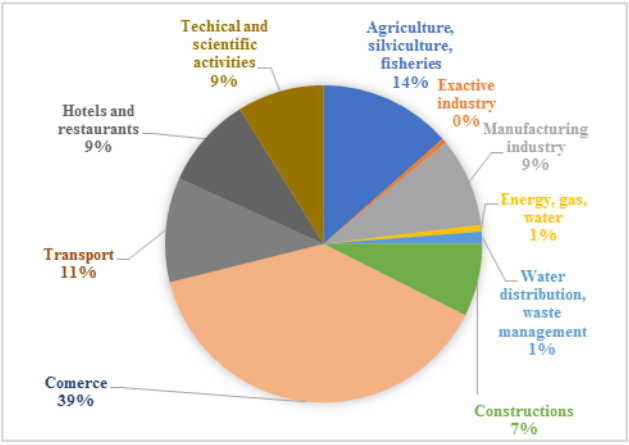

Fig. 1. Companies in Tulcea region according to main national economical accounts
Source: Own design

The companies activating in the area are mostly concerned with commerce (39 %), followed by agriculture, silviculture and fisheries (Fig. 1).

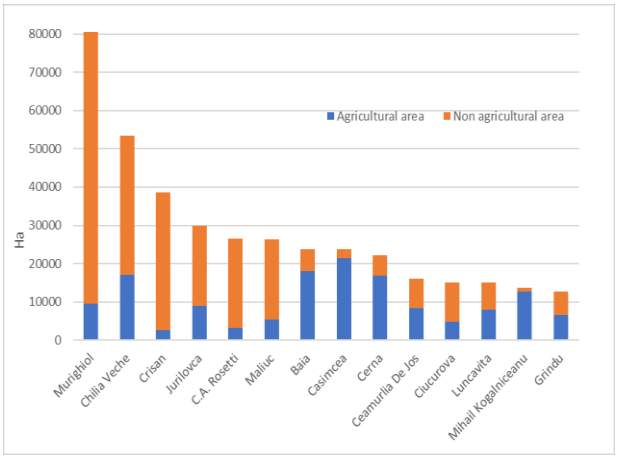

Fig. 2. Land utilisation by settlements, Tulcea County 2014
Source: original data retrieved from data from Tempo on line data base for 2016, NIS

However, agriculture is expected to remain the source of income for most of the population in the study area. 36% of the localities have over 80% of the area occupied by agricultural crops (Fig. 2.)

As mentioned in official reports, agriculture and forestry account for one third of the total workforce in Tulcea County, followed by fisheries, industry and services [NIS data].

In spite of this, agriculture is a branch with limited potential in the area due to the limited land areas and the low soil fertility (predominantly poorly developed salt and sand and alluvial soils).

The structure of production is dominated by field crops. More than 95% of the total area is cultivated with field crops, mostly cereals (70%), followed by oil plants 11%, sunflower (8%), and rapeseed (3%). Orchards cover only 0.04% the total cultivated area reducing the possibility of having higher agricultural revenues [NIS data].

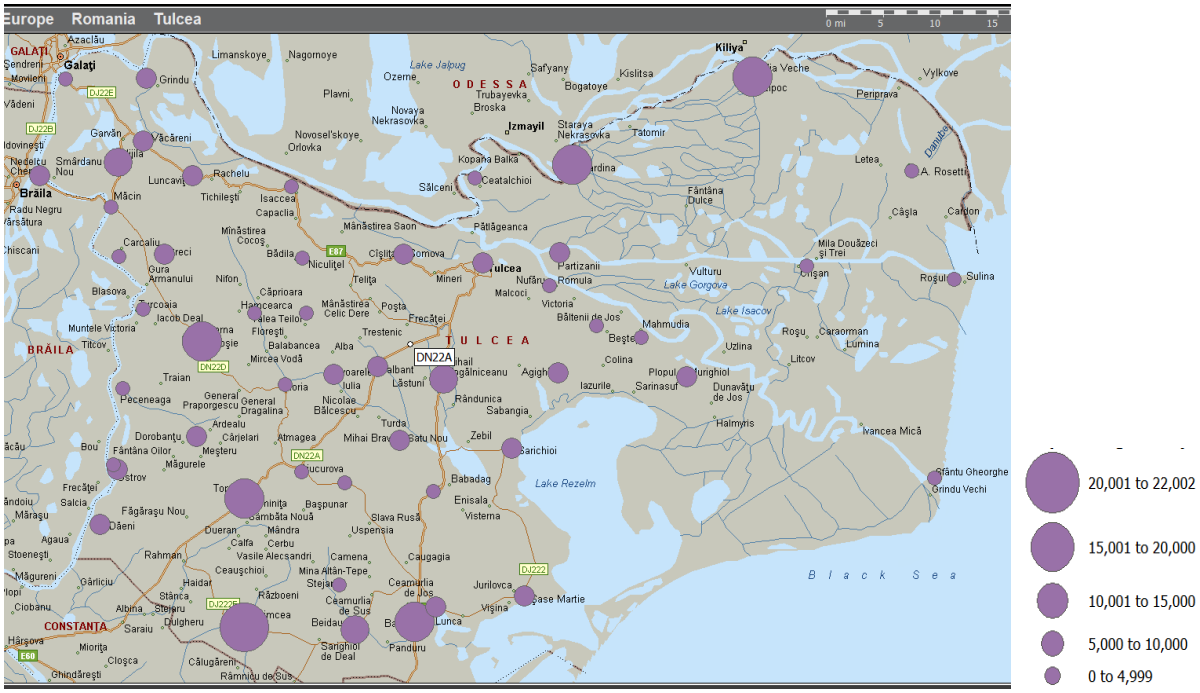

Fig. 3. Major teritories with Agricultural area in Tulcea county, 2014 (ha)
Source: [5]

An official report on Danube Delta area Spatial planning project [5] identified the following trends in the agricultural area of the region:

-Western and southern areas, suitable for efficient agricultural exploitation, with large areas of agricultural land, pastures and meadows (Fig. 3);

-The diversity of crops in the agricultural area makes it suitable for sustainable development in the future;

-In the Western part of the region, favorable factors are generated by the proximity of Tulcea, the largest market and contact with the Dobrogea plateau (Malcoci-Murighiol sector);

-Areas with agro - tourism potential insufficiently capitalized due to the lack of adequate infrastructure. In these areas the degree of urbanization is very low;
-existence of 2 areas with a predominantly agrarian profile located as follows: one in the north-west and the other around Tulcea municipality insufficiently used for complementary cultures;
-mixed area predominantly appropriate for of vineyards and orchards (Luncăvita, Isaccea and Niculiţel) that need development [5].

From the point of view of functionality, rural settlements are classified according to the economic activities [4] prevailing as:
-Agricultural settlements - *Ceamurlia, Mereni, Jurilovca, Pecineaga*;
- Tourist settlements - *Murighiol*;
-Tertiary mixed settlements - Agricultural: *Valea Nucarilor*;
-Tertiary - industrial settlements: *C.A. Rosetti, Mihail Kogalniceanu, Niculiţel, Topolog*
-Fishery and tertiary settlements: *Sf. Gheorghe, Crişan.*

Industrial enterprises are mainly located in urban centers (Tulcea, Babadag, Isaccea, Macin and Sulina), but there are also several companies in rural settlements (Niculiţel, Topolog, Mihail Kogălniceanu and others). The industrial entreprises produce trawlers for fishing, pots, dormers, alumina and ferroalloys, refractory, furniture, timber, garments, canned fish, meat and milk preparations, alcoholic beverages, bakery, etc [7].

In Tulcea County, 10 quarries for building stone were authorized. These are mining exploitations from Măcin, Greci, Turcoaia, Cerna, Bididia, Somova, Isaccea, Luncaviţa, Denistepe and Başchioi.

Regarding the land-sea interaction, the regional strategy of development for the South East area of Romania [6] points out that the permanent assessment of the risks and impacts of the natural, traditionally unstable conditions is complemented by information on the anthropic impact, which negatively influences from ecological and economical point of view the coastal zone.

The main anthropogenic pressures identified in the Romanian coastal zone with significant impact on the environment come from the development of socio-economic activities in the area.

Among these can be mentioned the following activities [6]:
-Tourism
-Agriculture and food industry
-Ports and sailing. Industrial shipping
-Construction of vacation homes in tourist areas;
-Petrochemical refining industry
-Extractive industry: ores, sand from coastal areas of small depth
-Shipbuilding;

Future prospects

Regional goals for the revitalization of the rural area concerning sustainable development towards bioeconomy are based on the general aims of European strategies in this area. The settlement of regional bioeconomy in the Tulcea county and the neighboring areas, has great potential due to the high availability of the biologically based raw materials. Agriculture is well represented and it may become a cornerstone for food processing industry, boosting the economic progress.

The development of reed/biomass sector may potentiate the county's incomes, and especially the coastal area including the Danube Delta [1].

Moreover, the agricultural sector is a great producer of large amounts of residues which may be used as raw material in the circular economy. For example, straw shows the highest potential, of which the most promising are wheat straw and rape seed straw. Maize stover can be extracted from grain maize production, also [10].

For a balanced evolution of the land sea interactions, the strategy should go beyond traditional uses of resources including innovative bio-based technologies.

A better use of waste and the recovery of resources, such as nutrients, is recommended, thereby contributing to resource efficiency and circularity. Thus biogas plants and wind energy represent a good opportunity of the area.

The resources of the region are practically unlimited - the Dobrogea Plateau is one of the five areas with wind energy potential in the

country that have attracted the attention of investors. Wind farms were built in different areas of the county (Baia, Valea Nucarilor, Topolog, Măcin) [7, 8].

Due to the existence of Danube Delta Reservation and the coastal area of Black Sea, various forms of ecotourism may become available in the region,

Agriculture is essential to food security and is also a primary base for local entrepreneurship, employment and social development in many countries around the world [11]. But it can only contribute to sustainable and socially-inclusive economic development when stakeholders, policy makers and entrepreneurs in the sector are promote business opportunities, adapt to the challenges and continuously innovate [11].

CONCLUSIONS

At present, the development of Tulcea County's economy is highly dependent on agricultural production while other industrial and commercial activities are implicated with a marginal role. For the near future, agriculture and ecotourism is expected to remain the major economic activity for the residents of Tulcea county, and more specific the coastal region and the surrounding areas.

The analysis of long-term impacts of agricultural activities and intensification of tourism for shoreline development is highly recommended as part of a resource efficient transition towards circular bioeconomy.

Cultivation practices, sustainability issues, legislative restrictions, technical limitations and competitive applications are to be considered.

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INDIVIDUAL FARMERS AND THEIR REGIONAL DISPARITIES IN SLOVAKIA

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Abstract

The paper points out the regional disparities of the individual farmers in Slovakia and explains the notion of individual farmer according to the Slovak legal regulation. The interests doing business in agriculture as individual farmers is renewed. However, the related legal regulation which is very strict and vaguest needs to be amending mainly on the fact that some rules were created for the purposes of the Czechoslovakia. In spite of the fact that the number of individual farmers has been increased, there are proved some regional disparities in Slovakia. The most individual farmers are concentrated in the Bratislava, the Nitra, the Trnava and the Košice regions. In the Prešov and the Trenčín regions, there are minimum individual farmers. There is a positive spatial autocorrelation and the individual farmers are more concentrated on the fertile lowlands. Therefore the rural development policy should take into account the regional disparities among the regions and counties and support the role of individual farmers according to the priorities of a particular region.

Key words: *individual farmer, legal regulation, development, regional disparities, spatial autocorrelation*

INTRODUCTION

Small farms and family farming systems are the most worldwide favourable systems in the agricultural production. Especially, family farms are the biggest food producers in the world and create the most jobs in agriculture [6]. Family farms are the dominant business model in agriculture in the European Union and Europe as well [11]. Family farms are the business model mainly in small-scale agriculture. Family farms are considered as small farms by various authors [2], [6], [4]. They consider family farming as synonymous with small farms.

Small farms are diversified and contribute for maintenance of traditional values, environmental sustainability and economic flexibility than large farms [21], [6], [20]. Hennessy [11] show the significance of small farms, because large farms share in the global farm system only by a small proportion. The unique and substantial contribution of small farms is given to the food production, public goods creation, and balanced rural development as well [11]. Small farms contribute to a resilient, healthy and balanced regional development. A small farm can thus be seen as a complex and multifunctional entity, which engages in sustainability in its broadest sense - economic, social and environmental [8]. Because of high nature value, the farming systems fulfil an important role in the conservation of biodiversity across the European countryside [15]. However, small farms struggle to compete with large multi-national agro-businesses, they are under pressure from land grabbing, and they face serious challenges to secure public support, as they are often considered unviable and outdated [5]. Moreover, farming in urban environments is increasingly constrained and marginalised [22].

After the complex reforms in Slovakia including land privatization, land restitutions, decollectivization, and creation of new private ownership based farming organizations, market and price liberalization and introduction of market support and incentive framework [3], the dual farm structure has been created. On the one hand there are still large commercial farms (e.g. cooperatives and

commercial corporations) cultivating more than 80 percentage of agricultural land. On the other hand, there are small farms represented mainly by the individual farmers as a legal form of doing business in agriculture that could be established after 1990. It covers the most of small and family farms. The individual farmers create 67.15 % of all agricultural businessmen including the legal entities; however, they cultivate only 16.56 % of all agricultural land [18]. The average acreage of agricultural land which is cultivated by an individual farmer ranges from 46.97 hectares to 103.44 hectares [18]. It is negligible acreage of land when taking into account the average acreage of land cultivated by the cooperatives (1,267.26 ha), joint-stock companies (1,098.01 ha) or companies with the limited liability (455.85 ha) [18]. However, these statistical data do not prove the importance of the individual farmer for Slovak agriculture. And according to the above mentioned views, there are suggestions related to the very significant and worldwide roles of small farmers as well as considerations that small farms are outdated. By the number of individual farmers and their development in Slovakia and in the particular regions of Slovakia we would like to point out the present importance of this legal form of doing business in agriculture. The paper is organised as follows. The first chapter explains the notion of individual farmer from the legal point of view. The second chapter analyses the regional disparities in the number of individual farmer in the particular regions (NUTS III) of Slovakia. If there is an existence of regional disparities, we analyses if it is an accidental distribution of individual farmers in the space or there is a spatial autocorrelation among them.

MATERIALS AND METHODS

We used the statistical data about the number of individual farmers in the particular regions from the database STATdat and register of the organisations that are available at the Statistical Office of the Slovak Republic. The regional disparities are followed in the period 2004- 2014 according to the data available at the above mentioned database; in addition we selected some years to prove the regional disparities among the NUTS III. Moreover, we used the particular legal regulations, scientific papers and literature related to this topic.

There are used the method of legal science and the statistical and mathematical methods as well. The method of legal analysis is used in the first chapter to find out the problematic aspects of the legal regulations of the individual farmers. The quantitative methods should to prove non-accidental character of regional disparities in the number of individual farmers, mainly the descriptive statistics, statistical induction (non-parametric Kruskal – Wallis test) and the coefficients of spatial autocorrelation (Moran index and Geary index).

For non-parametric testing of the statistical significance differences among the regions NUTS III in the number of individual farmers, the Kruskal – Wallis test was used characterised as follows:

$$H = \left(\frac{12}{N(N+1)} . \sum_{j=1}^{k} \frac{R_j^2}{n_j} \right) - 3.(N+1)$$

H – Kruskal – Wallis test characteristics
N – total number of regions (all groups combined)
Rj – rank total for each group
nj – number of regions in each above mentioned group
k – number of groups

For assessment of the spatial autocorrelation the Moran´s and Geary´s indexes were used.

Moran´s I-index is calculated on a variable *x* for observations *n* at locations *i* and *j*:

$$I = \frac{n}{S_0} \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2}$$

$\bar{x}$ - the mean of the variable *x*
w_{ij} – the weight matrix elements
S_0 – sum of the weight matrix elements calculated as: $S_0 = \Sigma i \Sigma j\ w_{ij}$

Weight matrix defines relationships between locations where measurement is made. We used the binary weights and provide the results in the Statistical Analytical System (SAS).

Moran´s I Index ranges from -1 to +1. Moran´s I index is near to zero when autocorrelation is missing. If Moran´s I index tends to +1, it indicates positive spatial autocorrelation. If Moran´s I index is near to -1, negative autocorrelation is high probably [14].

Geary C-index is calculated as follows:

$$C = \frac{n-1}{2S_0} \frac{\sum_i \sum_j w_{ij}(x_i - x_j)^2}{\sum_i (x_i - \bar{x})^2}$$

Geary´s C index varies from zero to a positive value. The value 0 signalises a maximal positive autocorrelation. The higher positive values indicate a higher negative autocorrelation [7].

Moran´s I index is sensitive to extreme values of x. Geary´s C index is sensitive to differences in neighbourhoods. Moran´s I index is preferred in spite of the fact that both indexes should result in similar conclusions [10].

RESULTS AND DISCUSSIONS

Notion of individual farmer in the Slovak legal regulation

The Slovak Commercial Code defines four groups of businessmen. The last one is a natural person engaging in agricultural production and registered in the special evidence of businessmen. The special business evidence was created by the Law 105/1990 Coll. on private business of citizens, mainly its second amendment (Law 219/1991 Coll.) which brought the legal definition of the individual farmer (§ 12a of the Law 105/1990 Coll.). Individual farmer is a natural person engaging in agricultural production on behalf of his/her name, his/her account and his/her responsibility by himself/herself or by help of other persons and for the purpose of permanent source of incomes. In addition the notion of agricultural production is a key to classify a physical person as individual farmers. According to the Law 105/1990 Coll. the agricultural production including the activities in the forest and water areas is:

a)a production of commodities of agricultural production for the purpose of permanent source of incomes, mainly by sales, eventually

b)processing of his/her agricultural production, or

c)occasional activities near to the agricultural production with the occasion to use the agricultural machinery in the season when it is not possible their full utilization for agricultural production, or mining the non-reserved minerals.

According to this definition of agricultural production, the base activity of the individual farmers is an agricultural production (plant and animal production) including the production in the forest and on the water areas. The other activities in the definition have only additional character to the agricultural production. It results from above mentioned definition a contrario that a natural person is no individual farmer if he/she is engaged in the agricultural production only for his/her own consumption or occasional sale of surplus.

By the legal definition, the additional activities to the agricultural production are:

(i)a processing of his/her agricultural production; however own agricultural production. It results a contrario that the processing of an agricultural production from another individual farmer or another natural persons or legal entity is not considered as an activity of the individual farmer. It means that the business license received by the registration in the evidence of individual farmer is not sufficient. This physical person needs business license from the Trade Licensing Bureau according to the Law 455/1991 Coll. Trade License Act.

(ii)occasional activities near to the agricultural production with the occasion to use the agricultural machinery in the season when it is not possible their full utilization for agricultural production. It means that an individual farmer may provide a service to another subject; however there are two

elementary characteristics of these services. Firstly, the service providing is only occasionally. There is no legal definition of the word "occasionally." We can use the synonym "temporary nature" and use the definition from the judgment of the European Court of the Justice. The temporary nature of the provision of services, envisaged in the third paragraph of Article 60 of the EC Treaty, is to be determined in the light of its duration, regularity, periodicity and continuity. Secondly, the agricultural machinery is used at the time when it is not possible their full utilization for agricultural production. So the agricultural machinery is primary used for the agricultural production but it could be used also for the non-agricultural activities if there is a capacity for its utilization mainly out of the agricultural season (e.g. snow plough or lawn mower at the public areas).

(iii)mining the non-reserved minerals. According to the systematic order of this rule, we can state that it is also only additional activity to the agricultural production and occasional activity with the use of the agricultural machinery in the season when it is not possible their full utilization for agricultural production. An individual farmer is not entitled to mine all kinds of minerals but only the non-reserved ones. The non-reserved minerals are the minerals which are not named in paragraph 3 (1) of the Act. No 44/1988 Coll. on the protection and use of mineral resources. The non-reserved minerals are e.g. stone, crushed stone, sand or peat. The reserved minerals are in the state ownership; the non-reserved minerals are a component of the land and belong to a landlord of the land plot.

The present legal regulation was prepared for the needs of Czechoslovakia and therefore it is outdated. Moreover, some of the legal rules are too vague and it is not clear if some activities are still considered as an activity of individual farmer or a business licence is necessary. When increasing interests to do business as individual farmers, there is a need of a new legal regulation of individual farmer as one of the legal form doing business in agriculture.

Regional disparities of the NUTS III in Slovakia

The number of individual farmers was decreased in the period 2004 – 2013; however after the economic crisis the number of individual farmers was increasing in the most of regions. The numbers of individual farmers is not developed similarly in all Slovak regions. The biggest decrease was recorded in the regions with the best conditions for agricultural production; in 2014 with the comparison to year 2004, there was less number of individual farmer about 36.56 % in Nitra region, 33.86 % in the Trnava region, 25.74 % in the Košice region. However, these regions maintained their position with the highest number of individual farmers per 1 km^2 of a region. We suppose that the most individual farmers are concentrated in the regions with the best agricultural conditions. The development of the numbers of individual farmers per 1 km^2 of the particular region is documented in the figure 1.

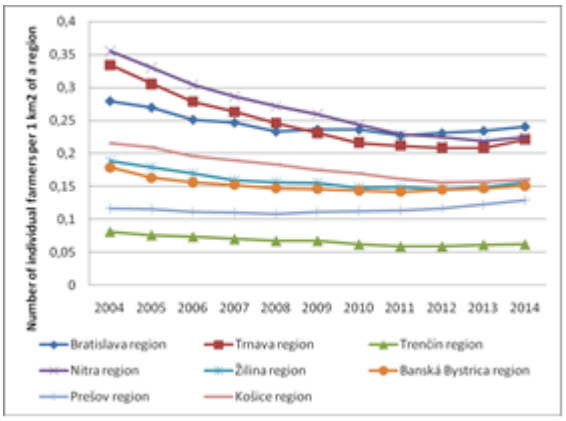

Fig. 1. Development of the number of individual farmers per 1 km2 of a region 2004- 2014

In the most regions, the decrease was stopped after the economic crisis (2012 – 2013).

The number of individual farmers is increasing in all regions what is similar to the trend in Slovakia as well. The individual farmers are oriented more on the plant production which is less costly than the animal production. Moreover, the revenues from the plant production are higher than revenues from the animal production [13], mainly from the production of maize, wheat and oil seeds.

There are no evident differences among the regions, so we need the statistical non-parametric test to prove or reject the hypothesis about the statistical significance differences related to the number of individual farmers among Slovak regions. We use Kruskal-Wallis test described above. The results are in the table 1. The numbers of individual farmers were calculated per 1 hectare of a county (LAU 1) belonging to the particular region (NUTS III). We tested the statistical significant differences in 2004 (access to the EU), 2011 (the biggest decrease of the individual farmers in the regions) and 2014 (period after the economic crisis and the starting point of increasing number of individual farmers in Slovakia).

Table 1. Differences in the number of individual farmers among the region in particular years

Region NUTS III	2004		2011		2014	
	mean	variance	mean	variance	mean	variance
Bratislava	0.00485	1.22E-05	0.004695	2.53E-05	0.004807	2.12E-05
Trnava	0.002806	3.29E-06	0.001775	1.23E-06	0.001877	1.1E-06
Trenčín	0.000876	2.08E-07	0.000661	1.53E-07	0.000678	1.38E-07
Nitra	0.003602	2.04E-06	0.002357	8.34E-07	0.002322	7.27E-07
Žilina	0.001884	3.64E-07	0.0016	4.85E-07	0.001657	5.05E-07
Banská Bystrica	0.001687	6.76E-07	0.001322	2.18E-07	0.001418	1.87E-07
Prešov	0.00123	7.22E-07	0.001194	5.13E-07	0.00136	5.74E-07
Košice	0.002349	1.66E-06	0.001854	8.57E-07	0.001916	7.69E-07
p-value	0.00001836		0.000273		0.000155	
K-W statistics	33.8521		27.4846		28.8322	

Source: own calculations, 2018

By the results of Kruskal-Wallis test (the p-value is smaller than 0, 05 in all tested years), there are statistical significant differences among the regions in the number of individual farmers. The p-value is increasing and the value of Kruskal – Wallis statistics is slightly decreasing between the years 2004 and 2011. We assume that the regional disparities in the number of individual farmers were slightly decreased. However, the year 2014 shows a tendency to deepen the regional disparities among the regions NUTS III again.

Now, there is a question where the statistical significant differences are situated – among all regions or between some of them. The multiple range tests was used in the programme Statgraphics. There are no statistical significant differences among all regions. In 2004, there were statistical significant differences between the Bratislava region and the rest of regions (excluding the Nitra region). The statistical significant differences were also between:

-the Trnava region and the Trenčín and the Prešov regions;

-the Trenčín region and the Nitra and the Košice regions;

-the Nitra region and the Banská Bystrica, the Žilina and the Prešov region.

In 2011 and 2014, the statistical significant differences were between the Bratislava region and other regions of Slovakia. Therefore we exclude the Bratislava region from the observations and we repeated the tests without this region. Thus, we received the statistical significant differences also among other regions. The statistical significant difference in the number of individual farmers was between the Trenčín region and other Slovak regions in all tested years. The Trenčín region has the smallest density of individual farmers per 1 ha. The biggest density of individual farmers is on the lowlands where the most fertile lands are situated (e.g. the Bratislava region, the Nitra region, the Trnava region, the Košice region).

In general according to the Kruskal-Wallis test we can assume the decreasing trend of regional disparities in Slovak regions. However, it is not a trend among all regions of Slovakia. The statistical significant differences between the Nitra and the Žilina regions were disappeared till 2014; however, the statistical significant differences between the Trenčín region on the one hand and the Žilina, the Banská Bystrica and the Prešov regions on the other hand were increased.

With the context of regional disparities of individual farmers in Slovak regions, we considered the arrangement of the individual farmers in particular region is accidently or there is a spatial autocorrelation; it means if there are any relations among the counties (LAU 1) that create a cluster on the base of observed indicator (e.g. the number of individual farmers per 1 ha of a particular county in our case). The spatial autocorrelation is an existence of spatial structure of the mapped indicators in relation to their geographical nearness [9]. If the similar occurrence or attributes are situated nearer in a space, it is a positive

autocorrelation. If the markedly different values are aggregated, the negative autocorrelation is probably. If the data are situated in a space without any relations among them, the analysed values are not statistical significant [16].

We observed the number of individual farmers per 1 ha of a particular county in three selected years 2004, 2011 and 2014 (the reason of this selection is mentioned above). The results calculated by the SAS are in the table 2.

Table 2. Spatial autocorrelation in the numbers of individual farmers in Slovakia

Coefficients	Observed	Expected	StdDev	Z	Pr> |Z|
Moran´s I					
2004	0.457	-0.0204	0.110	4.341	<.0001
2011	0.302	-0.0204	0.0804	4.01	<.0001
2014	0.394	-0.0204	0.0861	4.813	<.0001
Geary´s c					
2004	0.914	1.0000	0.296	-0.28	0.7724
2011	1.223	1.0000	0.4283	0.52	0.6029
2014	1.122	1.0000	0.4092	0.299	0.7652

Source: own calculations, 2018

Moran´s I index is more effective than Geary´s c index [1] that evaluates only a positive autocorrelation [12]. Geary´s c index is non-significant; it means there is no autocorrelation and the individual farmers are situated in a space accidentally. However, Moran´s I index is more preferred and used more frequently; we state the conclusions from this result. Moran´s I index is statistical significant (all p-values are less than 0.05); therefore we can refuse the hypothesis about the non-existence of spatial autocorrelation and about the accidental arrangement of the individual farmers in Slovak regions. By other words, the numbers of individual farmers has a positive spatial autocorrelation (Z-score and Moran´s index are positive). The values of Moran´s index range from 0.302 to 0.457; it means the middle strong positive autocorrelation.

Moran´s diagram is centred on the position (0.0) because values of an indicator are considered as deviations from their means. Moran´s diagram creates four quadrants; each of them charts a particular type of relations between original values of indicators (localised on the horizontal axe) and average values of the neighbour indicators (localised on the vertical axe). The relations between values of indicators influence the regression slope that represents Moran´s I index [17]. Figure 2 documents Moran ´s diagram.

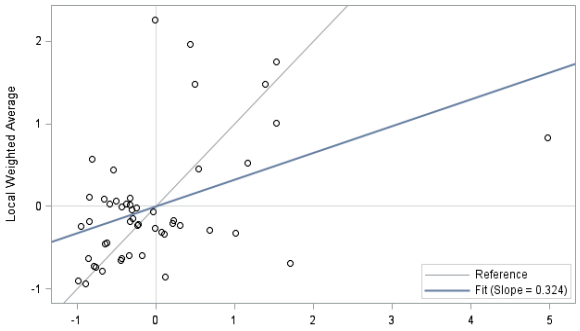

Fig. 2. Moran Scatter Plot

The units localised in the upper right quadrant (hot spots) and quadrant left bottom (cold spots) indicate the positive spatial autocorrelations.

The upper left quadrant and quadrant right bottom signalise the negative spatial autocorrelation. There are spatial outliers. Moran´s diagram signalises that the most of units is concentrated in the quadrant left bottom and in the upper right quadrant that proved the positive spatial autocorrelation of individual farmers in Slovak regions. It confirms the most of individual farmers are situated on the fertile lowlands of the Bratislava, the Nitra, the Trnava and the Košice regions. However, the positive effect that the individual farmers bring for the rural development is necessary also for the less fertile regions as well as the mountains regions.

Therefore the rural development policy should consider the regional disparities among the regions and support the role of individual farmers mainly in the less favourable regions for agricultural business.

CONCLUSIONS

The legal regulation of individual farmers is vague and strict and was created at the time of common state of Czech and Slovak countries. We assume that the renewed interest in the individual farmers needs new legal regulation that will limits more precise the agricultural activities of the individual farmers and their duties when starting their own business as well as during whole time of their business as individual farmers. The carefully legal regulations and political and economic incentives for small and new farmers should be focused also by law makers at the national level because it is a way how to support environmental sustainability, rural development and preserve traditional values of a country. It is also very important to prepare the incentives for new individual farmers however as well as to create the conditions for maintenance of individual farmers.

Moreover, the numbers of individual farmers were not developed in the similar way in all Slovak regions. There are statistical significant differences among the regions in the number of individual farmers that are slightly decreasing over the observed period of time. However, it is not a trend among all regions of Slovakia. The statistical significant differences between the Nitra and the Žilina regions were disappeared till 2014, but the statistical significant differences between the Trenčín region and the Žilina, the Banská Bystrica and the Prešov regions were increased.

The arrangement of the individual farmers in particular region is not accidently, there is a positive spatial autocorrelation among them. They are more concentrated in the regions typically by their lowlands and the most fertile lands. The political and economic difficulties are the reason why the biggest decrease was recorded in the regions having the best conditions for agricultural production. We assume that the positive effect that the individual farmers bring for the rural development is necessary also for the less fertile regions as well as the mountains regions. Therefore the rural development policy should take into account the regional disparities among the regions and support the role of individual farmers especially in the regions which are less favourable for agricultural business. However, at the time of political and economic changes, the support is necessary also for the individual farmers on the lowlands. The results proved the higher sensitivity of these regions on such changes because the decreasing of numbers of individual farmers was much higher than in other regions.

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EFFICIENCY OF THE USE OF THE "*PENISETUM PURPUREUM*" PLANT FOR AN ADEQUATE BALANCE IN THE C / N RELATIONSHIP AS A MEASURE TO CONTROL THE PRODUCTION OF SULF HYDRIC ACID AND THUS PREVENT ENGINE COHERRETION

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Abstract

The results of this study undoubtedly demonstrate that the plant Penisetum purpureum is a plant with great energy potential, and can become a great solution to be used as a source of biomass to produce biogas and therefore for the production of energy electric as an alternative energy source. In this experiment, we have comparatively studied three mixtures of substrate of animal origin (sardinia) and substrate of vegetal origin (Penisetum purpureum), with the purpose of determining the variables corresponding to different proportions in the mixtures taking as parameter the C / N ratio. ; and its incidence in the control and reduction of hydrogen sulfide in the biodigester. Laboratory analyzes were carried out for fresh weight, dry weight, volatile mass and biogas production, methane production and also at the level of a biogas production plant the volume of hydrogen sulfide was analyzed according to the different mixtures proposed. The main objective of this work was to compare the total production of biogas and methane versus the increase in the production of hydrogen sulfide and the control and reduction of this through the use of the species Penisetum purpureum as a contribution of carbon within the C / N ratio.

Key words**:** *biogas production, methane gas production, C / N ratio, Penisetum purpureum species, renewable energies,, Costa Rica*

INTRODUCTION

Obtaining fuels from different types of biomass, specially farming, has been explored for a long time. The attention in this products has increased in recent years due to multiple factor that have made us look for different energy sources, such as biogas, which may be inefficient if is not produced in the right way [7].

The interest of this study explains how the deterioration of the motors in mesophilic biodigestion stations has grown, as a result of the corrosion caused by the high content of hydrogen sulfide in the biodigestor, in some cases it increased more than 1,500 ppm when the permitted is in ranges from 50 to 100 ppm [2].

In most biogas stations, especially those that feed on substrate of animal origin, the problem is notorious and very harmful [9]. For this reason, this study is based on the need to develop an ideal mix of substrates taking into account the C/N ratio, which allows controlling and decreasing the production of hydrogen sulfide within the biodigestor [6], since it can be demonstrated that less quantity of hydrogen sulfide is better quality and quantity of both biogas and methane [8].

Taking into account this C / N ratio, we have also concluded that the species *Penisetum purpureum* has a great potential as an energy plant.

Table 1. Comparison between different energy crops yields

Energy crop	Yield Ton/ha	Energy MJ/kg	Price SUS/ton	Energy yield GJ/ha)	Income SUS/ha
Panicum virgatum	25	17.9	50	448	1,250
Miscanthus	39	17.9	50	698	1,950
Jatropha	1.6-2.0	42	700	67-84	1,120-1,400
Aceite de Palma	3.5-5.0	42	700	147-210	2,450-3,500
King Grass - Penisetum sp.	100-135	18.4	50	1,840-2,484	5,000-6,750

Source: Kukkonen, 2010.

In Table 1 we can see the benefits of this plant comparing it with other species that can provide us with the necessary carbon, to make more efficient the production of biogas with a hydrogen sulfide within the allowed parameters.

It is also important to mention that this species of plant Pennisetum purpureum, could become a solution to replace the use of corn, which in fact is already being restricted for the production of energy due to its great importance in food safety [10].

The main objective of the investigation:

Analyze different mixtures between substrates of animal origin (sow), from a pig farm; and substrates of plant origin (Pennisetum purpureum), with an adequate balance between the C/N ratio, which allows controlling the production of hydrogen sulfide.

Among the specific objectives we analyzed:

• Feeding the biodigester with different types of mix with contributions of sardinia and Pennisetum purpureum

•Analysis of variables such as pH, total solids, volatile solids and chemical oxygen demand (COD).

• Analysis of the relationship C /N

• Analysis of the production both in quantity and quality of biogas and methane versus the increase in the production of sulfhydric acid.

MATERIALS AND METHODS

The objective of this research is to understand how the use of a raw material of purely animal origin can affect the performance of a mesophilic biodigestion system both in quality and quantity of biogas or by-products generated in the process, in addition to this is intended to make known how the C / N ratio affects the aforementioned parameters and their role in reducing the production of hydrogen sulfide (H2S).

To carry out this study, the sources of carbon and nitrogen were studied separately, in this case the potential of *Pennisetum purpureum* was analyzed in the production of biogas, for which the sectioned plant was studied in each of its organs and its contribution in biomass (total solids) for the biodigestion process [12].

The potential for biogas production was analyzed at the laboratory level in 2 liters digesters, and the production potential of methane (CH4) was also obtained.

Alternating to the study conducted in *Pennisetum purpureum*, the production of biogas, methane and hydrogen sulfide was analyzed in a biodigester fed only with a source of raw material of animal origin, in this case pig manure (sowing). In addition, mixtures of different proportions of C / N between *Pennisetum purpureum* and the sow were made in order to study the change in the production of methane in its different proportions and if there is a reduction in the production of hydrogen sulfide, which is a primary objective in biodigestion systems currently used as the cost of repair of a motor damaged by hydrogen sulfide can amount to hundreds of thousands of euros [3].

RESULTS AND DISCUSSIONS

Initially, a comparative analysis was made of different green carbon sources in which Pennisetum purpureum was selected as the source with the greatest potential for the generation of biogas and with a higher quality index.

Table 2. Comparative analysis of different sources of biomass for electricity generation

Source	Biogas production (L / kg WS)	Methane contend (%)	Methane production (L / kg SV)	Electricity production (Kw / h * T)
Cow manure	380	55	30.096	105
Zea mais	610	52	61,52	215
Variety P. purpureum de Bajura	650	52	72.2	252
Variety P. purpureum de Altura	610	52	72.3	253
Sorghum bicolr, Var. saccharatum	620	52	60.15	207

Source: Viquez Saborio C., 2015 [14].

Among the varieties that were analyzed, Pennisetum purpureum was selected because of its great biogas production capacity in L / kg of dry matter, as can be seen in table 2, and it was also the one with the highest rate of

methane production. in L / kg of volatile solids.

Table 3. Biomass of Pennisetum purpureum plants and structure of components

Part of the plant	Green mass (G)	%	Total solids (G)	%	SV Content %
Root	303.5	43.0	63.1	32.6	20.8
Stem	105.1	14.9	24.2	12.5	23.1
Leaf	296.5	42.1	106.1	54.8	35.8
Total	705.1	100	193.4	100	27.4

Source: Viquez Saborio C, 2017, [15].

As can be seen in Table 3, the *Pennisetum purpureum* variety has a high content of both total solids and volatile solids, which makes it one of the best green raw materials that can be used in a biodigestion system[4].

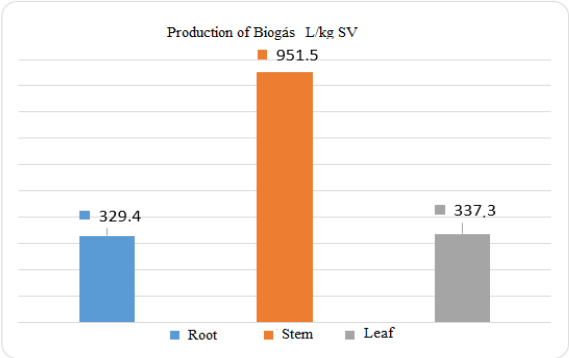

Fig 1. Biogas production by vegetative organ.
(Source: Viquez Saborio C, 2017, [15].

In *Penisetum purpureum* the total green biomass was 705.1 g / plant and the dry substance was 193.4 g / plant. In the biomass structure, the leaf organ represented the largest proportion of 42.1% of the green biomass and 54.8% of the dry matter produced by the plant.
The results suggest that the variety *Penisetum purpureum* is the grass with the greatest potential in energy generation due to its high efficiency at the level of total and volatile solids generated by vegetable organ.
Not only is it important to evaluate the behavior of biogas production of vegetative substrates, but also to evaluate the behavior of these in the production of methane and the effect obtained from this mixture in the generation of hydrogen sulphide [1], which is one of the objectives of the study, since an efficient biodigestion system has an adequate balance in the organic part, which is made up of 10% of the components of the mixture that must be used in a biodigester.
An analysis of the biogas production was carried out in a system fed only by a source of animal origin (sowing).
Figure 2 shows how an almost exponential increase in the production of hydrogen sulfide (H2S) in the biodigester is occurring, which is due to the low C: N ratio in the system.

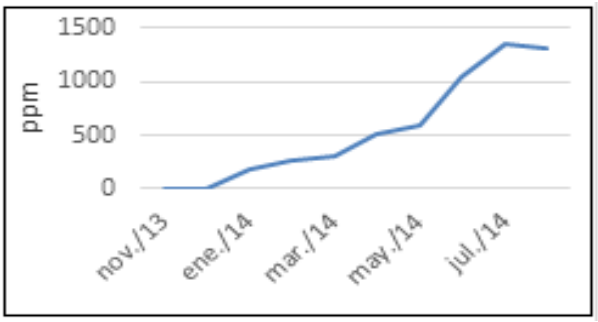

Fig. 2. Content of sulfuric acid in the biodigester fed only with pig manure.
Source: Viquez Saborio C, 2017 [15].

Levels of H2S above 1,000 ppm cause serious structural damage [16], in this case it is shown in Figure 3 how the engine of the biodigester is oxidized and degraded.

Fig. 3. Degradation of the engine due to the high content of hydrogen sulfide in biodigester
(Source: Viquez Saborio C, 2017, [15].

Analysis of the behavior of the biodigester in terms of the production of H2S with a balance in the C / N ratio.
Before planting in the biodigester, it was carried out in a hydrolysis process that was carried out under the conditions in Costa Rica,

it was a pre-fermentation process that did not last more than 10 days [11].

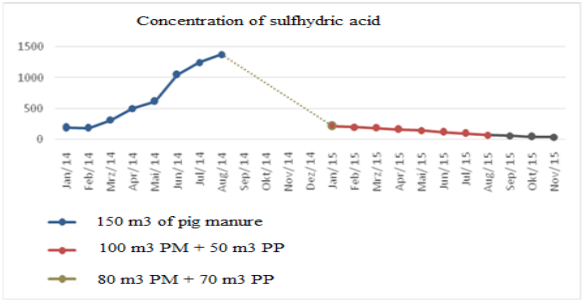

Fig. 4. Concentration of sulfuric acid after feeding with different types of biomass.
Source: Viquez Saborio C, 2017, [15].

How much biogas began to go with biomass, hydrogen sulphide began to decrease as shown in the previous figure.
The more we increase the amount of biomass through the *Pennisetum purpureum* plant, the lower is the sulfuric acid and we increase the production of biogas and methane in L / kg SV per day, as can be seen in the following figures.

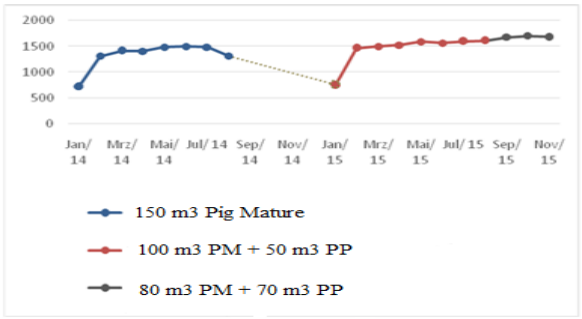

Fig. 5. Production of biogas after feeding different types of biomass
Source: Viquez Saborio C, 2017, [15].

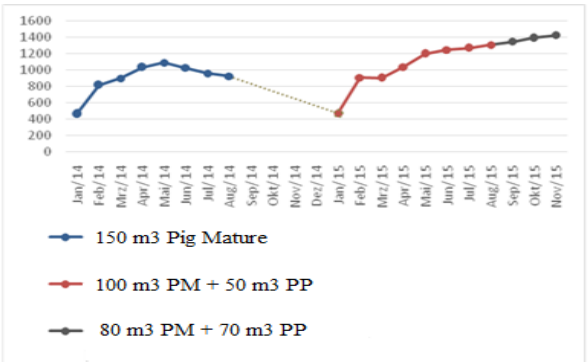

Fig. 6. Methane production after feeding with different types of biomass
Source: Saborio C, 2017, [15, 16, 17].

These data, we can conclude that the greater the amount of plant biomass (*P. purpureum*) used in the biodigester than the biomass from animal manure; the greater the amount of methane and the lower the amount of H2S. This is the most important part of anaerobic digestion because the concentration of methane depends on the caloric energy, which is what most interests us to produce good and efficient electricity [13].

CONCLUSIONS

The comparative analysis of the species showed that the *Penisetum purpureum* variety achieved a higher biomass production (705 g / plant) compared to the other sources of green biomass that were studied.
An increase in the amount of biogas generated in the biodigester was recorded when increasing the proportion of *Penisetum purpureum* used in the biodigestion mixture.
There was an increase in the quality of the biogas generated in the biodigester when the proportion of *Penisetum purpureum* used in the biodigestion mixture was increased as there was a significant increase in the production of CH4.
Research on different mixtures shows that the maximum level of biogas production is used when mixtures are used at a ratio close to 1: 1 between manure and plant biomass [5].
It was shown that by improving the C / N ratio in the biodigestion system there is a significant reduction in the amount of hydrogen sulphide [15] and thus preventing damage to engines or structures that could generate a malfunction of the biodigestion system.

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METHODOLOGY FOR ESTIMATION OF ECOLOGICAL SAFETY IN THE AGRICULTURAL OF UKRAINE

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Abstract

The article is devoted to research and development of methods for estimation of ecological safety in the agricultural area of the region's economy based on a comprehensive analysis of the main criteria and indicators that allow us to make motivated management decisions to prevent environmental threats and risks in this area. The methodology provides for the account of the integral index of ecological safety in the agricultural, which is defined as the sum of the normalized values of indicators (characterized by the corresponding indicator), taking into account the respective weighting coefficients. It is assumed that the difference in the dimensions of the parameters to be measured is eliminated by normalizing (transferring them to a dimensionless form). The estimation of the level of ecological safety in the agricultural of the regions of Ukraine has been carried out on the basis of the developed methodology. The distribution of the territory of Ukraine has been carried out on the following levels of ecological safety: stable, unsatisfactory, critical, crisis and dangerous. In general, the realization of the proposed methodology makes it possible to identify the features and trends of the ecological situation in the agricultural area of the region's economy in order to level out environmental contradictions in the form of a deviation between the actual and target state of agroecosystems in the process of balanced development of agriculture.

Key words: *ecological safety, agricultural, agrarian sector of economy, estimation, criteria, indicators.*

INTRODUCTION

The introduction of intensive methods of agrarian production of Ukraine, focused exclusively on economic development, has entailed a violation of the ecological balance between economic activity and agroecosystems. At the same time, the compensating nature management mechanism in the agricultural, which is currently in force in the country, puts forward only general restrictive environmental requirements for agricultural production and aims at eliminating environmental consequences, rather than preventing environmental threats and risks. Therefore, ensuring ecological safety is an essential element of public agrarian policy, since the most intense pollution of the environment, as well as other negative effects on it, occurs precisely in the process of human economic activity, the damage from which must be minimized.

Effective functioning of the system of ensuring ecological safety in the agricultural is impossible without a comprehensive estimation of the ecological state. Proceeding from this, the main part of the system of its ensuring is the analysis of the existing state and level of the object of research. The need for analytical assessment is indisputable, because it is its results that are the basis for making managerial decisions that allow choosing the optimal strategy, tools and methods in the framework of the organizational-economic mechanism for ensuring ecological safety.

However, taking into account modern theoretical-methodological developments and analytical developments in the field of ecological safety diagnostics in the agrosphere, it is worth noting that there is still no single generally accepted and normatively approved methodology for its assessment at various levels: state, regional, enterprise. Given this, important issues are the choice of methods for assessing the ecological state of the agroecosystems, in particular indicators that most objectively reflect the level of

ecological safety, as well as the corresponding interpretation of the results obtained with a view to selecting, on a certain basis, a strategy for managing ecological safety.

The existing methods of estimation of the ecological safety can be divided into three groups depending on the approaches: ecological safety estimation by the method of rationing, by the method of ecological risk and by the method of integral index. In addition, regardless of the method of ecological safety estimation, its basis is the output criteria for which it will be implemented.

These methods for analyzing ecological safety require the use of different evaluation criteria. Criteria in the framework of standardization techniques provide for an assessment of ecological safety in the following groups of indicators: the amount of emissions and discharges, MAC, soil contamination; the area of disturbed and technologically contaminated lands, plowing, etc. [1]. The advantages of these methods include: officially approved criteria, extensive experience of application, official statistical information illustrating these criteria. Deficiencies include the following characteristics: information bias, non-compliance with the specifics of production, lack of approved standards for all sources of environmental pollution, etc.

Proponents of the method of environmental risk tend to assess ecological safety because of the likelihood of an accident and the amount of damage. With the help of environmental risk assessment of economic activity, E.V. Khlobystov [4] offers to identify the level of ecological safety. He notes "that the assessment of ecological safety is based on an understanding of the specifics of recipients of negative impact", among which the main are man and the basic component of the natural environment – the ecosystem [4]. Some scientists offer additional criteria: the state of flora and fauna, the change in the gene pool of animals as an indicator of the ecological state of the territory, indicators of the quality of environmental management and control, personnel, criteria based on the specifics of production, the level of public health, etc. [2; 10; 14].

The analysis of issues of environmental risk assessment has showed that this method is expedient for applying at the local level. On the scale of the region or the country as a whole, this method is practically not used, since there are no databases for assessing environmental risks that characterize the scale and frequency of their occurrence. In addition, existing methods for assessing environmental damage do not correspond to the economic relations prevailing in the region, and most of them do not have the necessary legal status for use in the agricultural.

It should be noted that theoretical-methodological developments in the sphere of environmental risks are, as a rule, limited by the analysis of situations caused by negative environmental impacts in the event of violation of regulatory regulations. Such situations are also directed to methods for assessing ecological damage. In developed countries, the assessment of ecological damage is directly caused by a disruption in the functioning of the economic system for causing harm to the environment [9; 16].

Representatives of the National Institute of Strategic Studies S.P. Ivaniuta, A.B. Kachinskiy notes [6] that "the level of ecological safety in Ukraine in the future is determined by the magnitude of the risk from both possible natural and man-made disasters, and from negative processes that occur slowly, but in time can lead to social explosions (environmental issues, social conflicts)".

Such a methodology will correspond to the "parameters of determining the grade of ecological safety in the event of emergency situations of natural and technogenic origin, and while ensuring the ecological safety of the regions, we emphasize that it is necessary to pay attention not only to environmental risks [6]". In this connection, it should be noted that S. Lisovskiy [8] offers "a method of an integrated indicator of ecological safety, namely, calculated on the basis of eight indices". In our opinion, the advantage of this technique is its complexity in combination with the relative simplicity of calculations, and the main drawback is the failure of many indicators that reflect the qualitative

parameters of natural resources. Scientists A. Obihod and T. Omelyanenko emphasize that the construction of a certain rating, providing for a sufficient number of indicators, is possible only if the latter is built up to an integral estimate [11]. Thus, the integrated assessment allows, in addition to the study of hazard phenomena, to conduct statistical comparisons, which greatly facilitates the analysis process and makes it objective. It should be noted that in the domestic sphere of environmental, there is a state system for monitoring it, in accordance with which a system for monitoring ecological indicators is being implemented. However, analysis and estimation of the situation based on the results of observations in order to identify negative trends, determine and assess their level of danger, and then develop scientifically sound proposals for their overcoming, requires the use of modern methods of quantitative and qualitative analysis.

In general, the lack of an optimal system for estimation of the level of ecological safety in the agricultural, in our opinion, is caused by the following negative trends: lack of scientifically sound environmental standards, compliance with which could reliably prevent the negative effects of agricultural activities; imperfection of the system of environmental monitoring and, as a result, insufficient objectivity in assessing the existing environmental situation; absence of a reliable and complete assessment of the actual and predicted anthropogenic load. In addition, the available methodological developments in ecological safety assessment take into account the specifics of the predominantly industrial sector or the ecological safety of the country as a whole, focusing exclusively on the level of high-risk facilities.

MATERIALS AND METHODS

Based on the results of the conducted studies and analytical generalizations of existing methodological approaches to ecological safety assessment, we can state that today there are no modern developments that allow us to comprehensively assess its level using the appropriate criteria and indicators in accordance with the current conditions of management and specificity of the agrarian sector. Taking into account the specifics of agriculture, formation of the methodological basis for assessing the level of ecological safety, in our opinion, should be carried out in several stages, namely: characterization of factors that cause environmental issues and threats; definition of integral index; the ranking of objects and zoning of the territory according to the level of ecological safety. An important element of the information-analytical component of the realization of the strategy for ensuring ecological safety is a system of criteria and indicators that provide for the assessment of environmentally-oriented development, quantification of the level of ecological safety and ranking of its species [7; 11; 12].

In our opinion, the criteria for ecological safety are no less important for the sustainable development of the agrarian sector than the economic efficiency that was a priority in a market-based industrial consumer society. As a result, there arises the need to develop and use a small number of integrated environmental criteria and to derive from them a generalized assessment of the state of the facility [5; 13]. Therefore, it is important to distinguish the following main criteria:

– maintenance of health and proper vital activity of the person (ES_1) (to assess the level of ecological safety, this criterion is used by the mortality, fertility, morbidity, disease factors caused by environmental factors, etc., in general, characterize the level of health and quality of life of society);

– preservation, reproduction and productivity of natural resources of the agrosphere (ES_2), in particular, for the ecosphere and its elements – biomes, regions, landscapes, in other words more or less large territorial natural complexes – can be the level of environmental-economic or natural-industrial parity, that is, the degree of compliance of the overall environmental burden in the territory of its assimilation potential;

– balanced development and sustainability of agroecosystems (ES_3), that is, a combination of natural (relief, soil, biota, water objects) and anthropogenic elements, which allows to

maintain resistance to environmental threats). In particular, the integrity, safety of their species composition, biodiversity and the structure of internal interrelations are important indicators of ecological safety.

Each criterion must correspond to a certain set of indicators needed to make management decisions that disclose the natural and anthropogenic characteristics of the factors that trigger the occurrence of environmental issues.

The choice of the system of indicators was carried out taking into account the accumulated domestic and international experience, methods in ensuring ecological safety, as well as the recommendations of state authorities and relevant international organizations, in particular World Economic Forum, United Nations Commission on Sustainable Development, Food and Agriculture Organization of the United Nations, Scientific Committee on Problems of the Environmental.

The selection of indicators is also carried out according to the principles of representativeness (that is, weighty indicators are taken into account that affect the level of ecological safety). These indicators depend on the object (state, region, district, separate territory or agricultural commodity producer), which determines the ecological safety in the agricultural. In their definition, a number of features should also be taken into account, in particular: the efficiency, the availability and reliability of statistical data and laboratory research, the availability of analytical information, timeliness and continuity of its receipt, as well as the costs of obtaining it. The main issue in the choice of the system of ecological safety indicators in agriculture is the contradiction regarding the importance of the indicator and the availability of its information characterizing.

The list of indicators on the criteria and components of ecological safety in the agricultural of Ukraine and its regions in particular has been determined taking into account the existing forms of manifestation of environmental threats. The mentioned indicators characterize the state of agroecosystems and the level of eco-destructive influence of negative factors on the ecosystem data and human activity. Some indicators also characterize the state of the natural resource potential and the assimilating potential of agroecosystems. The system of these indicators has been formed taking into account indicators of the Environmental Performance Index (EPI) [5].

RESULTS AND DISCUSSIONS

The developed list of indicators in order to avoid a double effect of the interrelated factors in the calculation of the integral index by means of the analysis of the matrix of paired correlation coefficients is checked for multicoline (the existence of a linear dependence between factor variables). According to the calculations, and taking into account the above principles, conditions and peculiarities of domestic information support, the author has formed a set of indicators (Table 1), which most fully characterizes the level of ecological safety taking into account the specificity of agroecosystems.

The inconsistency nature of the ecological safety estimation requires the use of various analysis methods. For the purpose of quantitative estimation of ecological safety the agrarian sector include the total number of indices (indicators) in the three main criteria identified as relative indicators indicators of its components. This technique assumes the elimination of the difference in the dimensions of the given parameters by normalizing or translating them into a dimensionless form, that is, reducing to an interval from 0 to 1 (1 corresponds to the best (optimal) value of this index, and 0 – the worst (unacceptable) of its value). To do this, the absolute values of the indicators are compared with the primary (threshold) values of the corresponding indicator.

Therefore, an important step in the account of the ecological safety index is the determination of threshold (limiting) assessment indicators, non-observance of which leads to negative, destructive tendencies in ecological safety and impedes the balanced development of the country's agrarian sector. Determination of threshold

values of indicators depending on the properties of the index is carried out using the following methods: analog (the optimal (basic) (reference) value for a given type is considered optimal, which means the desired value for optimization (maximum or minimum); normative approach (critical or optimal value is determined in regulatory legal acts) of the expert evaluation. The values of the threshold indicators for estimation of the level of ecological safety of the domestic agricultural for the regions and the criteria for their optimality are given in Table 1.

Table 1. The main indicators of ecological safety in the agricultural of the region's economy of Ukraine and their threshold values

№	Indicator name	The threshold values of the indicator	Criterion of optimality of the indicator
x_1	Ecological risk to public health, %	0.05	Min
x_2	Infant mortality rate, unit.	5	Min
x_3	Ecological and agrochemical land evaluation, point	100	Max
x_4	Coefficient of ecological stability of territories, units.	0.51	Max
x_5	Degree of soil erosion, %	10	Min
x_6	Pesticide load, kg / ha a.s. in year	1.2	Min
x_7	Chemical load, kg / ha a.s. in year	90	Min
x_8	Dynamics of humus content in soil, %	100	Max
x_9	The level of implementation of the normative-reasonable rate of application of organic fertilizers, %	100	Max
x_{10}	The area of agricultural lands contaminated with radionuclides, %	1	Min
x_{11}	The level of drinking water contamination in decentralized water supply with nitrates, %	5	Min
x_{12}	The level of expenditures for the conservation of biodiversity and ecosystems in the overall structure of environmental costs, %	10	Max
x_{13}	The share of the components of the ecological network in the overall structure of agricultural land, %	40	Max
x_{14}	Coefficient of coverage of damage caused for environmental pollution, UAH / UAH	1	Max

Source: author's elaboration.

Thus, the translation of factual values into normalized values occurs in the range of normalized values of each indicator from 0 to 1. In this case, the indicators between which there is a direct connection with the integral index (that is, the desired increase in the indicator relative to the base index) are calculated as the ratio of the factual value to the limiting one, and, accordingly, those indices whose optimal decrease is calculated as the ratio of the limit value to the factual:

$$\text{if } x_i \to \max, \quad \text{then } x_i = \begin{Bmatrix} 1, y_i \ge z_i \\ \dfrac{y_i}{z_i} \end{Bmatrix}, \qquad (1)$$

$$\text{if } x_i \to \min, \quad \text{then } x_i = \begin{Bmatrix} 1, y_i \le z_i \\ \dfrac{z_i}{y_i} \end{Bmatrix}, \qquad (2)$$

where y_i – the factual value of the i-th indicator;

z_i – threshold (limiting) value of the i-th indicator;

x_i – normalized value of the i-th indicator.

The next step is to calculate the values of the weight coefficients, which is determined by peer review. We have conducted an expert survey of specialists from the majority of regional departments of agro-industrial development, as well as departments of ecology and natural resources in the regions of Ukraine, with a view to collecting system

information on the level of ecological safety in the agricultural. The results of the survey made it possible to determine expert assessments with characteristics of the weight of each indicator. The organization of the examination was carried out by the method of questioning, the determination of weight coefficients – by the method of direct evaluation [3, p. 49]. The undoubted advantage of this method in comparison with other approaches to determining the weight coefficients of integral indexes of the state of complex systems, in particular ecological safety, can be considered as obtaining a quantitative estimate. At the same time, expert digitizations make a significant element of subjectivism in the values of weight coefficients [15]. According to this method, experts assign points to scores on a certain scale (from 1 to 10). Next, for each indicator, the scores are summed and the average (C_i) [15]:

$$C_i = \frac{\sum_{i=1}^{n} C_{ij}}{n}, \quad (3)$$

where n – number of interviewed experts;
C_{ij} – sum of points for each indicator.

Calculation of (d_i) weighting coefficients for each indicator characterizing the integral index of ecological safety in the agricultural, we propose to implement the following formula:

$$d_i = \frac{C_i}{\sum_{i=1}^{j} C_i}, \quad (4)$$

where j – the number of indicators used in calculating the average score.

The weight coefficients of indices for calculating the integral index of ecological safety in the agricultural of the regions are given in Table 2.
The calculation of the integral index of ecological safety is proposed to be defined as the sum of the normalized values of the above-mentioned indicators, taking into account the corresponding weight coefficients:

$$I_{ES} = \sum_{i=1}^{n} x_i \times d_i, \quad (5)$$

where x_i – normalized value of the i-th indicator;

d_i – weighting factor determining the degree of contribution of the i-th indicator into the integrated index of ecological safety in the agricultural;

n – number of indicators used in the calculation of the integral index of ecological safety into the agricultural.

Table 2. Weighing coefficients of indices for calculating the integral index of ecological safety in the agricultural

№	Indicator name	Weighting factor value
1	Ecological risk to public health,%	0.12
2	Infant mortality rate, unit.	0.11
3	Ecological and agrochemical land evaluation, point	0.08
4	Coefficient of ecological stability of territories, unit.	0.08
5	Degree of soil erosion, %	0.08
6	Pesticide load, kg / ha a.s. in year	0.07
7	Chemical load, kg / ha a.s. in year	0.07
8	Dynamics of humus content in soil, %	0.07
9	The level of implementation of the normative-reasonable rate of application of organic fertilizers, %	0.06
10	The area of agricultural lands contaminated with radionuclides, %	0.06
11	The level of drinking water contamination in decentralized water supply with nitrates, %	0.06
12	The level of expenditures for the conservation of biodiversity and ecosystems in the overall structure of environmental costs, %	0.05
13	The share of the components of the ecological network in the overall structure of agricultural land, %	0.05
14	Coefficient of coverage of damage caused for environmental pollution, UAH / UAH	0.04

Source: author's elaboration.

Based on the results of calculating the integral index of ecological safety in the agricultural, it is possible to assess the facility (region) according with its level in accordance with the proposed classification (Table 3).
Thus, the methodology, including a list of basic indicators, their normalization in

accordance with certain threshold values, as well as the algorithm for calculating the integral index, allow assessing the level of ecological safety in the agricultural.

Table 3. Classification of levels of ecological safety in the agricultural

Levels of ecological safety	The value of the integral index (or a separate indicator) of ecological safety
Stable	0,76–1,00
Unsatisfactory	0,51–0,75
Crisis	0,26–0,50
Critical	0,01–0,25
Dangerous (environmental hazard)	0

Source: author's elaboration.

Also, the proposed system of analytical assessment can be a composite environmental passport that, in addition to assessing the environmental friendliness of production technologies and products, provides an opportunity to consider, in combination and interdependence, the environmental factors that have determined the result of the assessment.

Assessment and diagnostics of the level of ecological safety in the agricultural of the Ukrainian economy were carried out in the context of regions and the country as a whole. The use of the considered methodological approaches made it possible to differentiate the regions of Ukraine depending on the integrated index based on 2017 data (some indicators were averaged over a certain period of time) and ranking them according to the level of ecological safety in the agrarian sector (Table 4).

Table 4. Ranking of the regions of Ukraine according to the level of ecological safety in the agricultural area, 2017

Region	**The value of the integral index of ecological safety**	**Rating of the region by the integral index of ecological safety**	**Level of ecological safety**
Vinnytsia	0.46	24	Stable
Volyn	0.67	2	Unsatisfactory
Dnipropetrovsk	0.50	19	
Donetsk *	0.49	21	
Zhytomyr	0.60	8	
Transcarpathian	0.76	1	
Zaporizhia	0.52	18	
Ivano-Frankivsk	0.57	10	
Kyiv	0.62	4	
Kirovohrad	0.53	16	
Luhansk *	0.56	12	
Lviv	0.53	17	
Mykolayiv	0.54	14	
Odesa	0.57	11	
Poltava	0.54	15	
Rivne	0.50	20	
Sumy	0.62	5	
Ternopil	0.59	9	
Kharkiv	0.55	13	Crisis
Herson	0.61	6	
Khmelnytskyi	0.47	23	
Cherkasy	0.48	22	
Chernivtsi	0.61	7	
Chernihiv	0.66	3	
Ukraine	**0.55**	–	**Unsatisfactory**

* Data without taking into account a part of the territory of the region.
Source: author's elaboration.

The integrated index of ecological safety in the agricultural, as a result of a comprehensive assessment, allows us to evaluate this generalized indicator for the regions of

Ukraine. On average, in Ukraine the value of the integral index is 0.55, which characterizes the level of ecological safety in the agrarian sector of the Ukrainian regions as unsatisfactory, with the approach to the crisis – 0.50. The lowest level of environmental safety – 0.46, which refers to the crisis level, recorded in the Vinnytsia region. In our opinion, this is due, first of all, to the intensity of agricultural production in this region. The pre-crisis level also occurs in five more regions. A stable level of ecological safety (0.76), as of 2014, was recorded only in one region of Ukraine – in Transcarpathian region.

CONCLUSIONS

Thus, the mandatory elements of practical implementation of the methodology for assessing the level of ecological safety in the agrarian sector of the region's economy are: 1) (i) a comprehensive analysis of the main indicators, taking into account regional characteristics of agricultural production; (ii)method of rating these indicators in accordance with certain threshold values; (ii)algorithm for calculating the integral index. The integrated index of ecological safety in the agricultural, as a result of a comprehensive assessment, allows us to assess this aggregate indicator by regions of the country, which in the future will allow us to make motivated management decisions to prevent environmental threats and risks in this area.

The results of the research and analytical data on the level of ecological safety in the agricultural can be used in the development of regional strategies for the sustainable development of agriculture in order to level out environmental contradictions in the form of a deviation between the actual and target state of agroecosystems.

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OVERVIEW OF IMPUNITY, OPPRESSIVE ECONOMY IN RECESSION AND FEAR FACTORS IN FARM MECHANIZATION FAILURES IN NIGERIA

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Abstract

Agricultural engineering cannot promote economic recovery in Nigeria through food and agro-raw materials production in the midst of rampant and colossal failures of Arable crops farm mechanization projects. *Good leadership virtues (which include integrity, statesmanship, productivity, respects, love, etc) have been eroded in Nigeria so much so that the success of an individual is now being weighed on the* ***wrong scale of senseless materialism****. The extent of material accumulation, level of damages notwithstanding, influences stake in award of honorary, chieftaincy and academic titles amongst other types of reward from the ruling class, either in government or traditional institutions in our society today. These looters act with impunity while the common working class people watch helplessly and hopelessly afraid of losing the little income earning jobs they have at hand should they attempt to either behave rightly or ask for same from the ruling class. In so many instances they feel safer to aid and abet for survival on their jobs. This ugly and destructive scenario pervade all spheres of activities in Nigeria. The results are hunger, starvation and abject poverty of great majority of citizens in the midst of the plenty nature has endowed the country with. Farm mechanization projects and programmes have not been spared of this mis-management acts with impunity and recklessness. This paper is considered apt in view of the 2017 Umudike Conference of the Nigeria Institution of Agricultural Engineers (NIAE), which theme was "Dynamics of Agricultural Engineering for food and Agro Industrial Raw Materials Production for Economic Recovering in Nigeria". It ends with some recommendations that can lead the way to agricultural revolution for rural development and socio-economic development of Nigeria.*

Key words**:** *impunity, fear, oppressive economy, recession, failure, mechanization*

INTRODUCTION

According to [5] "Agriculture in recent time has become known and appreciated as "green economy" and remains the hope of the Nigeria economy. Mechanization remains the key to unlocking this green economy for the wellbeing of Nigerians. It is estimated that **inappropriate mechanization of Agriculture** has over the years caused the collapse of small family farms particularly in developed countries. Also, the failure of agricultural mechanization in developing countries has left some 1.4 billion people under-nourished and poor, 70-80% living in rural areas, who can no longer afford to buy enough food, even when food is available". And many reasons have been adduced for the failures, but not from the angle from which this paper is prepared. It is considered a neglected critical angle that affects all other factors.

This paper is an overview of the trends in crop farm mechanization activities in Nigeria, especially now that the economy is frequently in and out of recession with increasing deregulation leading to continuous soaring of the cost of goods and services, in job loss, failing businesses, increasing general poverty, hunger and starvation. In this regard, the theme for the 2007 Conference is very apt, that is, "Dynamics of Agricultural Engineering for Food and Agro-Industrial Raw Materials Production for Economic Recovery in Nigeria". According to [8] "past governments have made efforts to promote and possibly privatise mechanized farming. Thousands of tractors and implement were procured and sold at subsidized prices. State and Local Governments also established

tractor-hiring units (THU) which have not been profit oriented and most of them folded up as of today [5]" He Stated further that "it is also observed that the high tractors and implement breakdown are due to various reasons such as wrong selection and matching of tractors with implements, lack of spare parts, and insufficient knowledge on how to operate and maintain tractors, inadequate experienced mechanics, especially in the rural areas, lack of planned and preventive maintenance culture, etc." [5] added high cost of imported machinery and inappropriate government policy to the list of reasons for failures in farm machinery and equipment application.

For ease of presentation the introduction is broken into sub–heads.

Oppressive Economy and Fear of Job Lost

In the opinion of the author, an economy becomes oppressive when law abiding common class citizens are subjected, in great majority, to the least of harsh living conditions gladdened with unpredictable and largely unsure tomorrow and today that cannot offer immediate equivalent to what individuals have as income earning activities and in which situation individuals are always afraid to lose their jobs, businesses, charity benefits, etc taking into consideration their socio-economic dependants and families hope and expectations. And as a result, there is continuous erosion of self-dignity and capacity to stand for what is right, fair, equitable or judicious, thus, leading to the creation of a beggarly slavery condition of work and living. The creators of these conditions are nothing but **economic oppressors as well as looters and loosers in all sense of natural justice and humanity.** The heartless lootings have caused the collapsed of the Nigerian economy to the detriment of law abiding great majority.

Deregulated Economy and Economy in Recession

An economy is deregulated when goods and services are allowed to flow freely outside of Rules and Regulations and therefore not being controlled by public authority (the government), but subject to the dictates of market forces of **demand and supply.** Fall in the value of the local currency and inflation is two of the main features.

An economy can be declared to be in recession after three (3) consecutive negative growth in the Gross Domestic Products (GDP). Two (2) of the main features of economy in recession are business collapse and job loss by workers.

Farming as a Business and Farm as an Industry for Economic Recovery

It is significant that agriculture is being referred to "green economy" in recent time and it cannot just be separated from deregulation of economy and economy in recession because it is not just the oldest but one of the major branches of the economy of most nations worldwide. **Farm is the place of practice of agriculture, which is the raising of crops and livestock as well as management of all the incidentals for the benefits of man and his domestic animals. To apply appropriate mechanization for food and agro-industrial raw materials production for economic recovery in Nigeria, the agricultural production units (farms) must take their places as industries and the activities managed as business operations.** Engineering (in the form of input of farm machinery and equipment) alone is not sufficient, other inputs such as hybrid varieties, chemicals (fertilizers, pesticides, herbicides, liming materials, etc), good knowledge of soil and other economic factors must be available and accessible. To be able, in modern time, to contribute to economic recovery and/or development, farms must be managed as industries and farming seriously taken as big business with appropriate application of the benefits of science and technology.

According to [13] and [2] the features that make farms industries and farming as business are the following:

Farming as Business

Business, in economic term, represents a particular money-earning activity or place and it is therefore one's work or employment. Farming is the practice of working in a farm and results in the production of food materials (crop produce and animal products) and raw materials for industries. These materials are

produced for personal consumption and sale for income earning. Thus:
(a)Farm provides employment opportunities and
(b)Farm is a sources of income or revenue.
Farm like every other business organization is operated/managed on the basis of plan of production and budget. This plan can be of any duration and reflects types, quantity and quality of produce as well as expenditure, income and the projected profit together with the balance sheet showing assets and liability after due taxation.
Since man came into existence many peoples' livelihood is based on material and/or money earned from farming whether directly (for producers) or indirectly (traders of farm produce and agro-allied industrialists). In the provision of employment, farm gives opportunities to the proprietor, hired farm workers, workers in agro-allied industries as well as traders/merchants in farm produce and agro-allied products. Out of the physical and /or mental services put into farm and its related activities, people earn money to take care of their social needs. It is clear from the above that farming is a business and it can be very lucrative if well managed.

Farm as an Industry

Is farm really an industry? Literally, the word "industry" refers to a large group of employed people and building (s) set up with the purpose of producing particular sort of goods, especially in quantities, using machines and/or modern methods. The general characteristics of industry include:-
(a) Organization and operation on the principles of economic returns on investments;
(b) Production on the basis of plan and budget, which can be monthly, quarterly, seasonally, annually, etc;
(c) Capital investments which are both fixed and circulating (recurrent). The fixed capital is gradually amortized through depreciation deduction;
(d) Provision of skilled and unskilled employments opportunities;
(e) Mechanization of the process of production;
(f) Continuous application of science and technology as well as new production methods for the purpose of both efficient utilization of materials, energy and power resources and for the obtainment of improved quantity and quality produce and products;
(g) Revenue generation which can be for government in the form of taxes and rents and for the proprietors in the form of profits;
(h) Organization of activities which is composed of:
-Management structure: Directors and Managers
-Productive structure: commercial section, accounts section, personnel section, research and laboratory section, real production section, maintenance section, etc.
Commercial or large scale farms in the past one hundred (100) years significantly posse the afforested characteristics of an industry and **they cannot therefore be referred to otherwise but as industries.** In fact, farms belong to the group of industries called **primary extractive industries.**
However, there are some features which distinguish farming industries or enterprise and other types of industries and these include the influence of climate, seasonality and natural phenomena; open field operations of majority of the machinery; working on living things and predominantly during the day; occupying larger surface area than industries of the same economic size, etc.

Acting with Impunity

In the [10] the word **"impunity"** refers to a situation in which a person willingly does bad things, exhibits morally wrong behaviour or break the laws knowing that he/she has the superior authority that will condone the activities. That is, knowing he/she would not be punished for wrong things done. To **condone** something means doing something to accept behaviour that is morally wrong, while to **punish** means to make someone suffer because he/she has broken the law or done something wrong. Thus, impunity is the opposite of punish.
Good leadership virtues (which include integrity, statesmanship, productivity, respects, love, etc have been eroded in Nigeria so much so that the success of an individual is

now being weighed on the **wrong scale of senseless materialism**. The extent of material accumulation, notwithstanding the damages, influences the stake in award of honorary, chieftaincy and academic titles amongst other types of reward from the ruling class, either in government or traditional institutions. These looters act with impunity while the common working class people watch helplessly and hopelessly afraid of losing the little income earning jobs they have at hand should they attempt to either behave rightly or ask for same. In so many instances they feel safer to aid and abet for survival on their jobs. This ugly and destructive scenario pervade all spheres of activities in Nigeria. The psychology of the common people and the economy are worst for it. The results are hunger, starvation and abject poverty of great majority of citizens in the midst of the plenty nature has endowed the country with. Farm mechanization projects and programmes as well as the various agencies and organs of government handling them have not been spared of this mismanagement acts with impunity and recklessness. Not even the managements in Nigerian universities and various religious bodies can be looked up to with full assurances for succour.

There are gross mismanagement acts with impunity everywhere in the Nigeria socio-economic and governance institutions. The Nigerian Institution of Agricultural Engineers (NIAE) need to jealously guard its integrity for the positive growth, development and quick advancement in sophistication of the noble profession which has been the key to the greatness of the world's most advanced nations. There are records in Human Geography books, Economic Development Literatures and Science Literatures everywhere. The rampant and colossal failures of farm mechanization projects and programmes, mechanized crop production farms, mechanization agencies, etc in Nigeria, is very worrisome and already casting doubts on the collective integrity of professional agricultural engineers and we cannot therefore afford to remain the way we have been. There is urgent need for change and change we must despite political powers intimidations.

Basic Role of Engineering in Agriculture and Rural Development Cum National Socio- Economic Growth and Advancement.

There is nothing like economic development let alone sustainable development with the rampant and colossal failure of mechanization project and programmes, mechanized crop farms and agencies and organs of government in Nigeria. The 2017 conference of NIAE is an apt forum for members and friends of the institution to re-echo and further examine the ugly trend from the new dimension presented in this paper, with courage and honesty for the attainment of the purpose of the conference. There are uncountable literatures on the basic role of agricultural engineering and agricultural mechanization in socio-economic development of rural communities and nations.

According to [4], United States of America is economically the strongest country in the world and there is no doubt that it is a model of modern great civilization. Its total agricultural output surpasses that of any other country in the world. It has nearly three (3) million farms, averaging about 160 hectares each, with most of the holdings highly mechanized and electrified, and fertilizers freely used. [6] wrote "agriculture is not only Britain's oldest industry, it is also one of the biggest. Before the 1939 -45 war Britain farms provided a third of the food needed by a population of about 48 million. Nowadays, they produce half the food for a better fed population that has grown by some 7 million. Although output has increased tremendously in recent years, the number of farm workers has dropped steadily. The proportion of the working population engaged in farming fell from 90 percent in 1790 to 30 percent in 1915, and it is only 7 percent today. How has this increased productivity come about? Many factors helped but some of the most important have been the development of **specialized machinery, the use of fertilizers and pesticides and the introduction of new plant varieties.**

Therefore, the theme of the Nigeria Institution of Agriculture Engineers (NIAE) "Umudike

2017" 38th conference was very apt at this moment of cross-road in Nigeria. **The Engineering in agriculture goes beyond tractor and few soil tillage and produce processing equipment.** In Europe and United States of American (USA), the development of agriculture paved the way for the development of the manufacturing industries, which in turn paved the way for the construction industries that generated massive employment and created great population drifts and urbanization of the rural or farming settlements lifting them to the status of towns, cities and mega-cities of today. Agriculture is an extractive primary industry and have been associated with village or rural settings, thus, its development connotes the emergence of certain social structures and features which themselves are the indicators of community development.

They include [3]:

(i)Increase in the quantity and quality of food supply, hence the emergence of healthier populace capable of good intellectual and physical labour output.

(ii)Increase in raw materials for secondary industries;

(iii)Generation of finance for the development of the other extractive as well as secondary and tertiary industries;

(iv)Enhancement of income for the farmers and agro-allied workers;

(v)Opportunity for the development of market, transport and communication infrastructures required for effective distribution of the produce and supply of inputs;

(vi)Opportunity for the development of modern storage and processing facilities and these attract higher level of electrification and automation;

(vii)The creation of conditions for the increase in local population and hence the need for more housing, healthcare and educational facilities, more and stable sources of water supply, increased environmental management consciousness;

(viii)Opportunity for interactions of the local people with goods, services and people of other places with similar or varying cultural and technical background, thus, promoting tourism and education through trade etc.

[4] stated further that some of the reasons for the greatness of the United State of America in economic development included the following:

(i)Its varied climates and soils which are almost everywhere favourable for some form of agriculture;

(ii)Its oceanic setting and long coastline, which have not only encouraged the development of important fisheries but also the establishment of ports and shipping routes;

(iii)Its wealth of timber (both soft and hard wood);

(iv)Its rich mineral resources, notably coal, petroleum, iron, sulphur, phosphate and copper.

(v)Erection of small dams across rain carved gullies which boosted the extension of irrigation and improved soil erosion control and hydroelectricity generation at the same time;

(vi)Its large healthy and varied population that is hardworking, well-educated and enterprising;

(vii)Its readiness to take advantage of Europe's example ;

(viii)The use of a proportion of its capital for the development of irrigation facilities and hydro-electric power plant and for setting up industrial undertakings;

(ix)The large amount of internal capital it has been able to build up to enable it to establish large scale production techniques typified by the conveyor – belt and the extension of automations;

(x)The stability of its governments whether Democratic or Republican in their political affiliation.

The question is whether Nigeria has been able to borrow from either Europe or United States of America despite having so many of her citizens educated in these places? The answer is no, hence the agriculture has remained under peasant technology in ill-illuminated nuts lacking in almost everything developmental, most especially electricity, potable water and cottage industries. The objective of this paper is to draw more

attention to avoidable failures in developmental pursuit starting with agricultural development.

MATERIALS AND METHODS

Study Area

This paper is the outcome of scholarly inquiry base on secondary data and it is an overview of the trends in farm mechanization activities in Nigeria, especially now that the economy is frequently in and out of recession with increasing deregulation leading to continuous soaring in the cost of goods and services, in jobs loss, failing businesses, increasing general poverty, hunger and starvation. The questions is, can agricultural engineering play meaningful role in food and agro-industrial raw materials production for economic recovery in Nigeria in view of its prevailing Physical and Human Geography and Political/Governance Conditions? This is the question this work tried to find answer.

Geographical position. The country lies within Longitudes 4^0 and 14^0 East of the Greenwich Meridian and Latitudes 3^0 and 15^0 North of the Equator.

Surface. The country occupies about ninety eight (98) million hectares of land out of which about seventy four (74) million hectares, that is, 75 % are arable agricultural land.

Population. With a population of over one hundred and sixty (160) millions out of which about forty percent (40%) are in the standard working age group of 21-45 years. ***Nigeria has varied population of over 200 tribal groupings and over 700 dialects spoken with many faces of religion.***

Territorial organization. Nigeria is a federation of thirty six (36) states (Constitution of Nigeria, 1999) even though it is practically operating like a unitary state with a single economy instead of multiple semi-dependent economies loosely united at the centre, but one strong external front as practiced in the United States of America (USA), Republic of Germany, etc.

Relief. The landscape is predominantly lowland with high rise plateaux in the central (Jos) and northern eastern (Gembu) parts. It has undulating surfaces ravaged in some parts (especially in the south–east and mid–west regions) by severe gully erosions.

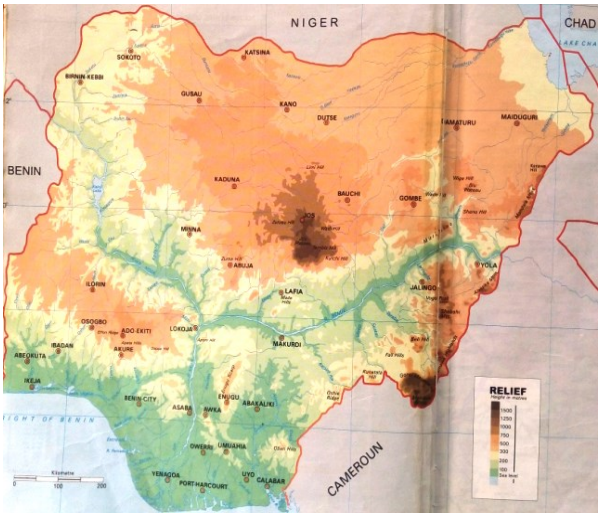

Fig. 1. Map of Nigeria showing it Physical Feature
Source: [9]

Climate. The climate is tropical and the vegetation extends from the southern marshing coastal areas to mangrove swamp through the high rainforest, Guinea and Sudan savannah to Sahel savannah with much increased and still increasing sand dune (desert condition) in the northern fringes.

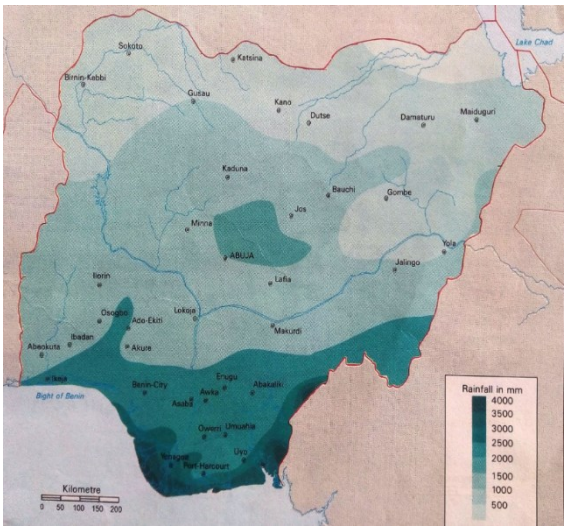

Fig. 2. Rainfall Map of Nigeria
Source: [9]

The effects of climate change is glaring with increase in coastal flooding plus ocean surge and increasing dryness in the northern part. The difference in the quantity of rainfall creates two (2) distinct seasons, namely, the wet/rainy season and dry season in the period

May-October and November-April respectively. In the dry season, the annual rainfall range is 1,100-1,250 mm and mean temperature is 29℃ and can reach 40 ℃ in March. In the rainy season, the mean rainfall is 2,500 mm and mean annual temperature of 22℃ which can reach 34℃ in the north.
Rainfall distribution is bi-modal having July and September as peaks. The early part of the dry season has cool weather called Harmanttan (November – February) in far north and December in the south. Irrigated tomato, carrot and other vegetables do well under irrigation in this period.

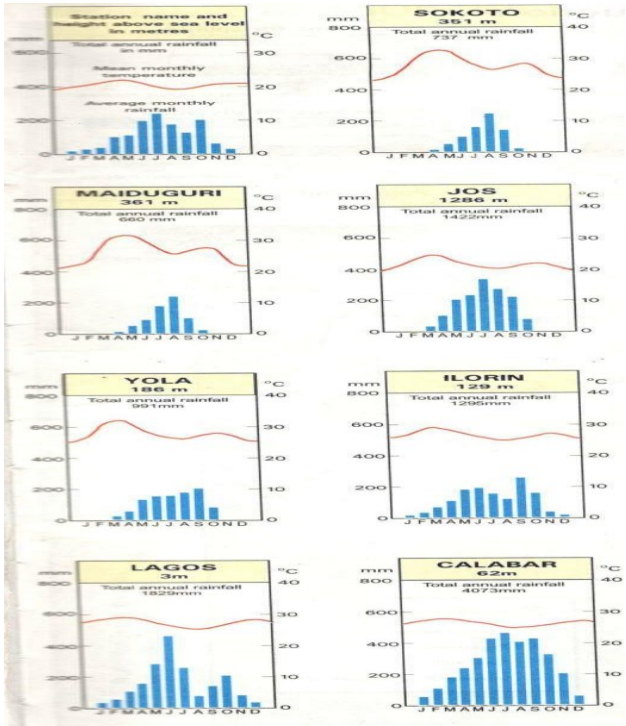

Fig.3 .Rainfall distribution graphs
Source: [9]

Rivers. The country is well drained by many rivers, the biggest/longest of which are the Benue and Niger that jointly cut the country into three (3) parts with both intersecting and joining at Lokoja (in the central part of the country) to form one river, called Niger, that emptied into the Atlantic Ocean forming delta in the south, known as Niger Delta.
Vegetation is determined by the environmental conditions and especially by climate features.

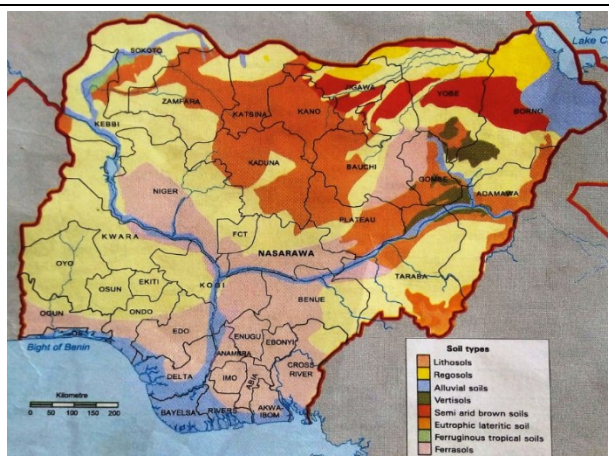

Fig. 4. Vegetation Map of Nigeria
Source: [9]

Soil. The soil include the Latertic south–east soil, the highly leached deep soil of the Midwest and south-west, black cotton soil in the lower north / middle belt to shallow loose stony soil in the mid-north and sand dune affected Sahel savannah in part of the northern fringe. There is highland stretch along the eastern boundary line from north to south known as the Cameroon mountains/highlands.

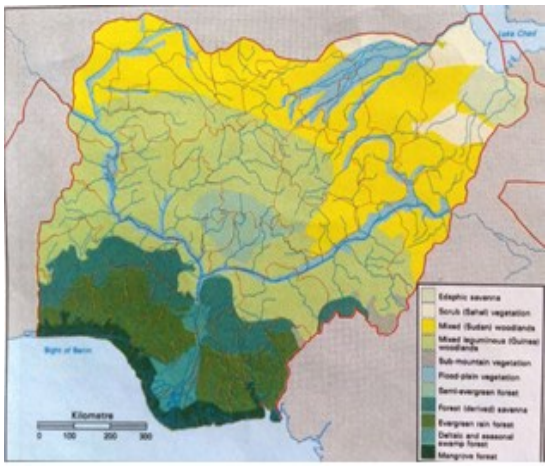
Fig. 5. Soil Map of Nigeria
Source: [9]

The exposure of the delicate tropical soils can create management challenges [1]. They support agriculture. According to [7], “even with its diverse climate and soils, the country has a huge agricultural potential if its soils and other natural endowments are well managed [13]”.

Fig. 6. Food Crops Map of Nigeria
Source: [9]

Resources. Reference to Atlas and textbooks of geography and [12], [5], [7], Nigeria is rich in human, agricultural and mineral resources. The country is a huge exporter of crude oil and gas, palm oil, cassava, gum arabic, rubber latex, etc. It has rich reserve of bitumen, coal, iron ore, tin and some deposits of gold, uraninum, etc.

Fig. 7. Fuel and Power Resources of Nigeria
Source: [9]

Possibility for Successful Farm Mechaniz ation for Socio-economic Development

With the conditions forested as seen in Figures 1-7, appropriate mechanization with satisfactory economic efficiency and returns is very feasible to varying degree from one part of the country to another. Nigeria has a great agricultural potential which if fully developed with the aid of **appropriate mechanization (**that is farm machinery and equipment plus the requisite accessories) is capable of producing enough food, fibres and other raw materials for the populace and the industries (local consumption) notwithstanding the challenges of soil conservation which meticulous study, understanding and approach can handle successfully and economically too for sustained production.

[11] defined Appropriate Mechanization of any particular work/operation and the process of production of any given crop as the employment of the correct equipment or mechanical aggregates/installations having the technical adjustments as dictated by the work/operation in the correct conditions of the work/operation/process of production in the particular environment and substantially enjoying other necessary back-up or complementary factors so that the objectives of the work/operation/entire process of production are satisfactorily realized with time, energy and economic efficiency.

Thus, mechanization of crop production is not appropriate without employment of the requisite complementary factors/inputs.

Our constrain is the impossibility of elimination of the unproductive and unprogressive vices of corruption of all forms and acts with impunity founded on weak minded crave for excessive accumulation of material wealth for self without production (that is, massive erosion of capital fund).

RESULTS AND DISCUSSIONS

After carefully studying failed crop farm mechanization efforts projects littering all over the Nigeria State, the result presented and which was also front burners were fear of job lost and acts with impunity.

Historians, political scientists, lawyers, etc import agricultural machinery and equipment; lawyers/Barristers are appointed heads of economic planning and budgeting units; mechanical engineers are farm managers/director; political scientists are managing directors of tomato farming and canning industries; agricultural engineers are appointed heads of museum and art gallery; etc. **These are all dysfunctional misplacements**. These types of appointment are **not usually** devoid of the **Nigerian factor**

and desperation to be present where the looting of money/public fund is to be taking place in the immediate.

After these wrong political appointees avail themselves to using non–conventional part that circumvent the merit based laws/regulations/rules to acquire positions where they preside over the affairs of people and materials put together for growth and development of the society, they become dis-focused and dysfunctional. They (100 % of them) begin to behave like **victorious emperors ruling over serfdom**. They participate in receiving supply of incomplete parts of assembled and yet to be assembled machinery and equipment from higher emperors. Also, they at their own levels make purchases and order subordinates to receive incomplete, malfunctioning, refurbished, wrong types, inappropriate, etc machinery and equipment that are branded as new ones. Evidence abound everywhere that significant majority of these machinery and equipment are condemned to workshops, laboratory stores, storage platforms or open field (under rain and sun), etc **mainly to serve the eyes and not to do any work.** In these situations, the invested capital is lost and the intended benefits are lost. Also lost is the passive energy embedded in such machinery and equipment [12]. The emperors blame everyone else except themselves and yet do not take actions to return the bad supply or remedy the ugly situations.

In our large scale crop farms (majority, of about 90 % now completely abandoned) and office compounds of mechanization agencies/organs/units,, machinery and equipment of all kinds that have never been used for once are littering and rusting away. It is a massive waste of passive energy, financial and material resources and developmental opportunities. After several lootings and wastages, the peoples/**workers' rights and dues become personalized by the emperors such that the rights become privileges** that can only be doled out according to the emperors' whims and caprices to recognized sycophants', eye–service persons and compromising fellows pleading on their kneels, bending, lying down, etc for favour to be accorded them. These are the desperate, weak minded and not qualified ones who can neither ask nor wait for the right things to be done. They are usually few in number (less than 2 %) but are allocated sensitive positions that enable them to join the emperors to control the rest majority of over 98 %. We can not blame all these types of person because hunger and/or burden of reasonable duration can weaken and compromise people, especially when there are added pressures due to needs of loved ones within the extended family culture synonymous with us in Nigeria.

The dictators/emperors act with impunity and recklessness and are only interested in self-preservation and endless materialism. To this end, the need to appoint compromisers leads to wrong decisions placing wrong persons in very sensitive, technical and high skill requiring production duties. The appointees like the emperor-master are unable to perform such duties and therefore no production because incompetence ruling over competence can neither stand nor succeed. Things and the system begin to crumble and since there is no production, let alone profit to be carted, the capital fund comes in line for senseless and heartless looting, and later the entitlements or dues of the subordinate colleagues/staff are added thereto. While the children and wives of the emperors are allocated official vehicles with drivers separately for domestic movements, the emperor himself/herself move about in convey of cars (including escorts) whereas the immediate next in rank to the emperors do not have any official vehicle for official duties, especially if he/she does not belong to the same club, corruption class, fraternity, religion, etc as the immediate emperor-boss and/or the higher emperors. Other heads of units suffer the same faith as stated even though the financial records of the establishment will show otherwise, because the vehicles and facilities fraudulently attached to the emperors' domestic members are put on records to be allocated to officers who ought to actually have them. Furthermore, the pittance left for staff as salaries and other welfare packages are not

paid (salaries being owed up to 6-10 months) and where paid it is not the correct amount despite the numerous frivolous deductions earlier made therein. Frivolous reasons are given even in the clear visibility of **personal extravagancy and misappropriation of the hatchet emperors**. While hunger and economic pressure mount on dependants of the system, the wrongful weak minded conspirators begin to get salary advances and receive all kinds of payments. **And to maintain this status, they join the emperors–masters to threaten and terrorize the good law abiding citizens who become so afraid that they standby and watch helplessly and hopelessly not wishing to lose what they have at hand because there is no immediate equivalent alternative.**

With economic pressure in the home front, the hungry workers become angry people and their primary duties begin to be handled lackadaisically or performed with levity, while sneaking out to find quick income earning supportive jobs/services. Eventually, there is system collapse, the production has completely failed and it is shot down. The looters, now with affluence and flamboyancy to blow their trumpets loud, **quickly work their ways to new thriving units taking along with them the best of the sycophant's and yes persons**. In all these, the emperors keep paying homages to the powers that be behind them. As long as the homage payments continue to flow, the surrogates emperors are good and loyal children of their emperor-fathers notwithstanding public outcry regarding the enormous damages to the welfare of the common people, the public economy and the society at large.

The evil unproductive and unprogressive scenario are created, re-enacted or repeated wherever the production failed emperors are moved to and with each new higher move, they behave more intolerant, autocratic and reckless and with greater acts with impunity that bring about more damages in order to meet the need of an increasing ego, societal recognition and the desire to sustain the ostentatious life style after leaving office (whether through due retirement or forced retirement, termination), etc.

With these vices in rampant occurrence, no system survives, let alone growing to become developed and benefits yielding for the masses and the society. There can be no recovery without production and until farm mechanization is yielding good results it cannot contribute to economic upgrade or growth.

CONCLUSIONS

The role of acts with impunity and fear of loss of job in compromising the professional integrity of many civil/public service agricultural engineers, just like others, has been given considerable treatment, and thus the topic of this paper is apt within the theme "Dynamics of Agricultural Engineering for Food and Agro-Industrial Raw Materials Production for Economic Recovery in Nigeria". It is an obvious fact that many members of the Nigerian Institution of Agricultural Engineers were the managers of the failed mechanization projects, agencies and farms, etc. They were carried away by societal vices at the detriment of their professional integrity, growth and development. **This is now to the extent that the membership of the professional body in Nigeria is more for fulfilling the requirement of promotion rather than as a vehicle for growth in professional competence and integrity and as a path to contributing to the advancement of the profession.**

The following are the recommendations:

(i)Nigerian Institution of Agricultural Engineers (NIAE) must create a properly functioning unit to be known as Ethics and Value Commission and to be vested with enough power and material mobility to evaluate, receive, report, investigate, etc on conducts of members charge with management of engineering facilities in agricultural production nationwide. The commission should be able to render professional advices and assistance to members in positions promptly as the needs arise and at no pre-conditions or cost. The

working fund of the commission shall be certain percentage of the annual dues of members and sponsorship grants. In this way, the Institution shall be having a machinery to closely monitor the field performance of its members.

(ii)Establishment and management of a model of mechanized crop production farm in any part of the Guinea and Sudan Savannah Vegetation belts of Nigeria with rain fed and irrigation technologies supported by good crop rotation to make it an all year round production industry with practice of appropriate mechanization of all the processes in crop raising, (from pre- planting chemical treatment of materials, loading, off–loading, transportation, actual field works, post-harvest primary processing of produce, storage and post-harvest field management). This farm should be managed by **NIAE** Ethics and Values Commission and its success shall promote the professional integrity of agricultural engineers in Nigeria, thus, creating excuse for its members to exonerate themselves from the mismanagement acts withimpunity that have contributed to the fail ures of all mechanized crop farms and mechan ization projects/programmes/agency/organs under the civil/public services.

(iii)The Institution (NIAE) must start to rally around its members who wish and are ready to do the right things as dictated by the noble profession, and to protect such members **(under the doctrine of all for one and one for all)** from the claws, harassments and intimidations of the greedy looting emperor–oppressors of the society, economy and masses.

(iv)The government should allow the right persons only to manage or handle specialized services/operations/activities for proper management and development

The above recommendations are to grow the profession for growth of appropriate mechanization for economic upgrade (whether growth or recovery).

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CLIMATE CHANGE: A CHALLENGE TO SUSTAINABLE LAND RESOURCE MANAGEMENT IN AGRICULTURE AND THE EXTENSION OF ARABLE CROPS MECHANIZATION IN NIGERIA

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Abstract

In agriculture, farm land is any space or medium that supports agricultural practice/production. This is in tandem with economics which has land as one of the four main factors of production. But ecologically, land can be said to be the solid part of the 'Earth' along with its components in the interior, on the surface (ground level) and above the ground level. These are respectively the rocks and minerals including underground water; the soil and biological matters within and upon it; and the atmosphere. The interactions and interdependency of these factors made land and climate inter-twined and have created series of dynamics and phenomena which have influenced and shall continue to influence all forms of existence on earth. Agriculture which is a principal branch of any national economy is tied in major part to the soil which is the topmost part of land and therefore, farm is tied to ecology and its factors (which include climatic factors). The limit in the size of land available for farming and the continuous decline due to other competing needs of humanity together with the ever-increasing population of the world have made efficient mechanization the panacea for intensification of production to cope with the ever-increasing demand for food and raw materials. The path to overcoming the looming danger is sustainable management, which is present beneficial exploitation, utilization, maintenance, co-ordination and control of resources that ensures the continuous existence / availability for future needs. Certainly, it is now a known fact that changes in climatic conditions/ factors have brought about either positive or negative or both in the different parts of the world, and Nigeria is not an exception. This paper is an original scholarly inquiry based on review of related literatures (academic and public awareness information outlets), reports and physical observations of the authors. The results reveal that a worrisome land management culture and practices at present in Nigeria. This is being worsened by climate change effects of drier (including desert expansion) northern parts and wetter (including coastal erosion, ocean surge, swamp expansion and heavier erosion) southern parts of Nigeria. These coupled with poor handling of wastes, mining operations, pollution from oil spillage and gas flaring; wrong use of chemical (agro-related and environmental Sanitation related); reckless deforestation; etc constitute huge threats. The paper ends with propositions of mitigating actions and ameliorative measures to be taken by stakeholders in land holding and development.

Key words**:** *climate change, sustainable management, ecology, mechanization, farming, interdependency*

INTRODUCTION

Having regard to the format of papers/articles for Nigerian Journal of Soil Science, the introduction shall integrate the review of related literatures on which the scholarly inquiry /research is mainly based.

Over the years and centuries, human activities have been producing both negative and positive effects on man himself and his environment. While the positives, have contributed to development and better life-style, the negatives tend to fight against the gains or progress made. Overall, the positives have been superior to the negatives. One of the great worries of humanity today is climate change and its effects, which overall is of negative superiority.

Sustainable Management is the present beneficial exploitation, utilization, maintenance, coordination and control of resources that ensures the continuous existence/availability for future needs. Land is one (1) of the four (4) main factors of production and the two (2) most important features of existence on earth are Land and

human beings, with the land sustaining the human beings and their activities for their existence, well-being and continuous existence.

Land is a precious (very valuable) national asset for a country, community and individuals and for the farmer, it is an indispensable need and partner. Nations are known to have bitterly fought very deadly wars because of land; the threat and strife still exist and shall continue to exist, more so, that the ever-increasing population of the world is putting great pressure on the available land which is, unfortunately, in continuous decline due to several factors. Among these factors is Climate change.

According to [6] "Climate change is a long term significant change in weather pattern of an area. The alteration of weather and subsequently climate change arises from global warming that is considered to be the most serious threat facing the world today. This has necessitated the Kyoto protocol, which is the international agreement to cut greenhouse emission that causes climate change. Climate is the most crucial factor which determines nature of natural vegetation, soil characteristics, the crops that can be grown and farming practice in a region. Climate has implication on soil productivity, human and animal nutrition, employment and human development. The northern part of Nigeria is confronted with high temperatures and lower precipitation leading to increased desertification. The south is challenged with increased and more frequent rainfall resulting in increased flood occurrences and erosion. Soil productivity and organic matter are affected by climate change". This is an open knowledge which is also in tandem with the position of the authors of this paper.

Climate has been simply defined as the average weather conditions of a place observed over a long period of time of minimum of thirty-five (35) years. Weather is the atmospheric conditions of a given place at any given time, usually daily, but can be weekly, monthly or annually. The atmosphere is the air space above the surface of the earth and it is made up of gasses, vapour and floating particles which receive solar energy from the sun. And weather is confined within the troposphere, which is the lower part of the atmosphere from the surface of the earth. The measurable elements of weather are Rainfall (and other forms of precipitation), Temperature (heat level), Sunshine (duration and intensity), Pressure, wind (direction and velocity/speed) and Humidity (absolute and relative). They are influenced by latitude. Altitude, Continentality, Ocean/Sea breeze, Ocean Currents Natural Vegetation and Soil Relief and Cloud Cover [3]. All these elements and climatic factors are also part of ecological factors. Due to their permanent interactions and interdependency, any change in anyone translates to (bring about) change(s) in others, and eventually on land resource.

Over the last decades, the observed change in the rise of global temperature is producing negative effects of such great magnitude that it has become a cause of concern for safety and security of man, his means of lively-hood and the entire earth itself (particularly the land and the environment) in the present and in future. According to [4] cited in Ojeniji (2014) "warming of the climate is irrequivocal as is now evident from observations of increases in global air and ocean temperature, widespread melting of snow and rising global average sea level". [6] stated further that "well drained soil of humid tropics are expected to reduce in fertility and stability when subjected to continuous leaching arising from increase in rainfall; temporary flooding results to decline in organic matter decomposition in depressions; and runoff is expected to occur on slopes resulting to loss of top soil which causes sedimentation downstream and down slope. In subtropical and semi-arid environments, more rain had been predicted for some places and less rain in other places. Soils of low rainfall areas are expected to produce less dry matter and soil organic matter. These are the obvious reasons climate change has become a challenge to sustainable development and sustainable management of all kinds of earthly resources.

Whatever it is that challenges land resource development and management also challenges agriculture which is based principally on land as medium of production. And due to decline

in the land available for agriculture and the increasing demand for food (qualitatively and quantitatively) and primary raw materials, coupled with the declining and ageing population in the farms due to youth migration to urban centres, farm mechanization has been found to be the panacea for increase production and supply because it provides more power in the hand of farmers, the intensification of production and thus, the maximization of the productive capability of the land/soil and the raised material (crops and livestocks).

According to [2]. "the continuous increase in both human and animals population is responsible for the progressive development of agricultural methods and techniques for overcoming the challenges of producing enough food, feeds and fibres for both human and animals consumption. Every stage in agricultural production involves work and power performs the work. Because of the ineffectiveness of hoe, cutlass and other related hand tools for meaningful food production, the use of animals power was invented, but was soon found to have brought in negligible increase to food and reduction of drudgery in agriculture. The shortcoming led to the invention of tractor, farm machinery, fertilizers, improved seeds and other related developments to increase farm size and food production capacity of farmers when the techniques are fully and effectively used on the farms. Most of the techniques employed in the tropics gradually destroy the ecosystems when agricultural soil is **bare**. As a result, there is severe erosion and fertility status of the arable soil is depleted continually".

The possibility of practice and extension of mechanization are regulated by the existence of favorable environmental conditions, principally, the climatic conditions and the nature of land/soil. Here, we talk about the type of soil, the nature of land (topography/relief), rainfall pattern, depth of soil and its drainage feature, and the level, quantity and quality of the underground water.

According to [8] mechanization is basically the exploitation and management of machines, engines and mechanical aggregates/installations in replacement of manual and draught animals works in agricultural production, in this way, it includes the efficient selection, operation, repair, maintenance, and the replacement of machinery. The wetter and drier is the soil, the softer and harder the soil is respectively, and beyond certain limits of wetness/softness and dryness/hardness field mechanization of crop husbandry operations become impossible in the absence of high capital, high technical skill and high managerial expertise. This is another reason the climate change which has been creating extreme wetness and extreme dryness in various parts of the world and in Nigeria, is a challenge to the extension of farm mechanization. These are respectively happening in the southern part (which lies within the equatorial rain forest area) and in the far northern part (which lies in the sahel Savannah/semi-arid area).

In agriculture, the introduction of mechanization has created the challenge of sustainable management of the soil due to compaction on one hand as a result of tractor-machine (mechanical aggregates) traffic, and loosening of the top soil with tillage implements which makes the soil to be easier eroded by erosion agents and also expose the soil to quick degrading when left bare under reasonably high temperatures of the Nigerian tropical weather conditions. Such land can not be excluded from the damaging effects of climate change if proper managerial expertise is not employed efficiently.

According to [5] "*the most common causes of soil compaction are agricultural machines such as tractors, harvesting machines/equipment and implement wheels travelling over moist loose soil*". He cited [5] stated further that soils tend to be more compacted deeper into the soil profile due to the weight of overlying soil. [6] he stated that "soil compaction occurs when soil particles are pressed together, reducing pore space between them. Heavily compacted soils contain few large pores, less total pore volume and consequently a greater density. Agricultural machines traffic is the main cause of decreased structural soil macro-porosity. A compacted soil has a reduced rate

of both water infiltration and drainage. This happens because large pores are more effective in moving water downward through the soil than smaller pores. For this [6] stated that "heavier and more powerful tractors and machines have been used on farms throughout the world". This is increased load on the soil promoting greater challenge to soil/land management.

Climate change is a concept emanating from global warning as a result of rise/increase in the average global temperature and this rise together with the different environmental conditions it has created (especially in rainfall quantity duration, intensity, frequency and distribution pattern) have occurred over the past five (5) decades (50 years) that they have become permanent features/conditions such that the rise in temperature now constitute change in climatic conditions/weather elements. The regular flooding in Europe and Asia together with vexacious over flow of banks by rivers, seas and ocean water current worldwide) the wild fire in America, Canada and Australia, expansion of desert in Africa as well flooding, erosion of sea and ocean coastlines worldwide, the melting polar ice and glacier, rise in sea water level, etc. are all pointers of changes.

The earth's surface is shared by two (2) great bodies; the body of water and landmass. The sharing proportion which was in favour of water taking up 60-67% had, is and shall continue to change constantly to the detriment of land, hence the land available worldwide is decreasing being lost to the more powerful body of water. This is worsening the adversities brought upon land by climate change. Therefore, sustainable land resource management for agriculture and the extension of farm mechanization from the middle belt of Nigeria to the far northern and southern parts with respective increase in hard soil and alluvial deposits, is very seriously and greatly challenged by climate change. It is a known fact that no land no agriculture and no farm mechanization no modern agriculture and no sufficient production and supply of food and basic raw materials, no socio- economic stability and development.

Taken from another perspective, sustainable land management is a challenge in agriculture in Nigeria. Major agricultural practices/activities take place in an open field and are subjected to direct influence of climatic conditions and day to day atmospheric conditions of weather elements. Contending with the sustainable managements of exposed vast expanse of arable land/soil against rapid degradation in structure, fertility, stability and erosion under tropical climatic conditions that prevail in Nigeria is a very huge/massive challenge.

In bush clearing for agricultural purpose, the top soil must be preserved. The top soil contains nutrients needed by crops for optimum performance. Agricultural bush clearing is therefore defined as the process of scientific removal and disposal of existing materials, vegetation, rubbish and other obstructions from the land by manual, mechanical and chemical means for agricultural production. This according to Anazado (1986), NALDA (1992). Adama (2013) cited in Adama (2013) cited in [1].

"The basic objectives of agricultural bush clearing and land development are to remove unwanted materials from the land and to increase the size of the land to be cultivated" stated [1].

MATERIALS AND METHODS

Study Area

Nigeria lies within the tropics and therefore has the tropical climate. While the tropics are latitudes $23^1/_2$ degrees North and South of the Equator (zero degree), Nigeria lies within latitude 3^0 and 15^0 North of the Equator and Longitude 4^0 and 14^0 East of the Greenwich Meridian

Method

This work is an original scholarly inquiry based on review of related literatures (academic and public awareness information outlets), reports and physical observations of the authors.

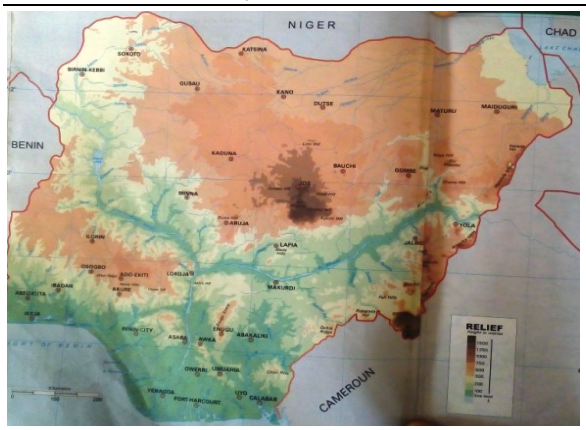

Fig. 1. Map of Nigeria showing the Physical Features
Source: [7]


Fig. 2. Vegetation Map of Nigeria
Source: [7]

RESULTS AND DISCUSSIONS

During the visits to the field for first time observations by the researchers, some pictures which reflect the effects of climate were taken and are presented below.

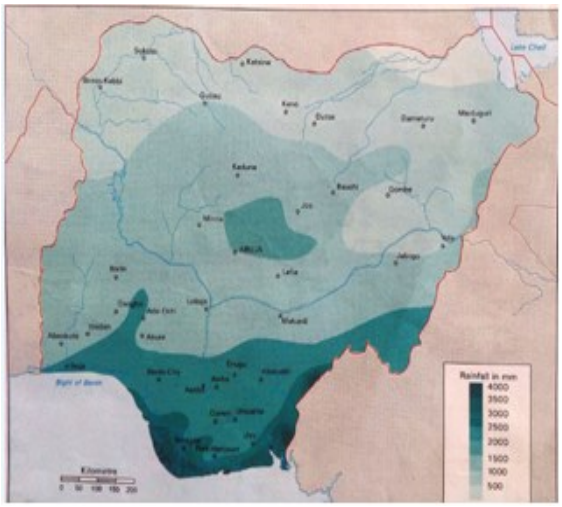
Fig. 3, Map of Nigeria showing the Geology
Source: [7]

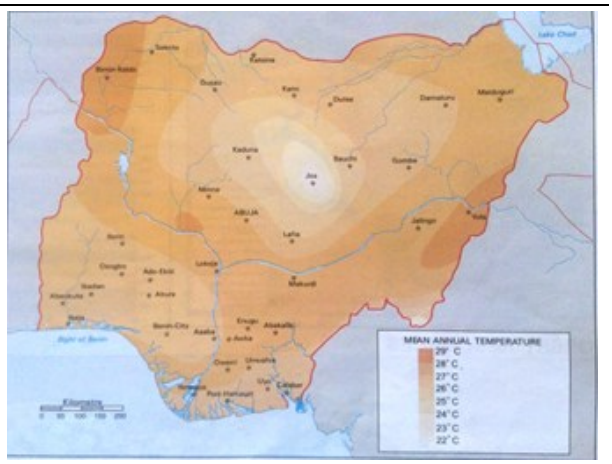

Fig. 4. Map of Nigeria showing Mean Annual Temperature
Source: [7]

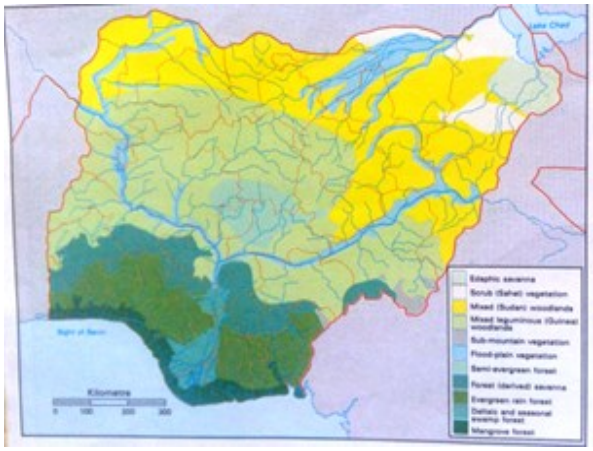
Fig. 5. Map of Nigeria Showing the Vegetation
Source: [7]

Fig. 6. Map of Nigeria showing the Population
Source: [7]

Fig. 7.Map of Nigeria Showing the Soil
Source: [7]

The effects of Gully Erosion Communties and Farmland across Nigeria are presented below in Photos 1-6.

Photo 1. Gully Erosion in Ondo State
Source: Gully Erosion in Imo State

Photo 2. Exposed Land in Edo State
Source: Researchers personal field photograph

Photo 3.Sheet erosion in Central River State
Source: Researchers personal field photograph

Photo 4.Gully Erosion in Imo State
Source: Researchers personal field photograph

Photo 5.Gully erosion in a farmland in Taraba State
Source: Researchers personal field photograph

Photo 6.Gully in abandoned farmland in Anambra State
Source: Researchers personal field photograph

The two extremes change to land resource that is easily physically observable are deep gullies which have happened at faster rate than previous in the southern part of Nigeria (flowing from the information gather from local residents), and the drier and harder soil/land in Northern part of Nigeria. The eroded soils have also been deposited in lower areas and in depressions and this makes the movements of mechanical aggregates (farm machinery) to become much more difficult. Deep devastating gullies are common features in the southern part of Nigeria.

There is need to urgently intervene with irrigation and drainage projects to contend with the dryness and flooding respectively. Other works such as land levelling, terracing, relay farming, mulching, strip cropping and incorporation of organic matter followed by light compression and avoidance of bush clearing by burning. The use of varieties of crops that are high water consuming and are needed to help in mitigating the effect of increased rainfall on land. No tillage or minimum tillage practice can also go a long way at helping the top of the land to remain cohensive and have greater strength to withstand light flood erosion. A drip from the roof of house neglected over a long time can eventually result in the formation of devastating gully.

Conservation measures have to be adopted (being never too early) and these include contour ploughing, strip cropping, the extended use of manures, the planting of new grasses such as vertiva grass, and soil binding leguminous plants, the transference of land from arable to pasture, the encouragement of mixed farming and the planting of trees, and most essentially **the erection of small dams across rain-carved gullies**. These measures have worked in advanced nations of today (United State of America and Europe) in their early developmental stages, and Nigeria can not be an exception except we have resolved to be indolent to be doomed.

The elimination of bush/land clearing by burning will eliminate the destruction of soil particles binding substances in the soil as a result of heat. The destruction of these substances often make the soil particles friable and therefore standing out individually at the detriment of their consistency and ability to withstand wind and water erosion.

CONCLUSIONS

Climate change is indeed a serious challenge to sustainable land resource management in agriculture and the extension of farm mechanization to the farther north and south of Nigeria. This challenge will worsen as time passes if the government at all levels do not change from their present non-challant approach to energetic mobilization of huge capital, skill and expertise (without tribal and religious sentimentality), and conscientious understanding of the pivotal position of capital and expertise in the success of well intended programmes of development. It is only hoped that the Federal Ministry of Agriculture and Rural Development implementation of a three phase “Nigeria Strategic Investment framework for sustainable Land Management (NSIF-SLM) aimed at promoting a multi-sector cooperation to reduce the risk posed by climate change on the livelihood of local farmer and ensuring the productive utilization of the nation’s resources would achieve the desired results and not fail like other projects by governments in Nigeria.

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ASSESSMENT OF PECTINMETHYLESTERASE ACTIVITIES (PME) IN THE JUICE OF TROPICAL FRUITS PURCHASED FROM THE ROMANIAN MARKET

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Abstract

*The purpose of this paper was to evaluate comparatively pectinmethylesterase activities (PME) from the juice of some tropical fruits purchased from the Romanian market. In this respect, a series of parameters, such as: pH, protein content (with Folin-Ciocalteu reagent) and pectinmethylesterase activities (PME) by the titrimetric method, were analyzed from the juice of kiwi, mango, avocado and persimmon fruits. From each type of fruit, three samples were analyzed. The results were statistically evaluated. Descriptive statistical parameters revealed very large variability of PME activity in persimmon juice (CV%=50). The t test highlighted that: pH values differed very significantly between fruits juices, protein content was significantly higher in kiwi juice (0.779 mg%) and persimmon (0.485 mg%), compared to other juices (t varied between 14.246*** - 179.365***; p<0.001). Mango and avocado juices had lower and similar protein content (0.317 mg% and 0.324 mg%, t=0.281 ns). The PME activity (ηEqv carboxyl/gs) had the following values: 29.993 in kiwi, 16.660 in mango, 56.660 in avocado and 106.650 in persimmon juice. The variance analysis (ANOVA) of the PME activity revealed, with a probability of error less than 5%, that there were real differences between at least two of the fruit juices. The post hoc Tukey HSD test revealed that PME activity in persimmon juice was significantly higher than the PME activity in kiwi and mango juices (p=0.035, respectively p=0.015). It can be said that the mango and kiwi fruits, analyzed in our experiment, seemed to be in a more advanced ripening phase, compared to avocado and persimmon fruits.*

Key words**:** *pecti metylesterase activity, statistical assessment, tropical fruits juice*

INTRODUCTION

Pectin methylesterases (PME) are enzymes present in all organisms of the plant kingdom and are involved in adjusting the methylation degree of pectin, which is the main component of cell walls [5]. These enzymes are present in the physiological mechanisms that have as object: vegetative growth, reproductive processes, plant self - defense (plant - pathogen interaction), stress response, or senescent processes. Changes in pectin structure are associated with changes in cellular adhesion, plasticity, pH and ionic status of the cell walls [22]. Pectins are complex polyglucides rich in galacturonic acid, which may contain up to 17 different carbohydrates [32]. Pectins are the major components of the median lamella and of the primary cell wall, reaching up to 30-35% of the cell wall dry matter [29].

In the case of kiwi fruit (*Actinidia sp*.), the strongest scientific researches so far, support evidence of improvement in gastrointestinal tract functions. Preliminary studies have identified positive effects on attenuation of carbon tetrachloride-induced liver damages in rats, modulation of global immune function in mice, stimulation of bone marrow cells proliferation in vitro, reduction of chemotherapy toxic effects, increased resistance to effort [28].

Mango Fruit (*Mangifera indica*) is extensively studied for the polyphenolic content, with magniferin like antioxidant effect (one of the most powerful antioxidants known). The active substances in mango work synergistically and there is hope that they will

be used to reduce the incidence of degenerative diseases such as: cancer, atherosclerosis, diabetes and obesity [19].

The avocado fruit (*Persea american*) is known mainly for the richness of active compounds, present in the lipid fraction (omega fatty acids, phytosterols, tocopherols, squalene), involved in the reduction of cholesterol and of cardiovascular diseases incidence [6].

The persimmon fruit (*Diospyros kaki*) is considered a source of antioxidant substances, mainly from the high molecular weight tannin fraction. A number of in vitro studies have shown that these tannin substances can reduce the cardiovascular diseases risk, hypertension, diabetes and a wide range of cancers. Also, persimmon fruit consumption reduces the rate of alcohol absorption and metabolism, relieving hangover symptoms [8].

Most literature data show that the kiwi fruit pH is around 3.5 [7; 10]. The pH of mango fruit varies widely within the range of 3.00-4.80, as reported in the literature. The different results reported by the authors are mainly related to the fruit variety and the degree of maturation at which determinations have been made, considering that mango fruit is anyway a fairly perishable tropical fruit [12; 31]. Avocado pH also varies widely, depending on the maturation stage (5.68 - 6.30 on the data reported by Ozdemir et al., 2009) and decreases later on during storage [18, 21]. Certain authors reported for avocado pH values ranging from 6.0 to 6.5 [30]. With regard to the persimmon fruit, the number of storage days and packing are critical factors for the pH value. Khan et al. (2007) reports declines in pH value from 5.7 to 3.66 depending on these factors [16]. Previously, Sargent et al. (1993) reported pH values ranging from 5.29 to 5.86 for a variety of persimmon (*Fuyu* variety) cultivated in California and kept under different temperature conditions over a week [25]. Altunas et al. (2010) reported an average pH value of 5.5 for the same variety grown in the Black Sea region [1]. On the other hand, for varieties cultivated in the eastern Mediterranean part of Turkey, Yýldýz et al. (2007) found an average pH value of 5.0, for the persimmon juice [33].

Fruits protein content is essential for their nutritional value. Data from the literature show that kiwi fruit has a protein content of between 0.81 and 1.52%, depending on several factors, among which the variety and culture conditions seem to be very decisive [27]. For mango fruit, protein content ranges between 0.11-0.42% in juice or nectar and 0.82% in fruit pulp [26]. The average protein content of the avocado fruit is estimated to be about 1.8%, but there is a significant variation between different varieties and between different parts of the fruit. So, in *Fuerte* variety, the protein content is: 1.33±0.12% in peel, 1.20±0. 36% in pulp and 2.22±0.46% in seeds [23]. In the case of persimmon fruit, the protein content may range from 0.58% to 0.8% [4].

Considering that PME activity is correlated with loss of fruit consistency during storage, as a result of pectic substances degradation, the determination of PME activity is essential for overall assessing the degree of maturation and the quality of the fruits. Numerous studies have shown that the dynamics of the process of depolymerization and decrease of the methylation degree of pectic substances is characteristic for each species of fruits, being dependent on the complexity of pectic molecules, pectolytic enzymes, as well as on the intensity of metabolism. Activating or inhibiting factors of the process are: temperature, pH, presence of anions or cations etc. [3]. Practically, PME activity is directly proportional to the level of fruit maturation, going down to overripe fruits, that have passed the stage of consumption [15; 35]. The various methods of determination, the degree of fruits maturation, as well as the units in which the PME activity is expressed, make the results very different from author to author [14]. Also, thermal treatments of fruits significantly diminishes PME activity [9]. Thus, Gonzales (2011) reported the thermal inactivation of PME in mango fruit [11].

The main objective of the research was to highlight the comparative PME activity in the juice of several tropical fruits, provided by supermarkets in Romania.

MATERIALS AND METHODS

There were randomly purchased from a supermarket, imported tropical fruits (3 pieces of each assortment), namely: kiwi, mango, avocado and persimmon, in order to evaluate the pectinmethylestrase activity (PME). The fruits were fresh, ripe, seemingly free from signs of excessive soaking, indicating an advanced maturation.

In order to maintain the variability that we can not control, in low limits, each type of fruit was purchased from a single source or from the same batch, because their ripening stage was similar. Also, the fruits have been selected so, that on the assortments, they can be of comparable size.

The fruits were initially washed with water and dried at ambient temperature. Subsequently, they were peeled and cut into small pieces. These pieces were subjected to a homogenization with a blender, in order to be centrifuged and to obtain the juice. There were three juices replicas of each fruit assortment.

We determined the pH of the juices. Also, the protein content was analyzed by the use of the Folin - Ciocalteu reagent [13; 17; 20]. Extraction of PME was performed according to a protocol initiated by Zainon et al. (2004), which was also used by other authors, such as Avang et al. (2013) [2, 34].

Thus, 10 g of crushed fruit pulp was sampled and diluted with 20 ml of a 0.1 M sodium citrate buffer solution, in which polyvinylpyrrolidone, NaCl, EDTA and β-mercaptoethanol were dissolved according to the recipe for the preparation of the reagent, reported by Awang et al (2013), pH=4.6 [2].

The samples thus obtained (3 replicas / fruit x 4 fruits = 12 samples) were shaken for 30 minutes in containers immersed in ice water, after which they were centrifuged for 20 minutes with ultracentrifuge at 10,000 rpm at 4° C. The crude extracts (supernatants) were stored in the freezer to avoid alteration and destruction of the enzymatic activity, until analysis of PME activity. Enzymatic analysis was made by the titrimetric method proposed by Rouse and Atkins (1954) and adapted by Awang et al. (2013) [2, 24]. 0.5 ml of crude extract was added to 25 ml of 0.1M acetate buffer, pH 4.5 (containing pectin and NaCl) according to the reagent preparation recipe reported by Awang et al., (2013) [2]. The mixture was titrated with a 0.01N NaOH solution, until the pH had been stabilized at 7.3. The titration was done at 30^0C. The PME activity was expressed in ηEqv carboxil/gs groups.

Descriptive statistics of all analyzed parameters (pH, protein content, PME activity) were calculated and one way variance analysis (ANOVA) was performed for PME activities. Subsequently, the differences in PME activities among the tropical fruits assortments, were revealed by the post hoc Tukey test.

The experimental results have been subjected to computer-assisted statistical calculation, using StatSoft Statistica 7.

RESULTS AND DISCUSSIONS

Descriptive statistical parameters for kiwi, mango, avocado and persimmon pH are shown in Table 1 (n=3)

Table 1. Estimators of tropical fruits pH variability

Fruit	Mean (X)	Stand. dev. (s_x)	Variab. coeff. (CV%)
Kiwi	4.133	0.040	0.960
Mango	4.553	0.028	0.614
Avocado	5.866	0.115	1.960
Persimmon	5.250	0.034	0.647

Source: Own calculation based on the experimental results.

The pH values for kiwi and mango are similar or close to those in the literature (3.1-3.96, respectively 3.40-4.63), in avocado there were slightly lower values of pH (5.866) than those in the literature (6.27 - 6.58). The persimmon fruit had a higher pH (5.25) compared to that reported by other authors (4.42-4.70) [36]. Avocado and persimmon showed more alkaline pH values than kiwi and mango. The variation coefficients have been reduced to all tropical fruits varieties. We observed equal variances, because the variances ratio F between fruits was not significant. Although the tropical fruits pH values are placed in the weak acid range, the test t reveals very significant differences in the pH of tropical fruits (t varies between 8,897*** and

t=36,335***; knowing that: *p<0.05 significant; **p<0.01 very significant; ***p<0.001 extremely significant).

Determination of the protein content of fruit juices, with the Folin-Ciocalteu reagent, was made on the basis of the regression equation of the standard curve:

D.O. 660 nm = 0.0482 + 0.0034x, with a correlation coefficient of r=0.9965 (Table 2).

Table 2. Estimators of protein variability in tropical fruits juice(n=3)

Fruit	Mean(X) %	Stand. dev. (s_x)	Variab. coeff. (CV%)
Kiwi	0,779	0,003	0.385
Mango	0,317	0,018	5.678
Avocado	0,324	0,003	0.925
Persimmon	0,485	0,006	1.237

Source: Own calculation based on the experimental results.

Protein values vary greatly in juices of exotic fruits, taking into account the literature data. Some authors believe that juices contain only protein traces or protein content is zero [37; 38]. The values of the protein content in the fruits juices obtained by us are largely consistent with the data obtained by other authors.

In kiwi juice the protein content was 0.779%, insignificantly low compared to 0.81-1.52% range obtained by other authors [27]. The value of protein content in mango juice (0.317%) was similar to that in the literature (0.11-0.42%) [26]. In avocado and persimon juices, the found protein concentrations were lower than those reported by some authors, namely 0.324% and 0.485%, compared to 1.2% for avocado and 0.58-0.8% for persimmon [4; 26]. Variation coefficients of protein content were kept down, as we planned at the beginning of the experiment, the highest being in mango (5.678%).

Selected fruits juices contained relatively low amounts of protein, but very different among tropical fruits. In our experiment, the t test reveals an extremely significant higher protein content in kiwi and persimmon juices, compared to other juices (ranged from 14.246*** to 179.365*** p<0.001). Mango and avocado juices had a similar protein content (t=0.281 ns).

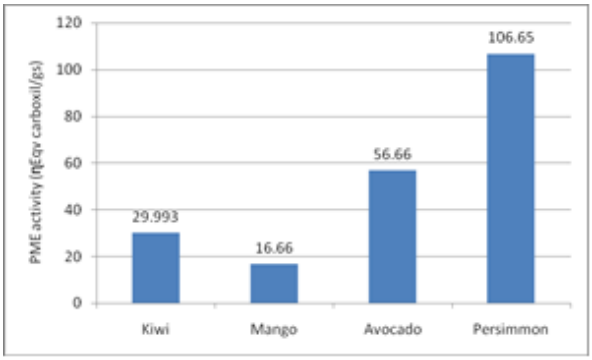
The PME activity titrimetric analysis highlighted the following values for the selected fruits juice (Table 3).

Table 3. Variability estimators of tropical fruits juice PME activity (ηEqv carboxil/gs)

Fruit	Mean (X)	Stand. dev. (s_x)	Variab. coeff. (CV%)
Kiwi	29.993	3.335	11.110
Mango	16.660	3.330	19.980
Avocado	56.660	10.000	17.640
Persimmon	106.650	53.330	50.000

Source: Own calculation based on the experimental results.

The PME activity variability coefficients are increased in selected tropical fruits juice, especially in the juice of persimmon (50%), where the standard deviation is extremely high. Substantial differences are observed between PME activities in the analyzed fruits juice (Figure 1).



Source: Design based on the experimental results.
Figure 1. PME activity of tropical fruits

Analysis of the variance (ANOVA) highlighted the existence of significant differences in PME activity between tropical fruits juice (Table 4).

Table 4. Analysis of PME activity variance in tropical fruits juice

Effect	SS (mean sum of squares)	df (degree of freed.	MS (mean square for errors)	F distri-bution	p
Intercept	33063.45	1	33063.45		
Fruit	14221.75	3	4740.58	**6.392** (4.07)	**0.016**
Error	5932.60	8	741.58		

Source: Own calculation based on the experimental results.

Following the table above, it is noted that the calculated F value of 6.392 was higher than the theoretical value of 4.07 for p<0.05.

It can be argued with a probability of less than 5% to be wrong, that there were real differences in the PME activity, between at least two of the fruits juices. We applied a post hoc single-step multiple comparison analysis, namely Tukey's HSD (honestly significant difference) test, to clarify which of the analyzed fruits had different PME activities from others (Table 5).

Table 5. Tukey HSD test for PME activity

Fruit (mean)		Kiwi	Mango	Persi-mmon	Avo-cado
		29.933	16.660	106.650	56.660
P	Kiwi				
	Mango	0.929			
	Persimmon	**0.035**	**0.015**		
	Avocado	0.644	0.340	0.190	

Source: Own calculation based on the experimental results.

It is noticed that the PME activity at persimmon was significantly higher than the PME activity in kiwi and mango ($p=0.035$ and $p=0.015$ respectively; $p<0.05$). There were no statistical differences between PME activities in persimmon and avocado.

PME activity in juices is variable, so the values found by different authors are very different. Generally, if the PME activity of a fruit is increased, the ripening and soaking process of the fruit follows. As the fruit is ripe, the PME activity goes down, due to the fact that the enzyme substrate, namely the content of pectinmethylesters decreases as well.

CONCLUSIONS

Avocado and persimmon juices had significantly higher pHs than kiwi and mango juices. The protein content was highest in kiwi juice, followed by persimmon juice, but PME activity was significantly higher in persimmon juice, followed by avocado juice. It can be said that the mango and kiwi fruits, analyzed in our experiment, seemed to be in a more advanced ripening phase, compared to avocado and persimmon fruits.

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THE EVOLUTION OF THE VEGETABLE SECTOR OF ECOLOGICAL AGRICULTURE IN ROMANIA

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Abstract

Organic farming is a modern concept which combines several factors such as tradition, innovation, science with the principles of health and ecology. It uses the existing resources for the welfare of the humanity without harming the environment. Through its content, the aim of the paper is to present the evolution of the ecological agricultural sector at national level. The paper presents aspects regarding the data of the exploited surfaces, the number of certified operators, the average size of the existing operators, during 2010-2016 period. The analysis of the indicators in the present paper was performed using the method of comparison and the percentage method. In this regard, the relative importance of different types of activities in the vegetal sector is highlighted for the analysed reference market. The data presented indicate a certified average area of 252,752.08 ha, an average number of operators of 11,161 units and an average area of 22.64 ha per operator. In the studied range, grain crops prevail (35.17%), followed by permanent crops - pastures and hayfields (28.93%) and industrial crops (21.43%), while the lowest weights are held by other crops on arable land (0.14%).

Key words**:** *dynamic, organic farming, operators, surface.*

INTRODUCTION

Among the global issues of humanity, the security of the population's diet and the protection of the environment are priorities. In present, efforts are being made to raise awareness of the limited capacity of natural resources as they are not inexhaustible [3]. Practicing the organic farming system can be a solution to these problems. The role of the organic farming system is to contribute to improving food security through the existence of a large number of economic opportunities that increase the added value of the products obtained [5]. Processing and marketing activities, better communication and cooperation between consumers and producers can lead to improved long-term food security and the development of an eco-friendly food system [8, 11].

Some authors recommend that an ecosystem approach should be prioritized in planning and policy-making at national and international level to ensure ecosystem health, to maintain food security and to achieve the Millennium Development Goals [6].

Others affirm that organic production accounts for only 1% of global agricultural production and suggests that organic farming can expand [1]. In addition, organic farming systems have various sustainability advantages and can contribute more to feeding the world. Organic farming has a long-term economic importance in the delivery of ecosystem services such as biodiversity conservation and environmental improvement [12].

In recent years, organic farming has grown rapidly globally, in 2016 being practiced in approximately 179 countries, with an area of 50.9 million ha and 2.4 million organic farms [10].

Promoting organic farming is an approach to a growing demand for high quality consumer products. The new EU policy confirms the importance and the rise of this sector in

agriculture. Thus, in 2016, in the European Union there were 12.1 ha organically grown, an increase of 68% (4.9 million ha) compared to 2007 [13].

The objectives, principles and rules applicable to organic production are included in Community and national legislation in this field. The organic production system is regulated at European level by Council Regulation (EC) No 834/2007 on organic production and labelling of organic products [4].

In the case of Romania, organic agriculture can be considered a market niche which is not sufficiently exploited, the development potential of the agricultural sector being well defined and real [2].

In order to achieve sustainable agriculture it is necessary to implement programs and initiatives aimed at minimizing the environmental impact and improving benefits for farmers. Romania can capitalize this sector on the advantage of less polluted soils and appropriate conditions for the development of this farming system. Supporting entrepreneurship in the field of organic farming can be a solution for the development of national agriculture sector. In the recent years, two agricultural support programs under the National Rural Development Program (2007-2013 and 2014-2020) have been in force, including measures to support the ecological sector.

The aim of this study was to examine the evolution of the vegetal sector in organic farming in Romania during 2010-2016.

MATERIALS AND METHODS

In the study are presented information about the number of certified operators, total area, names of crops and crop groups to be presented. The existing data has been retrieved and processed through various methods.

In this paper were used indices analysis, the method of comparison over time being emphasized through the mobile base index, calculated using the formula: $I_{bm} = \frac{Y_n}{Y_{n-1}} x100$, in which: Y_n - the level of indicator for each component of the dynamic series; Y_{n-1} - the level of temporal sequence indicator considered as a basis for comparison or reference period. In order to determine de indices structure at the national level (for the cultivated area) it was calculated after the following formula: $I_s = \frac{S_i}{S_t} x100$ (%), in which: S_i - the area occupied by each culture group (ha), S_t – total national area (ha) [7].

RESULTS AND DISCUSSIONS

In Table 1, there are presented information on the evolution of the total area, the number of operators and the average area per operator in Romania.

The number of operators certified in organic farming was between 3,155 (2010) and 15,544 (2012) and during this period the average was 11,161 operators. Regarding the evolution over time, the indicator recorded an upward trend from 2010 to 2012 (+207.5% and +60.2%), after which the dynamics are downward (the terms of comparison being higher than the current terms: -2.3%, -4.8%, -15.5%, -13.7% and -20.15% for 2013, 2014, 2015, 2016 and respectively 2017).

The total area recorded an average of 252752.08 ha (-2.21% in dynamics), with variation limits of 182,706 ha in 2010 and 301,148 ha in 2013. Until the year 2013, the dynamics of the indicator showed an upward trend (+25.9% in 2011 - 229,946 ha, +25.4% in 2012 - 288,261 ha, +4.5% in 2013), after which it decreased with 4.0% in 2014 (289,251.79 ha), with 15.0% in 2015 (245,923.9 ha), with 8.0% in 2016 (226,309 ha) and again increased in 2017 with 14.21% (258,470.92 ha).

Referring to the average area per certified operator, there exist variations limits from 18.54 ha in 2012 and 57.91 ha in 2010, and the period analysed the average of was 22.64 ha (-26.02% in dynamics compared to the previous term of the series). The evolution of the indicator was uneven over the time period studied. Therefore, there are decreases regarding the terms of comparison of 59.1% in 2011 (23.70 ha) and 21.7% in 2012, while

the other indicators of the dynamic series exceeded the baselines by 0.6% (20.11 ha in 2015), 0.9% (19.99 ha in 2014), 6.6% (21.43 ha in 2016), 6.9% (19.82 ha in 2013) and 43.03% (30.65 ha in 2017).

This decline in the number of operators and areas in organic farming may be due to difficulties in commercializing the products, insufficient financial resources for operators and even failure to comply with production and certification rules in this sector. Analysing the level of support for ecological practices [9], reported a significant increase in compensatory payments in comparison with the previous programming period, which should stimulate operators to continue such practices.

Table 1. The dynamics of the number of operators in organic farming

Year	Specification	Number of certified operators	Total area (ha)	Operator's average area (ha)
2010	Effective	3,155	182,706	57.91
2011	Effective*	9,703	229,946	23.70
	2011/2010**	307.5	125.9	40.9
2012	Effective*	15,544	288,261	18.54
	2012/2011**	160.2	125.4	78.3
2013	Effective*	15,194	301,148	19.82
	2013/2012**	97.7	104.5	106.9
2014	Effective*	14,470	289,251.79	19.99
	2014/2013**	95.2	96.0	100.9
2015	Effective*	12,231	245,923.9	20.11
	2015/2014**	84.5	85.0	100.6
2016	Effective*	10,562	226,309	21.43
	2016/2015**	86.3	92.0	106.6
2017	Effective*	8434	258,470.92	30.65
	2017/2016**	79.85	114.21	143.03
Average	Effective*	11,161	252,752.08	22.64
	Average/2017**	132.34	97.79	73.98

*http://www.madr.ro/agricultura-ecologica **own calculation

Tables 2 and 3 present the evolution of the surfaces of different types of crops.

Regarding the cereals, there are variation limits between the years 2010-2013 from 72,297.8 ha to 109,105 ha, and concerning the average of the period it reached 88,726.70 ha (+4.5% in dynamics). From 2010 to 2013, the area of cereals increases successively as follows: +9.5% in 2011 (79,167 ha), +32.8% in 2012 (105,149 ha) and +3.8% in 2013. After this time sequence there are decreases in the area cultivated by 6.0% for the year 2014 (102,531.47 ha), 20.6% in 2015 (81,439.5 ha), 7.7% in 2016 (75,198.31 ha), followed also by an increase of 12.9% in 2017 (84,925.51 ha).

If we analyse the areas allocated to dried pulses for the production of grains, an average of 3,152.02 ha is recorded, which is under 0.63 times the comparison term. During the dynamic series the downward trend of the indicator is observed. Thus, it starts from an area of 5,560.22 ha in 2010, after which the indicator records annual successive decreases of: 43.4% for 2011 (3,147.36 ha), 12.2% for 2012 (2,764.04 ha), 13.3% for 2013 (2,379.34 ha), 3.5% for 2014 (2,314.43 ha) and 20.7% for 2015 (1,834.35 ha). The exception is for the years 2016 and 2017 when there is an increase of 20.1% (2,203.78 ha) and respectively 26.6% (4,994.66 ha) (Table 2).

Regarding the situation of tuberculous and root plants, it starts from an area of 504.36 ha in 2010, then it grows 2.13 times in 2011 (1,074.98 ha), in 2012 there is an increase of 4.6% compared to the previous term of the dynamic series (1,124.92 ha), the indicator for the year 2013 decreased by 34.2% (740.75 ha), the downward trend with 15.4% (626.99 ha) continues for the year 2014, for the year 2015 the indicator increases by 6.5% compared to the reporting base (667.55 ha), a trend that is also maintained in 2016 (+5.9% representing 707.03 ha).

Table 2. The evolution of the areas related to organic agriculture in Romania at some types of crops (ha)

Year	Specification	Cereals	Dried pulses	Tuberculous and root plants	Industrial crops	Green harvested plants
2010	Effective*	72,297.8	5,560.22	504.36	47,815.1	10,325.4
2011	Effective*	79,167	3,147.36	1,074.98	47,879.7	4,788.49
	2011/2010**	109.5	56.6	213.1	100.1	46.4
2012	Effective*	105,149	2,764.04	1,124.92	44,788.7	11,082.9
	2012/2011**	132.8	87.8	104.6	93.5	231.4
2013	Effective*	109,105	2,397.34	740.75	51,770.8	13,184.1
	2013/2012**	103.8	86.7	65.8	115.6	118.9
2014	Effective*	102,531.47	2,314.43	626.99	54,145.17	13,493.53
	2014/2013**	94.0	96.5	84.6	104.6	102.3
2015	Effective*	81,439.5	1,834.35	667.55	52,583.11	13,636.48
	2015/2014**	79.4	79.3	106.5	97.1	101.1
2016	Effective*	75,198.31	2,203.78	707.03	53,396.86	14,280.55
	2016/2015**	92.3	120.1	105.9	101.6	104.7
2017	Effective*	84,925.51	4,994.66	665.54	72,388.33	20,350.75
	2017/2016**	112.9	226.6	94.1	135.5	142.5
Average	Effective*	88,726.70	3,152.02	764.02	53,095.97	12,642.78
	Average/2017**	104.5	63.1	114.8	73.3	62.1

*http://www.madr.ro/agricultura-ecologica/ **own calculations

In 2017 is recorded a decrease by 5.9% (665.54 ha) compared to the previous term. Under these circumstances, the average of the period reached 764.02 ha, which in dynamics determines the over-values of the calculated indices (114.8%).

Referring to the industrial crops, they are characterized by variation limits of the cultivated area, of 44,788.7 ha in 2012 (-6.5% in dynamics) and 72,388.33 ha in 2017 (+35.5%). In this period, the average was 53,095.97 ha (-26.7%). During the dynamic series analysed, the surface increased with 0.1% in 2011 in comparison with the previous term of the dynamic series (47,879.7 compared to 47,815.1 ha), in 2012 there is a decrease, the value in 2013 surpasses the reporting base 1.15 times (actual level of 51,770.8 ha), a trend that continues in 2014 (54,145.17 ha). The year 2015 recorded a decrease of 2.9% in comparison with the previous term of the dynamic series (actual level of 52,583.11 ha) and the year 2016 recorded an increase of 1.6% (Table 2).

Table 3. The evolution of the areas related to organic agriculture in Romania at other types of crops (ha)

Year	Specification	Other crops on arable land	Fresh vegetables and strawberries	Permanent crops - orchards and vineyards	Permanent crops - pastures and hayfields	Uncultivated land
2010	Effective*	579.61	734.32	3,093.04	31,579.1	10,216.8
2011	Effective*	851.44	914.08	4,166.62	78,197.5	9,758.55
	2011/2010**	146.9	124.5	134.7	247.6	95.5
2012	Effective*	27.77	896.32	7,781.33	105,836	8,810.73
	2012/2011**	3.3	98.1	186.8	135.3	90.3
2013	Effective*	263.95	1,067.67	9,400.31	103,702	9,516.33
	2013/2012**	950.5	119.1	120.8	98.0	108.0
2014	Effective*	29.87	1,928.36	9,438.53	95,684.78	9,058.66
	2014/2013**	11.3	180.6	100.4	92.3	95.2
2015	Effective*	356.22	1,210.08	11,117.26	75,853.57	7,225.85
	2015/2014**	1192.6	62.8	117.8	79.3	79.8
2016	Effective*	258.47	1,175.33	12,019.81	57,611.65	9,457.2
	2016/2015**	72.6	97.1	108.1	76.0	130.9
2017	Effective*	88.25	1,458.78	13,165.41	50,685.74	9,747.94
	2017/2016**	34.1	124.1	109.5	88.0	103.1
Average	Effective*	306.95	1,173.1	8,772.8	74,893.8	9,224.01
	Average/2017**	347.8	80.4	66.6	147.8	94.6

*http://www.madr.ro/agricultura-ecologica/ **own calculation

The green harvested plants are characterized by an average area of 12,642.78 ha (-37.9% in dynamics), with extreme values of 4,788.49 ha for 2011 (-53.6% compared to 10,325.4 ha cultivated in 2010) and 20,350.75 ha for the year 2017 (+42.5% compared to the reporting base). The indicator evolved in descending order only in 2011 compared to 2010, after which is an upward trend (2.31, 1.18, 1.02, 1.1 and 4.7 times of the reference terms for the years 2012, 2013, 2014, 2015 and 2016 (Table 2).

If we refer to the specific situation of other crops cultivated on arable land (Table 3), there is an area of 579.61 ha in 2010, an area that grows 1.46 times in 2011 (851.44 ha), then the indicator decreases drastically in 2012 (27.77 ha which represents only 3.3% of the reporting base). In 2013 occurs a spectacular increase of the indicator (it surpasses 9.50 times the previous term of the dynamic series - 263.95 ha), followed by a sharp decrease registered in 2014 (-88.7% comparative to the previous year - an area of 29.87 ha), while in 2015 the indicator is spectacularly recovering (surpasses 11.92 times the comparison term - 356.22 ha), and in 2016 it decreases (-27.4% that account for 258.47 ha) followed also by a significant decrease 88.25 ha (-65,9%) in 2017. As a result of the above mentioned, an average of 306.95 ha is reached, which in dynamics highlights an upward trend (+247.8%).

Fresh vegetables and strawberries were grown on average on 1,173.1 ha (-19.6% in dynamics), with variations of the indicator from 734.32 ha in 2010 to 1,928.36 ha in 2014. The evolution of the area planted with vegetables highlights supraunitary values of the indices for the years 2011, 2013, 2014 and 2017 (124.5, 119.1, 180.6% and 124.1% - actual levels of the areas of 914.08, 1,067.67, 1,928.36 ha and 1,458.78 respectively), but also subunit values in 2012, 2015 and 2016 (98.1, 62.8 and 97.1% - actual levels of 896.32, 1,210.08 and 1,175.33 ha respectively).

Considering the situation of the permanent crops - orchards and vineyards, there is a permanent increase of the certified areas starting from 3,093.04 ha in 2010, 4,166.62 ha in 2011 (+34.7% in the dynamics), 7,781.33 ha in 2012 (+86.8%), 9,400.31 ha in 2013 (+20.8%), 9,438.53 ha in 2014 (+0.4%), 11,117.26 ha in 2015 (+17.8%), 12,019.81 ha in 2016 (+8.1%) and also 13,165.41 ha in 2017 (9.5%). Consequently, during this period analysed the average was 8,772.8 ha, which in dynamics registered a 33.4% decrease unlike the previous term (2017) of the dynamic series.

Permanent cultures such as pastures and hayfields are characterized by an average of 74,893.8 ha (+47.8% in dynamics), having variation limits of 31,579.1 ha in 2010 and 105,836 ha in 2012. The indicator has experienced successive annual increases in 2011 and 2012 (+147.6 and +35.3% - an effective level of 78,197.5 ha for 2011), then from 2013 to 2017 the evolution registered downward trend (2.0, 7.7, 20.7, 24.0 and 12% while reaching actual areas of 103,172, 95,684.78, 75,853.57, 57,611.65 and 50,685.74 ha respectively for 2013, 2014, 2015, 2016 and 2017).

Uncultivated land is characterized by limits of 7,225.85 ha in 2015 (-20.2% in dynamics) and 10,216.8 ha in 2010. The average of the period recorded 9,224.01 ha (-5.4% in dynamics). The value of the indicator declined in 2011 by 4.5% compared to 2010 (9,758.55 ha), a trend which continued in 2012 (-9.7% and 8,810.73 ha), after which is an increase in 2013 (+8.0% of 9,516.33 ha), then the downward trend is registered for 2014 and 2015 (-4.8% for 2014, with an area of 9,058.66 ha), in 2016 again increased +30.9% (9,457.2 ha). In 2017 there is a slight increase of 9,747.94 ha (+3.1%).

In the year 2010 the structure of the total area was as follows (Table 4): 39.57% cereals, 26.17% industrial crops, 17.28% pastures and hayfields, 5.65% green harvested plants, 5.59% uncultivated land, 3.04% dried pulses, 1.69% orchards and vineyards, 0.40% fresh vegetables and strawberries, 0.32% other cultures, 0.28% tuberculous and root plants.

If we refer to the specific situation of 2011, the structure includes, in ascending order, the following weights: 0.37% other crops, 0.40% fresh vegetables (including melons) and strawberries, 0.47% tuberculous and root plants, 1.37% dried pulses, 1.81% orchards and vineyards, 2.08% green harvested plants, 4.24% uncultivated land, 20.82% industrial crops, 34.0% pastures and hayfields, 34.43% cereals.

For the year 2012, there are distinguished similar weights for pastures and hayfields and cereals (36.72 and 36.48%, respectively), followed by industrial crops with 15.53%, the rest of the crop groups having shares under 5%: 3.84% green harvested plants, 3.06% uncultivated land, 2.69% orchards and

vineyards, 0.96% dried pulses, 0.39% tuberculous and root plants, 0.31% fresh vegetables, 0.01% other crops.

Table 4. Share (%) of crops in total organic farming area in Romania*

Specification	2010	2011	2012	2013	2014	2015	2016	2017	Average
Total area	100	100	100	100	100	100	100	100	100
Cereals	39.57	34.43	36.48	36.23	35.45	33.12	33.23	32.86	35.17
Dried pulses	3.04	1.37	0.96	0.80	0.80	0.75	0.97	1.93	1.33
Tuberculous and root plants	0.28	0.47	0.39	0.25	0.22	0.27	0.31	0.26	0.31
Industrial crops	26.17	20.82	15.53	17.19	18.72	21.38	23.59	28.01	21.43
Green harvested plants	5.65	2.08	3.84	4.38	4.66	5.54	6.31	7.87	5.04
Other crops on arable land	0.32	0.37	0.01	0.09	0.01	0.14	0.11	0.03	0.14
Fresh vegetables (including melons) and strawberries	0.40	0.40	0.31	0.35	0.67	0.49	0.52	0.56	0.46
Permanent crops - orchards and vineyards	1.69	1.81	2.69	3.12	3.26	4.52	5.31	5.09	3.44
Permanent crops - pastures and hayfields	17.28	34.00	36.72	34.44	33.08	30.84	25.46	19.61	28.93
Uncultivated land	5.59	4.24	3.06	3.16	3.13	2.94	4.18	3.77	3.76

* own calculation

In 2013, the structure of the surface was as follows: 36.23% cereals, 34.44% pastures and hayfields, 17.19% industrial crops, 4.38% green harvested plants, 3.16% uncultivated land, 3.12% orchards and vineyards, 0.80% dried pulses, 0.35% fresh vegetables, 0.25% tuberculous and root plants, 0.09% other crops.

Year 2014 is characterized by an ascending structure as follows: 0.01% other crops, 0.22% tuberculous and root plants, 0.67% fresh vegetables, 0.80% dried pulses, 3.13% uncultivated land, 3.26% orchards and vineyards, 4.66% green harvested plants, 18.72% industrial crops, 33.08% pastures and hayfields, 35.45% cereals.

The structure of the crops in the year 2015 is predominantly of cereals and pastures and hayfields - which together account for about 64% of the total (33.12% and 30.84%), followed by the industrial crops (21.38%), followed by green harvested plants (5.54%), orchards and vineyards (4.52%), uncultivated land (2.94%), dried pulses (0.75%), fresh vegetables (0.49%), tuberculous and root plants (0.27%) and other crops (0.14%).

With regard to the specific situation of 2016, the structure comprises, in ascending order, the following weights: 0.11% other crops, 0.31% tuberculous and root plants, 0.52% fresh vegetables, 0.97% dried pulses, 4.18% uncultivated land, 5.31% orchards and vineyards, 6.31% green harvested plants, 23.59% industrial crops, 25.46% pastures and hayfields and 33.23% cereals.

Considering the situation in 2017, it is clearly that predominate cereals with 32.86%, than industrial crops 28.01%, pastures and hayfields have a share of 19.61%, followed by green harvested plants 7.87%, orchards and vineyards 5.09%, uncultivated land 3.77%, dried pulses 1.93%, while the rest of the cultures have shares under 1% such as fresh vegetables, tuberculous and root plants and other crops (0.56%, 0.26% and 0.03%).

The average of the period has a suggestive structure based on the data presented above: 0.14% other crops, 0.31% tuberculous and root plants, 0.46% fresh vegetables (including melons) and strawberries, 1.33% dried pulses, 3.44% orchards and vineyards, 5.04% green harvested plants, 21.43% industrial crops, 28.93% pastures and hayfields, 35.17% cereals.

The main difficulties with the ecological agriculture are those related to product marketing, limited financial resources, lack of information and business partners. Such difficulties are due to the lack of forecasting and organization of the sector.

CONCLUSIONS

This analysis led to the following conclusions:
-the number of certified operators experienced an upward trend from 2010 to 2012, after

which the trend was downward. It is worth noting, however, that the declines recorded since 2013 are not very pronounced;
- the total area increased from 2010 to 2013, after which there are somewhat similar decreases to the number of operators. In this context, it is worth pointing out that, for Romania, the ecological sector of agricultural production is not very important;
-the average area per certified operator declined substantially after 2010 (with recovery trends after 2012), which shows the attempts of many economic agents to fit into a niche market that is starting to grow better at the national level. This can be due to the structural changes that are beginning to take place at the level of consumers in terms of changes in consumer preferences (the phenomenon must be associated with the emergence of some consumers who, in terms of income, can turn to organic products);
- the evolution over time of the surfaces of different types of crops can be structured in the following directions: strictly descending trend for dried leguminous plants but has an increase in the last two years of the period analysed, strictly non-uniform evolution for cereals, fresh vegetables, industrial cultures, tuberculous and root plants and other crops, descending trend followed by a recovery and then again decrease for the uncultivated land, non-uniform evolution followed by an increase in green harvested plants, upward trend up to a point following decreases (pastures and hayfields), a strictly upward trend for orchards and vineyards;
-in the structure of the total area predominates the cereals (the first place almost every year), followed by pastures and hayfields (they held the third place only in 2010 and 2017, and for the rest of the period they were second), industrial crops (3rd place except the first and the last year when placed second). From the average total area, these groups of crop represent 85.74%. The surface occupied by the rest of the crops is below the 4.5% threshold. Nevertheless, it is worth noting that the surface of the uncultivated land had only 3.65% of the total average area;
- organic farming can be an opportunity to minimize the impact of human activities on the environment and to obtain benefits for farmers, the potential of this sector not being properly exploited in Romania, which requires further measures and policies to support this sector.

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CONSIDERATIONS CONCERNING WORLDWIDE PRODUCTION AND MARKETING OF SUNFLOWER SEEDS

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Abstract

In this paper are presented the main trends manifested in the world with reference to the production and marketing of sunflower seeds, during 2012-2016. Worldwide, sunflower culture is an important culture because it has a number of uses, such as: human food; for animal feed; for industry and energy; and other related uses. In this study we have presented and analyzed a series of indicators related to the production and marketing of sunflower seeds worldwide. Among the studied indicators were noted: areas planted with sunflower worldwide; overall rate of production of sunflower seed; the total amount of fertilizer used for the production of sunflower; average yield per hectare for sunflower seeds; human sunflower consumption; imports and world exports of sunflower seeds. In the future, it is expected both an increase in the area planted with sunflower and an increase in sunflower seed production. The main statistical data that was used in the paper was taken from specialized international sites.

Key words**:** *sunflower seeds; worldwide production of sunflower seeds; consumption; imports and exports*

INTRODUCTION

Currently, at a global level, oil plants are highly valued by farmers because the products resulting from their processing are demanded and used in several sectors of activity. Oil plants are plants that have a high degree of fat in seeds, which contribute to obtaining oil with special characteristics [1,9].
There is a worldwide increase in the production of oilseeds, which directly contributes to increased attractiveness for oilseed crops [10].
It is necessary to recall that the increase of the oilseed areas has been determined to a relatively large extent by a representative aspect, such as the use of oil crops for the production of biofuels because they represent significant substitutes for gasoline and diesel [8].
Sunflower (Helianthus annuus L.) is part of the oil plant category. The sunflower fruit (achenele) contains 50% oil, which on the one hand is highlighted by remarkable food properties and, on the other hand, a high degree of conservatism. Sunflower is currently used in several areas such as: the food sector; livestock sector; energy etc, [15].
Sunflower culture is mainly used to obtain alimentary oil. The oil obtained is a good quality oil used in the population feeding. It is also necessary to recall that phosphatides result from the oil extraction process and they are very important because of their usage on a large scale in the food industry [6].
Sunflower culture originates in Central and North America and is found throughout the globe [16].
Worldwide, sunflower culture is remarkable because it occupies significant areas, being considered a culture that contributes directly to providing food for both humans and animals. Another significant aspect for sunflower crops is represented by the high productivity, which leads to the permanently growth of the cultivated areas. On the globe, sunflower crops are ranked fourth after corn; wheat and rice [7].
Sunflower culture is an attractive crop for farmers because it has a number of advantages that directly contribute to increasing the achieved financial results. Among the advantages of this culture we mention:
-Lower costs per area unit compared to other crops;

-It is totally mechanized and does not raise problems for the farmer;
-Sunflower is an oil plant which capitalizes the terrain with medium fertility;
-Sunflower is a plant with moderate requirements for fertilization with nitrogen and phosphorus;
Sunflower is a good precursor for autumn wheat etc, [6].

Photo 1. Sunflower crop
Source: [3]

Globally, the cultivation of sunflower hybrids has helped to increase the attractiveness for this culture [11].
According to published statistical data, the sunflower culture is widespread in Europe, where over 70% of the world's production is achieved [4].
Currently, in Europe, the sunflower culture is widespread in the eastern and southern regions. Although there are significant sunflower productions in these regions, it is important to mention that the productivity of this crop is threatened by the adverse climatic changes in Europe. These climatic changes increase the vulnerability of sunflower crops, leading to the expansion of this culture to the northern areas of Europe [2].

MATERIALS AND METHODS

To achieve this paperwork we used a series of statistical data that were provided by specialized international sites. In order to carry out a study that would show the main realistic trends in the production and marketing sector of sunflower seeds worldwide, many specialized materials were consulted.

The main indicators that led to the realization of this study are: total areas cultivated with sunflower worldwide; total sunflower seed production worldwide; the total amount of fertilizer allocated for the production of sunflower; yield per hectare for sunflower seeds; human consumption of sunflower seeds; imports and exports of sunflower seeds worldwide. The indicators in this paper have been studied and analysed for the period 2012-2016.

RESULTS AND DISCUSSIONS

From the statistical data presented, the surface cultivated globally with sunflower oscillated from one period to the next. The largest area cultivated with sunflower in the world was recorded in 2016 (26,205,337 ha). On the opposite side, the smallest area cultivated with sunflower was in 2012 (25,071,000 ha). In 2016, the area planted with sunflower worldwide increased by 4.52% compared to 2012.

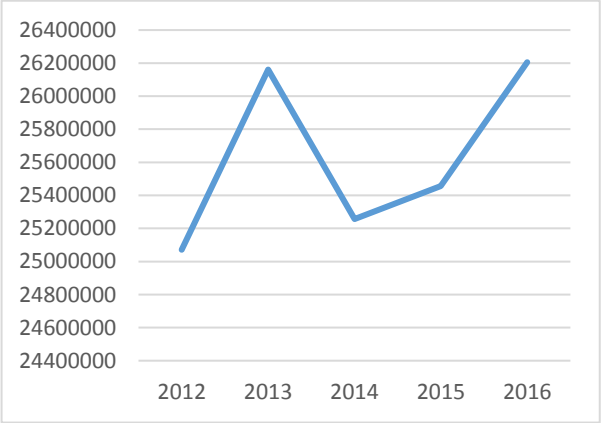

Fig. 1. The evolution of the area cultivated with sunflower worldwide, in the period 2012-2016 (ha)
Source: [4]

According to the statistical data published in 2016, the area cultivated with sunflower worldwide was distributed as follows: Europe (68.96% of the area cultivated worldwide with sunflower) respectively 18,073,117 ha; Asia (13.49%) respectively 3,537,592 ha; Americas (8.94%) respectively 2,343,571 ha; Africa (8.50%) respectively 2,228,056 ha; Oceania (0.87%) respectively 23,000 ha.

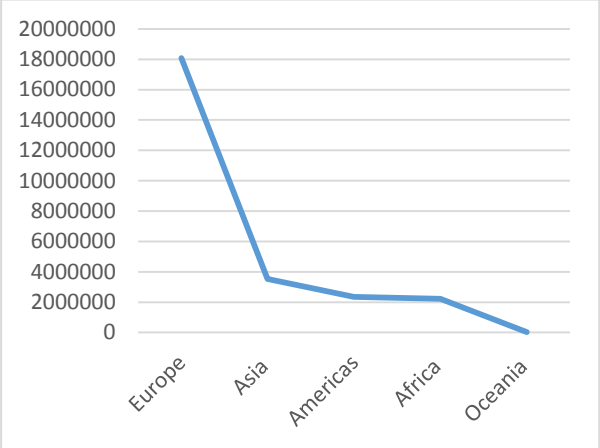

Fig. 2. Distribution of the sunflower areas by regions in 2016 (ha)
Source: [4]

Photo 2. Blooming sunflower crops
Source: [14]

Global sunflower seed production worldwide increased from 36,607,614 tonnes (2012) to 47,345,036 tonnes (2016). In 2016, the global sunflower seed production increased by 29.33% compared to 2012. During the analyzed period the production of sunflower seeds made at level varied from one year to the other.

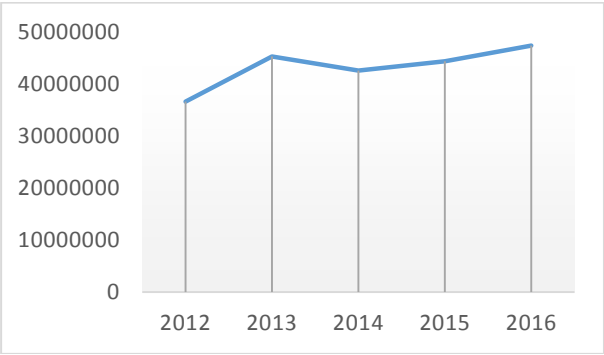

Fig. 3. The evolution of total sunflower seed production worldwide in 2012-2016 (tonnes)
Source: [4]

Photo 3. Sunflower seeds
Source: [12]

In 2016, 72.7% of the world sunflower seed production was made in Europe [4].
This is explained, on the one hand, by the fact that the largest sunflower area is cultivated in Europe and, on the other hand, by producing significant mean yields per hectare.
Also in 2016, according to data released by FAO, Asia made 12.9% of world sunflower seed production followed by the Americas (9.6%), Africa (4.7%) and Oceania (0.1%).

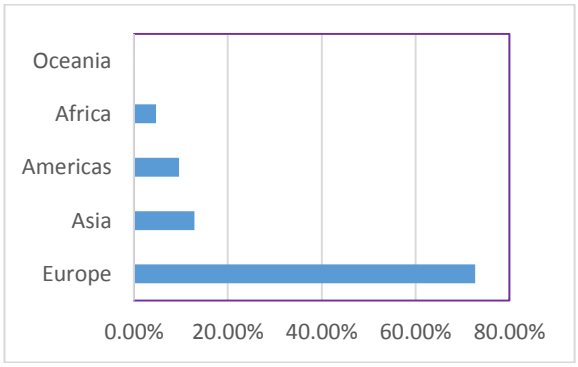

Fig. 4. Share of the production of sunflower seeds by regions in 2016 (%)
Source: [4]

In 2016, the ranking of the top ten sunflower seed producers worldwide was made up of: Ukraine (13,626,890 tonnes); Russian Federation (11,010,197 tonnes); Argentina (3,000,367 tonnes); China, mainland (2,587,422 tonnes); Romania (2,032,340 tonnes); Bulgaria (1,873,677 tonnes); Turkey (1,670,716 tonnes); Hungary (1,534,959 tonnes); United States of America (1,204,170 tonnes); France (1,189,832 tonnes).
In 2016, Ukraine achieved 28.78% of the production of sunflower seeds produced worldwide. It is necessary to specify that in

Ukraine sunflower is the main oleaginous crop. Compared to other oil plants, it ensures maximum oil yield per unit area. In this country, which is a large producer of sunflower seeds, the growth of sunflower areas is expected, as there is foreseen an increase in demand for sunflower seeds both domestically and on the external market [13].
The productivity of the sunflower culture is influenced by many quantifiable and less quantifiable factors. An important factor that determines the average crop yield per hectare for sunflower crop is represented by chemical fertilizers. Worldwide, in the period 2012-2016, fertilizer consumption has registered a decreasing trend.
The largest amount of fertilizer used worldwide was 1,137.6 thousand tonnes (2012), and the lowest amount used was 1,131.32 thousand tonnes (2016).

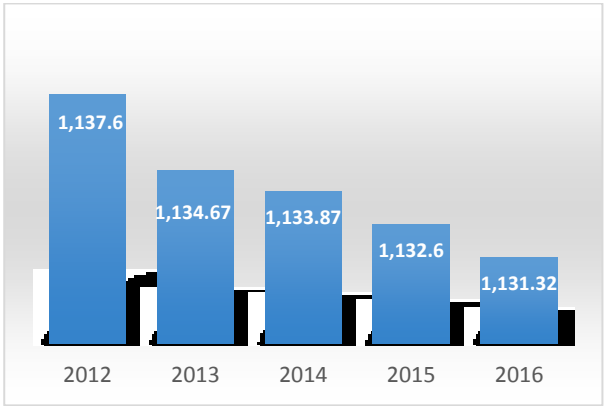

Fig. 5. Worldwide fertilizer consumption for sunflower crops in 2012-2016 (thousands tons)
Source: [5]

Average production per hectare of sunflower seeds worldwide (2012-2016) recorded yearly fluctuations. The highest average production per hectare of sunflower seeds was in 2016 (1.8 tonnes/ ha), and the lowest was registered in 2012 (1.4 tonnes / ha). In 2016, the average production per hectare of sunflower seeds worldwide increased by 28.57% compared to 2012.
From the data presented and analyzed for the period 2012-2016, it is noted that there is a close correlation between the amount of chemical fertilizers and the average production per hectare of sunflower seeds.

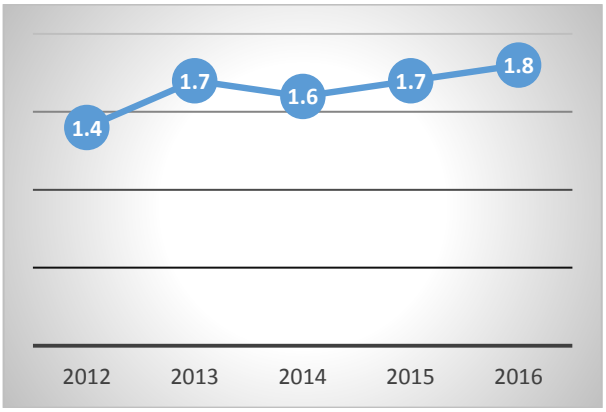

Fig .6. Average production dynamics per hectare of sunflower seeds worldwide in 2012-2016 (tonnes / ha)
Source: [4]

The consumption of sunflower seeds globally in the period 2012-2016 has seen a growing trend. The lowest consumption of sunflower seeds was recorded worldwide in 2012 (34,686.95 thousand tons), and the highest consumption was 36,095.33 thousand tons (2016).

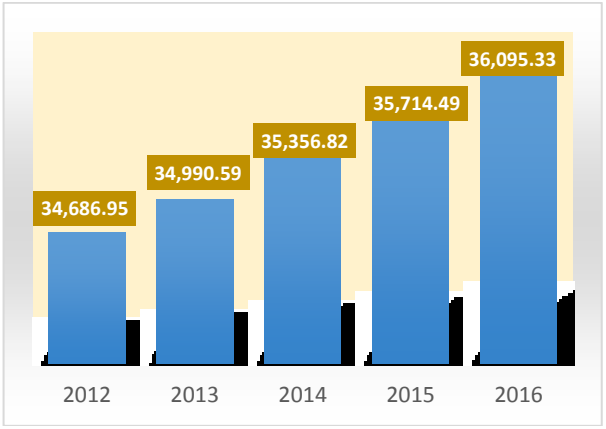

Fig. 7. The dynamics of the consumption of sunflower seeds worldwide in the period 2012-2016 (thousand tons)
Source: [5]

In the period 2012-2016, the quantitative imports of sunflower seeds worldwide have been evidenced by changes from one year to the next. The largest imported quantity of sunflower seeds was registered in 2013 (4,720,454 tonnes), and the smallest imported quantity was registered in 2012 (4,182,690 tonnes). In 2016, world sunflower seed imports increased by 11.10% compared to 2012. Also in 2016, global sunflower seed imports fell 1.56% compared to 2013, when the maximum point for quantitative imports was recorded.

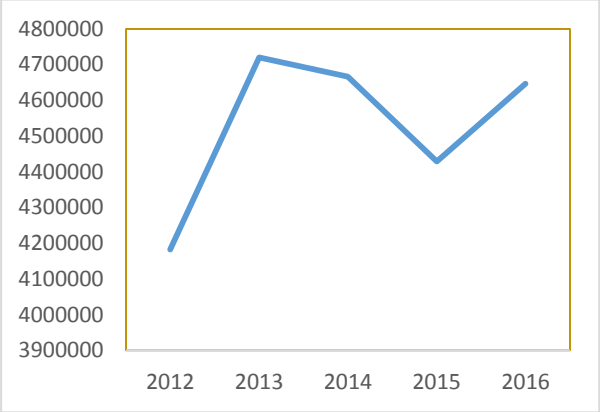

Fig.8. The dynamics of the world's sunflower seed quantity imports in 2012-2016 (tonnes)
Source: [4]

Quantitative imports of sunflower seeds in the main importing countries have fluctuated between 2013 and 2016. The Netherlands is the largest importer of sunflower seeds (646,667-690,442 tonnes), except for 2013 when it was overtaken by Turkey, with imports of 710,843 tonnes [17].

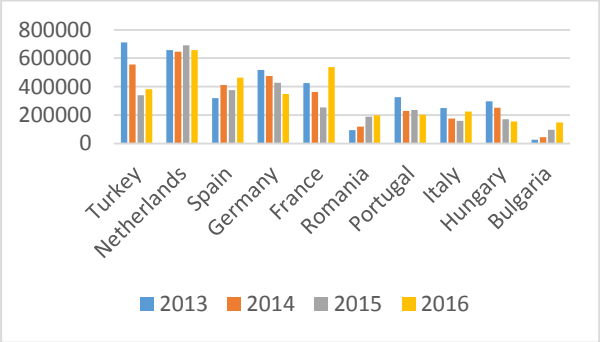

Fig. 9. Top of the main importers of sunflower seeds in 2013-2016 (tons)
Source: [17]

The value of imports of sunflower seeds worldwide during the period 2013-2016, according to official data, varied from one year to the next. In 2016, the highest value imports were recorded, of 3,187,737 Euros. The smallest value imports for sunflower seeds worldwide were € 2,801,164 (2014) [17].

According to the official data published for the period 2012-2016, the world's quantitative exports of sunflower seeds have varied from year to year. The largest exported quantity of sunflower seeds was registered in 2013 (5,295,515 tons) and the smallest exported quantity was in 2012 (4,246,600 tons). In 2016, global sunflower seed exports increased by 15.6% compared to 2012. Also in 2016, the global quantitative exports of sunflower seed declined by 7.3% compared to 2013, when it was the maximum for quantitative exports.

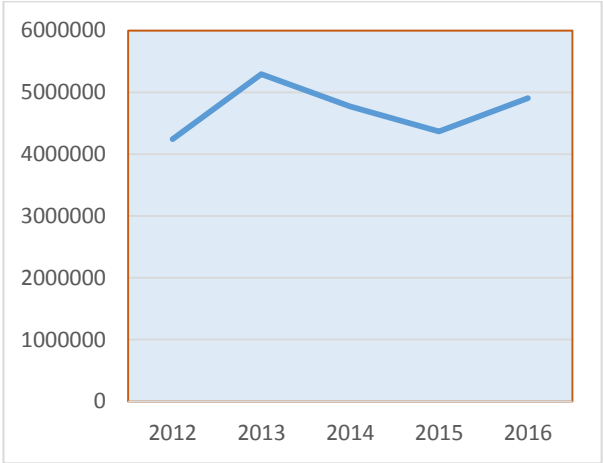

Fig. 10. The dynamics of quantitative exports of sunflower seeds worldwide in 2012-2016 (tonnes)
Source: [4]

Quantitative exports of sunflower seeds to the main exporting countries recorded changes over the period 2013-2016. Romania is the leader of the exporters of sunflower seeds (1,099,349-1,183,712 tonnes) [17].

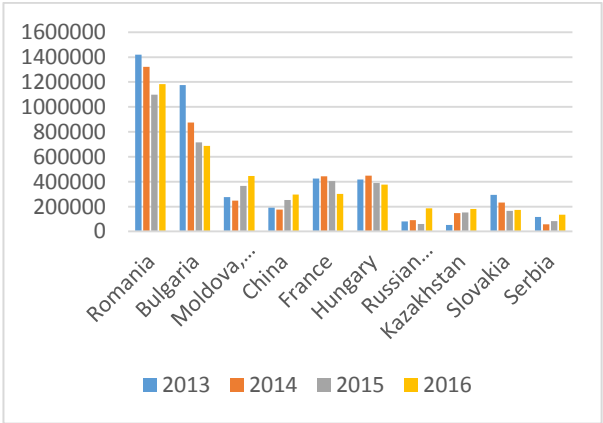

Fig. 11. Top of the main exporters of sunflower seeds in 2013-2016 (tons)
Source: [17]

The value of worldwide sunflower seed exports over the period 2013-2016, according to published data, has changed each year. In 2013, we recorded the highest export value, of 3,172,826 euros. The smallest value exports for sunflower seeds worldwide was 2,573,667 euros (2014) [17].

Nowadays, people's orientation towards organic food is becoming more and more visible, which makes it possible for the producers of sunflower seeds to grow this plant in an ecological system. Sunflower seeds made in an ecological system would, on the one hand, provide more substantial income for producers and, on the other hand, the environment would be less affected.

CONCLUSIONS

Following the analysis of the main tendencies in the production and marketing of sunflower seeds manifested in the world for the period 2012-2016, the following aspects are observed:

-The global area cultivated with sunflower increased by 4.52% in 2016 compared to 2012;

-In 2016, Europe held 68.96% of the area cultivated with sunflower worldwide;

-The world's largest production of sunflower seeds was 47,345,036 tons in 2016;

-Europe has obtained 72.7% of the total sunflower seed produced globally in 2016;

-Ukraine was the world's largest producer of sunflower seeds registered in the world in 2016 (13,626,890 tonnes);

-The chemical fertilizers used during the analyzed period were on a downward trend;

-The best average yield per hectare for sunflower seeds registered worldwide was 1.8 tons / ha in 2016;

-In 2016, there was the highest consumption of sunflower seeds, 36,095.33 tons;

-In 2013, was registered the most significant quantity of sunflower seeds imported worldwide, 4,720,454 tons;

-On average, the Netherlands is the leader of the quantitative exports of sunflower seeds from the analysed period;

-In 2013 was achieved the world's largest quantity of sunflower seed export 5,295,515 tons;

-Romania is the leader among the exporters of sunflower seeds. Quantitative exports of sunflower seed ranged from 1,099,349 to 1,183,712 tonnes;

In perspective, it is expected an increase in the areas cultivated with sunflower, because on the one hand it provides stable incomes for the producers, and on the other hand, the demand for sunflower seeds which are used in various fields of activity is expanding.

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MAIN TRENDS IN THE FORMATION OF RURAL SETTLEMENTS IN THE TERRITORY OF TARA (THE IRTYSH AREA) BETWEEN 1920 AND 1980

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Abstract

This article is concerned with studying the main trends connected with the changes of the borders of the Tara Irtysh area in the Soviet era. A wide range of sources, including some unconventional sources untypical of historical surveys (oral historical materials), was used as the basis of the research. The cumulative analysis of the above-mentioned sources enabled us to study the problem comprehensively, i.e. from the position of an inhabitant of the Irtysh area – the direct creator of history. The features of the used sources, the research object and its objective determined the basic tools that combined principles and methods generally accepted in historical science with peculiarities of new local history and rural history that were actively developing. In the course of the study, we have paid much attention to the factors determining the transformation of the rural settlement network under consideration throughout the designated period. We believe that the main factor was the state policy in the agrarian sphere. Among the reasons for the reduction in the number of villages were the policy of consolidation of the farms and the outflow of their population to cities, regional centers, and larger villages where the state planned to build central estates with a well-developed infrastructure.

Key words**:** *rural settlements, Tara, Irtysh area, migration, urbanization*

INTRODUCTION

In modern historical sciences, studying of a particular territory is in high demand, which can be explained by a number of reasons. Firstly, there is an increasing interest in "new local history" and "rural history" as its component. Secondly, the introduction of new data sources (for example, materials of oral history) into the scientific paradigm makes it possible to analyze the processes and phenomena that seemed to be fully studied from a different perspective, i.e. to see the history of Tara (the Irtysh area) "from within", to step into the shoes of its creator – the chosen person.

The notion of "Tarskoe Priirtyshye" includes the north of the Omsk region: Muromtsevsky, Bolsherechensky, Kolosovsky, Znamensky, Tevrizsky, Sedelnikovsy and Ust-Ishimsky.

A number of factors explain the increased interest in rural history. The main reason is the lack of special literature concerned with problems of a particular territory. Modern historiography on the stated problem is based on scientific works of scholars studying the history of Siberia devoted to the formation of a settlement network at the state level or in a separate region (Western Siberia). The crucial role is given to the publications of the following authors: Karpunina and Melentieva [16, 17, 31], Mazur [29, 30], Nikitaeva [34, 35, 36], Khisamutdinova [18, 19], Usoltseva [61], Chirkov [8, 9], Shlykova [48], Andreenkov [1, 2], Orlov [2, 39], Andreeva [3], Borisenko [6], Tomilin [59], Kolesnikova [24], Vasiliev [62], Okladnikov [38], Gorban [13], Sokolova [52, 53] and some other scholars.

Much attention to the region under study was paid by the Omsk scientist Kolesnikov [22, 23] who conducted research into the rural settlements in the Irtysh area and factors contributing to the formation of new villages), Sigutov [49, 50] (the author determined possible dates when rural settlements in the

Irtysh area were established), Golubetskii [12] (the author studied the settlement of separate regions in the territory under consideration), Moroz [32, 33] (the author analyzed the cultivation peculiarities and factors determining the above-mentioned peculiarities), Ilinykh [14, 15], Mazur [29, 30], Perevalov [40] and Rynkov [44].

The most factual material on the history of disappeared villages is contained in the works of local historians. We should emphasize the scientific research conducted by Fomina [11], Tsarev [60], Novikov [37], Kobutev [20, 21], Anoshin [4] and Kostina [26]. Unfortunately, there are no earlier historical works describing the territory under study at the turn of the 19th and 20th centuries. However, "these works provide valuable information and are spiritual resources that helped to preserve the identity of the regional culture" [45].

While new data are being introduced into the scientific usage that require comprehensive analysis and generalization, there is still no generalizing work on the rural history of Tara (the Irtysh area).

The chosen research object requires a comprehensive analysis of different sources. This article is based on a combination of written sources, cartographic materials and materials of oral history that have not been fully introduced into historical sciences yet. The latter are especially valuable since they directly relate to the fate of the history keeper and its creator.

The use of various written sources is primarily connected to their prevalence and accessibility. In addition, there is a traditional method of working with this source type. The written sources under consideration include legislative acts, documents of management and record keeping, statistical materials and periodicals. The analysis of legislative documents allows tracing the main directions of the state policy in all social spheres and stages of implementing the above-mentioned policy at the local level. The Decree of the Central Committee of the All-Union Communist Party (Bolsheviks) of May 30, 1950 "On the Enlargement of Small Collective Farms and Tasks of Party Organizations in this Enlargement" is of a particular interest [42]. This document reveals the state position in relation to separate villages. It defined the fate of the villages throughout the country.

While systematizing the above-mentioned documents of management and record keeping, we used the classification developed by Sokolova, which included documents of state institutions, namely business correspondence, information and accounting documents, reporting documentation [51]. The growth in the number of such documents significantly increased the amount of the sources for the research. For example, the Tarsk branch of the Historical Archives of Omsk region preserved the minutes of general meetings of collective farmers of 1950 where they addressed farming issues, suggested new names for collective farms and elected their chairpersons [54, 55, 56, 57, 58]. The analysis of annual reports and farm production plans reveals the main directions of economic activity led by collective farms, the achieved indicators and their belonging to a particular populated area.

Periodicals are a kind of a link between the "history from above" and "history from below". In this article, periodicals are mainly represented by "Omskaya Pravda" regional newspaper. Local newspapers have a significant research potential as they capture the history of destinies and give a chance to study historical processes at the microlevel. Periodicals highlight main events in the life of villages and thereby reveal the moods of their inhabitants, the successes and problems caused by the state decisions implemented in life.

Despite a tremendous potential of written sources, they reflect events and processes one-sidedly, expressing the position of the authorities. Thus, the role of nontraditional sources is constantly increasing in historical sciences. In this case, nontraditional sources are the materials of oral history. One can fully agree with Shcheglova that mass actions depersonalize history and this is one of the peculiar features of rural history. It is crucial to avoid objectification by studying the materials of oral history and introduce them into the scientific circulation [45]. Nowadays,

local libraries, local historical museums and family archives contain rich collections of memories, including those belonging to old-timers of villages that have already disappeared. The analysis of the collected materials shows that long-term residents highlighted the way of life in their villages, their appearance, rural holidays and the reasons that made villagers leave.

While studying the materials of oral history, researchers face a number of difficulties. They are connected with too much subjectivity in the analysis of materials and the lack of proven methods for their analysis. Memories reflect the inner world and emotional experience, i.e. they require special care and delicacy in the analysis [10].

Therefore, a comprehensive approach to the research of the sources allows us to fully study the chosen research object and achieve the stated objective.

MATERIALS AND METHODS

Rural history has become one of the promising directions in both domestic and foreign historical sciences in the recent decades. Developing as a part of new local history, it has resulted in the specialization of historical knowledge and manifestation of postpostmodern trends [10]. Practices of new local history and rural history enable focusing on suprapersonal structures and considering events not from the point of view of the state but taking into account the interests of a particular person, their inner world, views and attitudes. Scholars from Stavropol working on the "New Local History" project claim that "...the approach of new local history enables compiling a collective biography of local communities from the family to country level. Methods for implementing such projects are "history from below" and the multidisciplinary approach combining demographic, socio-cultural, economic-statistical, legal, political, historical and geographical aspects. In addition, "history from below" studies local communities through the history of individuals and families. It is all about the social role of the individual and behavioral stereotypes in a particular sociocultural, everyday, natural-geographical and geopolitical inhabitation. Another important aspect of studying new local history is the survey of changing forms, structures and functions of the given local space in the unity of the above-mentioned contexts" [25]. One of the research vectors of rural history is the study of disappeared villages that are regarded not as separate elements of a large country but as local sociocultural areas.

While conducting the study, we used traditional principles of historical sciences, i.e. the systematic approach and historicism. The systematic approach enabled analyzing the research object as a system, the combination of all its aspects and manifestations. The principle of historicism made it possible to study processes and phenomena in dynamics, taking into account the chosen historical conditions. It is crucial for the problem stated in the article since the state policy was among main factors determining the Soviet society.

We have used the general scientific methods of cognition and special methods of historical research for a comprehensive study and analysis of the issues the research deals with, including narrative (narrative-descriptive), comparative-historical and biographical methods. The narrative method comprises the logical presentation of historical facts taking into account the cause-and-effect relationship. The comparative-historical method enables identifying general and particular aspects in the processes under study, comparing changes in the development of the research object throughout the designated chronological period. The biographical method makes it possible to study the life features, activity results and the psychological portrait of a particular person in details. The biographical method is significant in this kind of research since methodological practices of rural history emphasize the fate of a particular person. This circumstance has also caused a special research interest in oral history that exists but "has not a graphic form" [46]. Turning to the materials of oral history, we should highlight that the modern interest in oral sources is associated with the growing interest of historians to a simple person, i.e. the "creator

of history" whose rich life experience has not been recorded in historical literature. This fact is especially relevant for this study since the personal factor is crucial for rural history. The materials of oral history give the opportunity not only to study the daily life of villagers but also to analyze their attitude towards the state policy in the field of villages in general [28].

Thus, a comprehensive study of the issue is possible only if we use a set of methodological practices and tools of both domestic and foreign historical sciences.

RESULTS AND DISCUSSIONS

The period between 1920 and 1980 was special in the Russian history as it was associated with significant changes in all social spheres. The key element determining the formation of the network of rural settlements in the Tara Irtysh area was the state policy.

By the beginning of the last century, the territory of Tara (the Irtysh area) had been densely populated. Different kinds of relationships were established among separate settlements. The joint management of economy began to develop. The number of settlements, their size and population were steadily growing due to several reasons. Firstly, the state weakened its control; secondly, there was a sufficient amount of land that provided relatively stable food security for peasant families; thirdly, it was the absence of landlord arbitrariness and tax oppression. In addition, by the beginning of the 20th century, the agriculture in Siberia and its separate regions was dynamically developing, and the construction of the Trans-Siberian Railway also increased the scale of peasant resettlement and arranged the export of agricultural products from the region [15, p. 467]. These reasons contributed to the growth of rural settlements on the territory of Western Siberia in general, and in the Irtysh area near Omsk in particular. This development was partly supported by Stolypin's reforms [27]. During this period, the territory of Tara (the Irtysh area) and the whole country used agriculture as the basis of economy and the main resource. By the early 1920s, large estates had disappeared, and peasant households with small allotments began to prevail [41, p. 109].

Since 1924, the state had started to implement territorial reforms to consolidate volosts and divide the Omsk Governorate into districts. By April 1, 1924, the consolidation of volosts and formation of new districts in the Omsk Governorate had been completed. On September 24, 1924, Sibrevkom (the Siberian Revolutionary Committee) approved a new territorial division. 178 volosts were consolidated into 31 districts. On May 25, the Siberian Region was formed in accordance with the Decree of the Siberian Revolutionary Committee of the All-Russian Central Executive Committee. On October 1, 1925, counties and provinces were eliminated and replaced with 16 districts of the Siberian Region. The Omsk Governorate was divided into three independent districts, including Omsky, Tarsky and Slavgorodsky.

Agriculture remained the main occupation of the locals, including the breeding of cattle, pigs, horses, sheep, chickens, and the cultivation of grain crops like oat or wheat.

In the 1900-1950s, settlements of Tara (the Irtysh area) were developing in different ways due to many factors, including their location, the quality of pasture and arable land, personal factors, accumulated farming experience and their population.

The period between 1920 and 1930 was special in the life of Siberian villages. At that time, partnerships for the joint processing of land (TOZs) and communes started to form. Since that moment, the life of the Siberian hinterland changed many times. The policy of complete collectivization and elimination of kulaks (rich peasants) as a class also had its toll on villages. In the early 1900s, the absolute majority of rural residents had been individual farmers. Significant changes in peasant farming started in the late 1920s. Back then, a large part of peasant farms were eliminated and thousands of well-off families fled from their villages after selling or destroying the property.

In December 1927, the 15th Congress of the All-Union Communist Party (Bolsheviks) proclaimed the collectivization of peasant

farms. The state puts many efforts to cooperate poor and middle-class peasants and limit the positions of "kulaks". At the end of 1926, there were 31.9% of poor peasants, 23.9% middle-class peasants and 29.5% wealthy peasants in the Siberian agricultural cooperatives. At the beginning of July 1928, the number of poor and middle-class peasants increased to 53.2% and 31.1%, respectively, and the well-off decreased to 20.4%. Collective farms were formed in all areas of Tara (the Irtysh area). As a rule, one collective farm united several nearby settlements. For instance, in 1922 a rural council was established in Godenovo Village, the Kolosovsky District, which also embraced Chiany and Teis Villages. Until 1922, Godenovo had been a part of the Teis Rural Council. In 1925, there were 43 houses in Godenovo Village, 47 houses in Chiany and 78 houses in Teis. There were 5 industrial enterprises in the rural council, including three butter factories, one oil mill and one windmill. The above-mentioned rural council had 489 acres of pastures, 109 ploughs, 24 mowers, 12 threshing machines and 59 winnowers [57]. The collective farm in the village was called "Krestyanka" ("Peasant Girl"), and after the war, it was renamed into "Pobeda" ("Victory"). Ivan Semenovich Stroenkov was elected as its first chairperson. Former inhabitants of Godenovo Village told that: "The collective farm was initially called "Krestyanka", and after the war, it was renamed into "Pobeda". The first chairperson was Ivan Semenovich Stroenkov and the second chairperson was Grigorii Grigorievich Belena. From 1953 to 1963 years, the chairperson had been Nikolai Arkhipovich Vydrin. Later the villages were consolidated into the collective farm "Strana Sovetov" ("The Land of Soviets"). The life was very difficult before the war and in the postwar years as everywhere else... We lived in poor conditions. Before Vydriny's arrival, we did not know about felt boots and sweatshirts" [47]. According to Vydrina, when she worked as a salesperson in Godenovo she was the first to bring two wicker boxes of felt boots and sweatshirts into the village. According to old-timers from Godenovo Village, the new collective farm produced wheat, oats, rye, flax plants and peas [47].

In the 1930s, the life in Siberian villages changed dramatically. The December Joint Plenum (1930) of the Central Committee and the Central Control Commission of the All-Union Communist Party (Bolsheviks) proclaimed the resumption of mass collectivization. In 1931, it was necessary to involve at least 50% of Siberian peasant farms into collective farms. Since March of this year, the collectivization in Siberia had escalated. This situation was explained by the following factors: since the beginning of the year psychological, political and administrative pressure on individual farmers had resumed; throughout the disengagement with collective farms, they were assigned more remote and low-quality land plots; tax and payload on individual farms were significantly increased, while collective farms and collective farmers received tax breaks [15, p. 486]. The property of newly-made collective farmers was almost completely surrendered to communes or artels.

According to the charter of agricultural artels also adopted by most collective farms, peasants were allowed to have a strictly defined number of pigs, large and small cattle. The inhabitant of the Kolosovsky District K.P. Borodina recalled collectivization in the following way: "In 1929, collectivization started all over the country. Peasants were forced to join collective farms. Then these collective farms began to take horses, cows, calves, sheep, pigs and other livestock, as well as all mechanisms and equipment, including shovels, manure forks and rakes. This expropriation was not compensated by money or food... My mother was not invited to a collective farm since our whole family was already labeled as kulak. They were deprived of all rights, and their house and all other buildings were confiscated" [7, pp. 66-67].

In the 1920-1950s, the main characteristics of developing rural settlements in Tara (the Irtysh area) were their rapid quantitative growth and change in the ways of life of the Siberian hinterland. These factors contributed to the growing number of settlements; however, their total number in the Irtysh area

reduced. The main reason behind these changes was territorial and administrative transformations.

In the period from the end of the 1950s to the end of the 1980s, the policy of agricultural nationalization played a key role in the life of Siberian villages. A typical feature of the period under review was the consolidation of small rural settlements into larger ones that was followed by the intensive resettlement of the villagers to larger and more comfortable settlements. The process resulted in the reduction in the number of small villages. During the historical period under study, West Siberian villages lost more than 2 million inhabitants. As a rule, able-bodied skilled workers and young people aged 16-19 left the countryside. The whole period was characterized by fertility reduction and mortality increase with some changes in certain years. These processes led to a decrease in natural population growth which declined from 23.0% to 4.5%. This ultimately led to a decrease in the number of people living in rural areas by 26% over the last 30 years (from 1959 to 1989), while the working-age population was reduced by 25.4% [43]. The number of collective farmers also decreased: people aspired to move to regional centers and cities.

The Great Patriotic War had a negative impact on the development of rural settlements and the number of their population. It affected the fate of small villages even to a greater extent. Small population of these settlements lost most males during the war. The proportion of adult working-age population rapidly decreased. The situation did not change when the war was over. The total share of male losses was about 65% of those called up and those who returned were often disabled.

In the postwar years, rural settlements were transformed influenced by the enlargement of collective farms in 1950-1952. Villages in eliminated collective farms had lost their economic independence, began to lose their population and gradually disappear.

The policy of enlarging collective farms originated in 1950 when the Central Committee of the All-Union Communist Party (Bolsheviks) adopted the Decree "On the Enlargement of Small Collective Farms and Tasks of Party Organizations in this Enlargement" [42]. The document noted that "... a significant obstacle in the further development of agriculture and enlargement of collective farms is a significant number of small collective farms that according to the size of their lands cannot sufficiently develop the public economy in their regions, territories and republics. It is not possible to use tractors, harvesters, threshers and other complex agricultural machines with high productivity in small collective farms. It is also difficult to create large-scale high-quality social production, build self-sufficient villages within collective farms, have agricultural specialists, develop public collective farm production and ensure a rapid growth of public incomes and raise the material and cultural level of collective farmers" [42, p. 614].

We should note that collective farms united peasants from one village since their formation. Thus, the scale of production depended on the settlement size.

In 1950, the first major consolidation of farms occurred: in July their number decreased by 17.2%, by October of the same year by 44.7%. In total, 199,800 (79.3%) of agricultural artels were united in 1950 and formed 64,300 integrated collective farms. [5, p. 317].

The above-mentioned Decree instructed to organize consolidation as follows:

– Land areas of unified collective farms should be transformed into a single land mass; therefore, collective farms should be consolidated with adjacent land use;

– Unification of small collective farms into larger ones should be carried out on a voluntary basis, providing explanations among collective farmers on the expediency of this activity;

– While deciding a question on the association of collective farms, not less than two-thirds of the total number of members of an agricultural artel should be present at a general meeting. Decisions of general meetings of collective farmers should be taken by each collective farm by a majority vote;

– Decisions of general assemblies of collective farms come into force after consideration by district executive committees [42, p. 615].

In pursuance of this Decree, collective farms in the territory of Tara (the Irtysh area) began to consolidate. After the formation of collective farms, things did not always go smoothly. However, the policy of enlargement continued.

The consolidation of collective farms meant the unification of small villages into a single economic center. Villages embracing a small number of households did not fit into the state scheme of large socialist giants and turned out to be "unpromising". In the light of these events, the term "unpromising" village was introduced into science and practice.

During the period from 1959 to 1970, more than 950 rural settlements (mainly small villages) were removed from the register in the Omsk Region. The number of small villages that had a population of up to 50 people decreased by 85.8% in 1959, while the number of settlements with the population of 51-100 and 101-200 people decreased by 64.5% and 26.6%, respectively [50].

A significant part of eliminated settlements included "unpromising" villages, in which capital construction was seized and the existing material funds completely wore out.

The policy of eliminating "unpromising" villages was meant to consolidate the population in relatively large settlements and eliminate small ones. According to the authorities, such measures could stop the outflow from rural areas and improve living conditions.

In fact, the situation often turned out differently. People learning that their small homeland was "unpromising" quickly left to cities and large regional centers. Thus, the policy of eliminating "unpromising" villages became one of the reasons for the decline in rural population. From 1959 to 1979 in Western Siberia, the number of rural settlements decreased by 52%, while in the whole RSFSR the reduction was by 40%. In the period between 1926 and 1989, more than 3,200 rural settlements were eliminated in the Omsk Region, settlement dispersion significantly decreased, the average population increased from 213 in 1939 to 440 in 1989 [50].

The policy towards the unpromising villages led to the destruction of the centuries-old traditions and the erosion of the rural way of life. Villages saw a transition to universal secondary education, a gradual process of everyday life urbanization and a rapid spread of television.

In order to preserve the existing village schools, the residents applied to various instances. The need to preserve schools was extremely acute as many villages, especially those that fell into the category of "unpromising", were at a considerable distance from central estates.

Thus, during the end of the 1950s – the end of the 1980s, the situation in the country's agriculture as a whole and in Tara (the Irtysh area), in particular, had been repeatedly changing influenced by the state policy. The policy of farm enlargement and resettlement of "unpromising" villages resulted in the decrease in settlements on the territory under study.

CONCLUSIONS

The process of development and settlement of the territory around Tara was influenced by various factors. Thus, favorable conditions for farming here have made this region attractive for immigrants since the 16th century. This also led to the relatively rapid pace of its settlement.

In the 1920-1980s, the state policy in the development of rural areas played the leading role in the development of the settlement network of the region. Its main direction - the high rates of collectivization and the liquidation of the "unpromising" villages - led to the reduction in rural settlements in Tarski Priirtyshye.

In the 1930s, farmsteads disappeared from the map of the Irtysh area. The policy of collectivization resulted in the abandonment of small villages that often consisted of one large family. Some small settlements, farmsteads and villages were consolidated into larger settlements.

The mass disappearance of villages began in the 1950s. In the 1950s, the state decided to enlarge small farms. The main direction of this policy was to further unify collective farms. As a result, several farms merged into one larger collective farm located in the central estate. This marked the beginning of the mass resettlement.

In the 1960s, the resettlement of "unpromising" villages was launched. The latter included settlements with a small number of inhabitants. There were many sparsely populated territories in the Irtysh area. The enlargement of populated areas mainly aimed to create comfortable conditions for the life and activity of people. In fact, villagers who fell into the category of "unpromising" were forced to leave their small homeland and move to the central estate. This migration was caused by the lack of roads, the closure of schools, medical stations, shops, and electricity outages.

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PROSPECTS OF THE LAND - RENTAL RELATIONS DEVELOPMENT IN AGRICULTURE OF UKRAINE

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Abstract

This paper deals with current status and features of land-rental transactions and relations in domestic agricultural. The author has suggested an approach to the justification of the prospects of land-rental relations development in agriculture of Ukraine based on the definition of interconnection of this field with major factors of influence. This approach is based on the application of the method of analysis of the cross-influencing factors, the initial data for the use of which are the conclusions of experts involved in solving specific forecasting problems. This approach makes it possible to calculate the likely tendencies of development of the main parameters of land-rental transactions in agriculture, depending on changes in factors of impact. Taking into account the current state and peculiarities of rental relations in domestic agricultural land use, medium-term scenarios for the development of this element of the market turnover of land have been formed, which provide an opportunity to predict the development of land-rental transactions and relations depending on market conditions.

Key words: *rent, land relations, market, development prospects, agriculture.*

INTRODUCTION

The main task of the modern state policy in the area of agrarian land use is the following improvement of land relations, which would ensure the balanced use of lands and soils on the foundation of ecologization, protection and maintenance of land as part of the natural environment, preservation, multiplication and reproduction of its productive power as a natural resource. The world experience of the functioning of the land market has shown that the realization of full-fledged market relations between the land use actors helps to optimize land use in the context of individual economic entities. The vast majority of peasants interact with economic entities (agrarian and farms) through lease relations. The lease has become one of the most dynamic segments of the land market, since its participants are interested in obtaining the maximum income for intensive use of land. Lease transactions at the present-day stage of land use are becoming increasing importance, since the purchase of agricultural land in ownership is still constrained by the legislation by the moratorium on their sale.

Proceedings of such scholars as V.H. Andriichuk, D.S. Dobriak, M.I. Malik, V.Ia. Mesel-Veseliak, P.T. Sabluk, M.M. Fedorov, O.Iu. Yermakov, etc. are devoted to the research of principles of development of land relations and operations in the agricultural, in particular, the institutional provision of leasing land of Ukraine. The proceedings of these, as well as several other authors, served as a theoretical and methodological basis for the study and allowed to reveal a number of peculiarities related to the disclosure of scientific and applied principles of leaseholding, in particular the definition of the main factors influencing this segment of the land market (the size of rent, the form of its payment, lease term, etc.).

Formation of an effective system of lease relations in agricultural land use is primarily due to the current state of participants in this segment of the land market and the variety of factors affecting them. Therefore, a very important theoretical and applied aspect is the substantiation of the development prospects of land-rental relations in domestic agrarian sector.

MATERIALS AND METHODS

The study is based on data provided by the State Service of Ukraine on Geodesy, Cartography and Cadastre and the State Statistics Committee of Ukraine. To determine the key factors of influence on the development of rental relations in agriculture land use of Ukraine, the method of analysis of the cross-influencing factors was applied. The cross-factor matrix is a graphical tool developed by Theodore Gordon and Olaf Helmer [3] in 1966 to establish links between various phenomena (processes) over the alleged cause-effect relationships. The goal is to determine what impacts need to be changed in order to achieve a certain result. The initial data for using the method of analysis of cross-influencing are the conclusions of experts involved in solving specific forecasting problems.

RESULTS AND DISCUSSIONS

The economic content of the lease relations is the relationship between the landowner (the lessor) and the tenant (the business entity directly using it) regarding the allocation and assignment of the lease-defined income ratio. The particularity of rental of land in agricultural is that it is considered as an independent form of management on the ground, determining the type of land ownership and the level of development of the productive forces of society [1; 6; 11]. Lease relations are inherently contractual, decisive decisions of the whole range of issues that satisfy the interests of process participants.

Depending on specific socio-economic conditions and structural changes, "in the agrarian sector of the developed economies, there is a tendency to increase the area of farms due to the lease of agricultural land" [6]. Ukrainian agricultural producers conduct economic activity mainly on rented land, the share of which in the total volume of land use is more than 45% (Fig. 1). In general, rental of agricultural land is an average of about 90% of all land-rental transactions in Ukraine.

Fig. 1. Share of leased agricultural land in total land use by regions of Ukraine, %
Source: formed by the author according to the State Service of Ukraine on Geodesy, Cartography and Cadastre.
* Note: data on the Autonomous Republic of Crimea as of 01.01.2014

At the same time, it is inappropriate to assume the remaining 55% of the shares that are not formally leased are not used in agricultural production or used directly by landowners. Unfortunately, the practice of so-called "hidden rent" on the territory of Ukraine is rather widespread, according to which the land is used by agricultural enterprises without the conclusion of corresponding lease agreements with landowners who receive a payment for the use of land in cash or in kind. There are also cases of using without landlord the land whose owners have died, and no successors [4; 10]. Today, according to preliminary estimates of such lands in Ukraine there are about 0.5 million hectares. Characteristics of the current state and main trends in the development of the land-rental relations in agrarian sector in Ukraine are given in Table 1.

Table 1. Basic indices of land rental in agricultural, 2011-2016

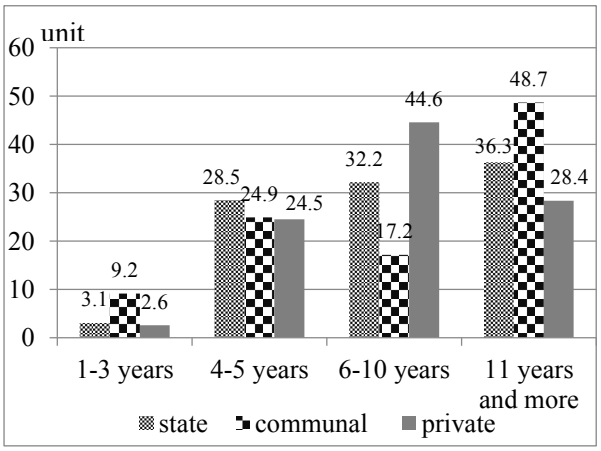
Years	Indicator			
	The total area of agricultural land leased, thousand ha	Average rent for agricultural land in Ukraine, UAH / ha	Average rent for agricultural land of state ownership, UAH / ha	
			with land trades	*without conducting land trades*
2011	17,421.0	327.5	x	x
2013	17,196.0	412.2	555.8	–
2014	17,166.1	664.0	894.8	–
2015	17,168.0	862.0	1,377.8	1,169.2
2016	17,099.1	1,093.4	2,249.8	952.0

Source: formed by the author according to the State Service of Ukraine on Geodesy, Cartography and Cadastre and the State Statistics Committee of Ukraine.

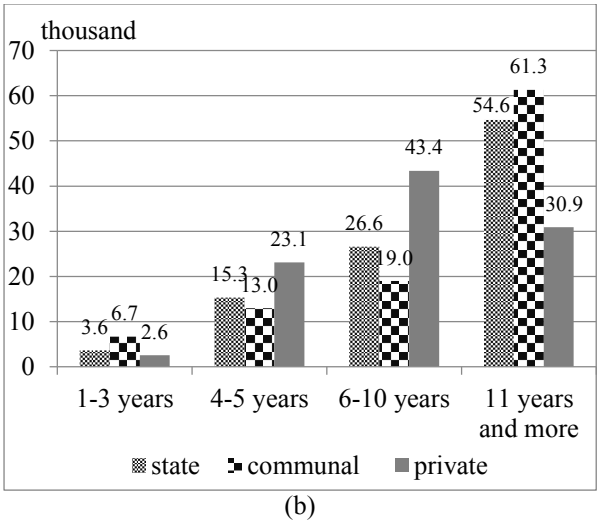
Regarding the allocation of land in accordance with the terms of the lease agreements, it should be noted that recently the number of lots leased for a term of up to 5 years is more than 30%, and over an area is 25%. Among the lands of private property the most common are lease agreements for a term of 6-10 years, and among the state and communal for 11 years and more (Fig. 2).

The specificity and diversity of the specialization of agrarian production confirms the assertion that even five years is not enough for a substantial restructuring of economic relations in this area. Therefore, in order to ensure the tenant of guaranteed land use, the minimum period of lease of land should be sufficiently long.

Despite the tendency to reduce the area of leased land, the average rent for agricultural land continues to grow. In Ukraine on average, the owners of shares in 2016 received 1,093.4 UAH per hectare, which is 27% more than in 2015 (862 UAH / ha). In the regional context, the lowest rent was in the Kyiv region (533.4 UAH / ha), the highest – in Poltava (2,243.2 UAH / ha) (Fig. 3). Regarding state land, the average cost of their lease has recently increased significantly. This is due to the proliferation of practices for the transfer of land for use through the mechanism of auctions.



(a)



(b)

Fig. 2. Allocation of the number (a) and area (b) of agricultural land in 2015 for the duration of the lease agreements, %

Source: formed by the author on the basis of data [10].

An analysis of the prerequisites for the development of land-rental relations allows us to conclude that this segment in the near future will remain the main element of the market circulation of land in agriculture of Ukraine. However, the further development of land-rental relations in agriculture is due to a number of factors influencing them. Two descriptive scenarios of transactions and relations in agriculture of Ukraine for the near future (by 2020) were formed on the basis of studying such factors and taking into account the methodology of Theodore G. & Hayward H. [3].

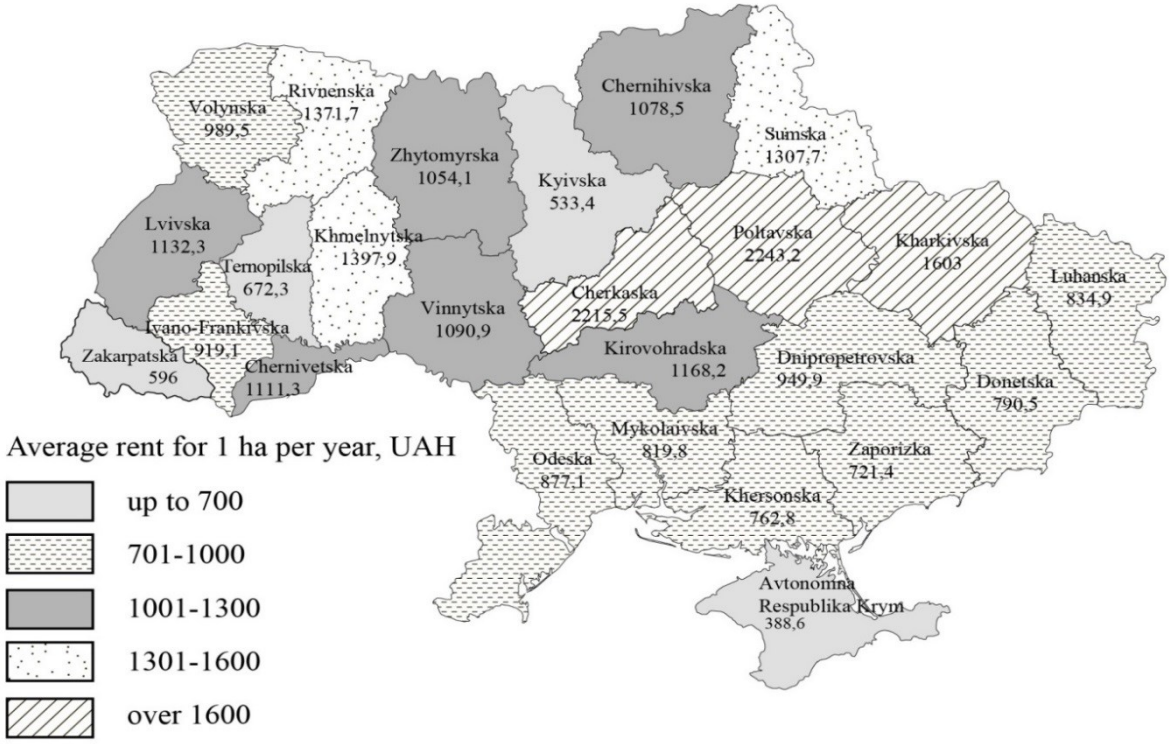


Fig. 3. Ranking of regions of Ukraine by the average rents for agricultural land, 2016 (UAH / ha)
Source: formed by the author according to the State Service of Ukraine on Geodesy, Cartography and Cadastre.
* Note: data on the Autonomous Republic of Crimea as of 01.01.2014.

The process of forecasting begins with the analysis of the formed square. It follows the process of managing the scenario, which involves the definition of external and internal factors of influence on the development of land-rental relations in the field of land use. For this purpose an important stage is the formation of the main scenario spheres of influence on the development of domestic rental relations of land use, which specify the main factors of influence by the method of expert surveys. As a result, 10 factors were identified that could affect the development of domestic land-rental relations in agriculture (Table 2).

Table 2. Factors influencing the main scenario spheres on the development of rental transactions and relations of agriculture land in Ukraine

Factor №	Influence factor
1	Infrastructure provision of the land market
2	The size of the rent for the land
3	Investing in agriculture
4	The fiscal policy of the state in the agrarian sector
5	Financial and credit policy of the state
6	Inclusion of land value in economic turnover
7	Environmental policy of the state in the agrarian sector
8	State support of agricultural producers
9	State regulation of the land market
10	Level of shadowing on the agricultural land market
11	Development of auctions for land lease
12	Methods of calculating rent for land

Source: author's development.

As a result of determining the factors of influence (on the basis of expert conclusions), the matrix of direct effect of factors of influence has been formed and analyzed (Table 3).

The values of "1" and "2" in this matrix indicate the force of influence, where: "1" is a weak effect; and "2" is a strong influence. The overall impact of asset factors means some other factor and is defined as the sum of the lines in certain.

The total liability indicator shows the influence of the factor on the part of other factors, and its value is defined as the sum of values in the columns. If you divide the quantity of an asset by the amount of a liability, you can obtain the so-called pulse index, which determines the impact of a particular factor. If the sum of the asset and the quantity of the responsibility factor multiplied, we obtain a dynamics index, which shows the degree of inclusion factor in the general system [5; 8; 12]. As a result, in the process of analysis of the matrix of direct effect of the factors of influence, the key ones are separated, those factors that are characterized by high dynamics index, high impulse index and significant amount of the asset.

Table 3. Multiplicative factor model of the interaction of factors of influence on the development of land-rental relations in agriculture in Ukraine

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Amount of the asset**	**Impulse index**	**Dynamics Index**
1	–	2	2	1	2	1	1	1	1	2	2	1	16	1.1	224
2	1	–	2	2	2	1	1	2	1	2	1	1	16	0.8	304
3	1	2	–	1	1	1	1	1	1	1	1	1	12	0.9	168
4	1	2	1	–	1	1	1	2	1	1	1	2	14	1.0	196
5	1	2	2	1	–	2	1	2	1	1	1	1	15	1.2	195
6	2	2	2	2	2	–	1	1	2	2	1	2	19	1.4	266
7	1	2	1	2	1	1	–	1	2	1	1	1	14	1.4	140
8	1	1	2	1	2	1	1	–	1	1	1	1	13	0.9	182
9	2	2	1	1	1	2	1	1	–	2	2	2	17	1.3	221
10	1	2	1	1	1	2	1	1	1	–	2	1	14	1.0	196
11	2	2	1	1	1	2	1	2	2	2	–	1	17	1.4	204
12	1	2	1	2	1	1	1	1	1	1	1	–	13	1.0	169
Amount of liabilities	14	19	14	14	13	14	10	14	13	14	12	13	164	x	x

Source: author's calculations.

The total of five main factors influencing the development of agricultural leases are among the key. These include factors whose general characteristics are their ability on the one hand to have a significant impact on the entire system, and on the other to be exposed to the system itself (Table 4). This increases their importance as levers of influence in cases when it is necessary to bring the system in motion in the event of emergencies.

The next stage is the consideration of possible options for the development of rental relations in the system of agricultural land use for optimistic (A) and pessimistic (B) projections (Table 5). The basis of economic relations between the tenant and the lessor are lease payments, which reflect the relationship of possession, use and disposal of land ownership.

Therefore, economically justified rental rates are the main link in lease agreements.

Table 4. Key factors influencing the development of land-rental relations in agriculture with high dynamics index

№	Factor	Dynamics Index
2	The size of the rent for the land	304
6	Inclusion of land value in economic turnover	266
1	Infrastructure provision of the land market	224
9	State regulation of the land market	221
11	Development of auctions for land lease	204

Source: author's calculations.

The unity and contradiction between the landowner and the tenant are concluded in them.

Table 5. Projections of key factors on development of land-rental relations in agriculture of Ukraine

Designation of the projection	A brief description of the projection
1	2
2A	The size of the rent is regulated by the limits of the tax legislation
2B	Unregulated quantity of rent for land
6A	Inclusion of land value in economic turnover in connection with the abolition of the moratorium on the sale of agricultural land
6B	The land will remain beyond the formal economic process
1A	Development of infrastructure provision of land market
2B	Infrastructure of the land market will remain unsatisfactory
9A	Improvement of state regulation of the land market
9B	State regulation will remain at the current level
11A	Development of auctions for the lease of agricultural land of all forms of ownership
11B	Slow introduction of auctions for rent of agricultural land

Source: author's development taking into account the Theodore G. & Hayward H. methodology [3] and indicators based on the data of the "Institute of Agrarian Economics" NSC [13].

Disturbance of the balance of benefits in the quantity of rent affects either the benefits of the lessee, or the interests of the owner. According to the optimistic scenario, the rent for land will be regulated based on the marginal amount of rent for agricultural land in the amount of 0.3 to 12% of the normative monetary valuation. Otherwise, market mechanisms for adjusting the size of the rent may be abusive on the part of tenants, which in modern conditions is threatening the sustainable development of rural areas.

Another factor that will positively affect the development of land and lease relations in agriculture in Ukraine, will be the lifting of the moratorium on the sale of agricultural land. Functioning and development of a full-fledged agricultural land market will enable the purchase or sale of land at a competitive market price [9]. In connection with the balancing of demand and supply, this will have a positive effect on those individuals who will continue to lease their own agricultural land on a lease. In turn, this will allow to fully include land in economic turnover [2; 7]. This will have a beneficial effect on the possibility of introducing into the statutory fund the right to lease land for agricultural purposes and the development of land mortgage lending to secure the rights to lease land. An effective agricultural land market will induce state authorities to develop regulatory and legal acts in the area of land lease market relations and development of its infrastructure support.

In a pessimistic scenario, the continuation of the moratorium on land will continue. As a result, civil land agreements will be non-transparent and will be uncontrolled, which will lead to economic losses on the part of the leaseholders, the state and local self-government. The infrastructure of the land market in agrarian sector will remain undeveloped.

The land market should be one of the most regulated markets of the state and special attention should be paid to agricultural land. In this regard, in addition to market regulators (demand, supply and price), institutions and organizations that are called to serve and regulate this market have a decisive influence. In addition, proper state regulation of the agrarian land market is an alternative to the moratorium.

Domestic experience has shown that the holding of auctions for the sale of land of state

and communal property enables to significantly reduce the corruption component and increase revenues to the State and local budgets. Due to the auctioning of land lease rights, we have a healthy, fair competition, significant additional revenue to the tenant. The auctioning mechanism for agricultural land in Ukraine is just beginning to operate, and therefore there are many unsolved issues. Therefore, in our opinion, it is necessary to create a unified system of auctioning land for all forms of ownership that will enable to ensure transparent competition and increase the efficiency of land and lease relations in the country.

Taking into account the above, one can conclude that in the case of the development of a pessimistic scenario on the territory of Ukraine, the agrarian sector expects a significant slowdown in the development of land-rental relations. This, in turn, will reduce the area of land rented. Moreover, the generated forecasts are relevant also when it comes to a long-term perspective.

The development of an optimistic or pessimistic scenario in the field of land-rental relations directly depends not only on the internal features of agrarian policy, but also on global economic trends. According to the results of the analysis of key factors, it has been found that the priority task in the agricultural sector is to create favorable conditions for the formation of a full-fledged land market. In addition, it is also necessary to take into account the state of the economy as a whole, since it affects not only the activities of economic entities, but also the indicator of the solvency of the population.

At present, there is an urgent need to form the institutional structure of the agricultural land market, because the imperfection of the legislative provision of market regulation and the presence of hemisphere schemes can lead to negative socio-economic consequences. The leading role in this matter is played by flexible and efficient infrastructure support built on account of the specifics of the product (land plots), especially at the stage of market formation.

CONCLUSIONS

Thus, the definition of the interconnection between the area of land and lease relations in agriculture in Ukraine with the main factors influencing them, gives an opportunity to calculate the probable trends of development of the basic parameters of this segment of the land market. An analysis of the current state and features of the land-rental relations in domestic agricultural has enabled the formation of medium-term scenarios for the development of this element of market circulation of land, which would allow to predict the development of land-rental relations, depending on market conditions. The primary factors in the development of land rental in agriculture are the abolition of the moratorium on the sale of land and the inclusion its in economic turnover.

The main obstacles to civilized leasing in the land sector remain: imperfect competitive environment among potential tenants of land; regulation of legislative requirements on the size of leased land at the legislative level; violation of the balance of interests of land rental participants in favor of tenants; inadequate and untimely payment for the use of land.

In general, the improvement of leased land relations requires the formation of a comprehensive system of their regulation, with strict adherence to it in the conditions of agrarian production and the adoption of a long-term government program for the development of lease in the agricultural sector.

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EVOLUTION OF THE ECONOMIC AND TECHNICAL INDICATORS FOR HOPS CULTURE IN ROMANIA. A RETROSPECTIVE OF THE LAST DECADE, 2006-2016

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Abstract

Hops is an increasingly rare crop on the territory of Romania, but this culture deserves attention due to its use. It is worth mentioning that the Romanian farmers are encouraged to cultivate this plant by increasing subsidies from one year to the next. For the analysis of evolution of this crop for the studied period, the technical indicators represented by the areas and production environments as well as the economic indicators represented by the prices, subsidies granted / ha and commercial trade will be taken into account. This paper seeks to highlight the technical and economic aspects presented above, their dynamics and the importance of this culture that will reflect on the demand for the national market for this product. The outcome of the study will highlight the support of the domestic hop market through domestic or imported production.

Key words**:** *consumption, hops, areas, average yields*

INTRODUCTION

Humulus lupulus [10], known as hops, has instead of flowers some light green seed cones, often used as a stabilizer and flavour agent in beer [8] but with utility in other beverages such as beans tea or even soft drinks, this plant can also be used in natural medicine having the same effect as valerian, used to treat anxiety, insomnia, etc. [5]. The history of hops is quite extensive and there is evidence that this plant has been used in beer production since the 9th century [7], and since then hops have not been replaced with another plant.

Worldwide, hops areas have been steadily rising, for example for the period under review, respectively 2006-2016, it has grown on average by 1.41% per year. Analysing the year 2016 compared to 2015, we see an increase in the global area of 5.57% (from 85,870 hectares to 90,653 hectares) and an increase of 13.9% compared to 2006, representing an increase of 11,057 hectares.

In terms of world production, they rose by an average of 2.79% per year, thus analysing the year 2016 compared to the previous year we see an increase in total production of 7.32% (from 131,872 tonnes to 141,528 tonnes) and an increase of 26.78% compared to 2006, representing an increase of 29,900 tons.[4]

Worldwide for the year 2016, according to FAO statistics, the state with the largest areas and implicitly productions with this crop is Ethiopia with an area of 31,367 hectares, followed by the US (20,581 hectares), Germany (17,210 hectares), and Czech Republic (4,775 hectares), with Romania ranked 20th overall in terms of areas and productions with this culture [1].

The main objective of the paper is to highlight, as the title says, the dynamics/evolution of the economic and technical indicators for the hop culture in Romania, importing and exporting with this product, thus emphasizing the importance of hops on the national market.

MATERIALS AND METHODS

Taking into account the importance of this culture in different sectors, a quantitative and qualitative analysis of the statistical data provided by the institutions in the field, such as the National Statistics Institute of Romania, Eurostat and Faostat, will be carried out as

well as the analysis of other documents specialized.

Also, the comparative method will be used, considering that this culture is taken in the analysis for a period of 10 years, it will concretize the evolution of area and production (for hops culture) using the processing series which are chronological and involving different indicators, as absolute, relative and average indicators.

In order to highlight the potential and necessity of the hop culture in Romania, a quantitative analysis of the national consumption data of this plant will be carried out, thus highlighting the trade balance aspects.

With the analysis of the above, we will also analyze the prices for this crop together with the subsidies granted for the period considered.

The work is carried out under the ADER 13.1.2 project, "Technical and economic costing of production costs and estimates of the prices for wheat, maize, sunflower, rape, soybean, sugar beet, rice, hemp, hop, tobacco, potato for conventional agriculture and organic farming" and has a synthetic methodological character, so that the research was based on descriptive research. The aim of the work should emphasize technical indicators and economic development indicators and to highlight the feasibility of this culture

RESULTS AND DISCUSSIONS

Given that the study goes through a longer period of time, it is advisable to analyze surfaces and total productions by processing chronological series using absolute, relative and average indicators.

A chronological series is a parallel between two strings of data, one of which is necessarily defined by the variable "time", the other being defined by the magnitudes recorded for the studied phenomenon.

Thus, the chronological series have been processed using absolute indicators starting from individual values denoted by "y" as well as from the total values "Σyt".

Absolute indicators show absolute changes (increase or decrease) over time.

Therefore, absolute changes with fixed and mobile / chain base have the following formulas: $\Delta t/t\text{-}1=yt\text{-}y1$; $\Delta t/t\text{-}1=yt\text{-}yt\text{-}1$.

With the help of relative indicators, we will identify the dynamic index that shows us how many times the variable has increased or decreased, in our case the surface or the production, from time to time, this index can also be calculated with a fixed base ($It/1=yt1/y1$) and with chain base ($It/t\text{-}1=yt1/yt\text{-}1$).

Within the same category of indicators is also the dynamics that measure the percentage changes from time to time, it can be calculated as the other indicators both with fixed base ($Rt=It1*100\text{-}100$) and with base in string ($Rt/t\text{-}1=It/t\text{-}1*100\text{-}100$); the absolute value of a percentage of the rate of change is expressed in the unit of the variable Y and the absolute measure of the change indicates a unit (1 percent of the rate of change) can also be calculated with a fixed base ($At/1=y1/100$) and in the chain ($At/t\text{-}1=yt\text{-}1/100$).

The average indicators will indicate the average level $\overline{Y} = \Sigma yt/n$ as well as the absolute changes, they show us how many units the average occurrence has been adjusted between two successive moments or intervals $\overline{\Delta} = (\sum \Delta t/t\text{-}1)/n\text{-}1=yn\text{-}y1/n\text{-}1$. The average dynamics index shows how many times or as many as the average phenomenon analyzed within the time horizon of the chronological series is averaged and is calculated according to the formula $\overline{I} = \sqrt{(\Pi It/t\text{-}1)} = \sqrt[n-1]{yn/y1}$. The average rhythm of dynamics expresses with how many percent the phenomenon analyzed from time to time is changed and is given by the formula $\overline{R}=\overline{I}*100\text{-}100$. [2]

In order to apply the calculation methods mentioned above it is necessary to know the surfaces and the products for the hop culture in the period 2006-2016, so we can see in Table 1 surface evolution and the productions of this culture.

Table 1. Evolution of hops surfaces and production in Romania

Year	Surface (hectares)	Total production (tons)	Average yield (kg / ha)
2006	652	435	667
2007	440	374	850
2008	501	257	513
2009	456	245	537
2010	215	232	1079
2011	177	117	661
2012	226	173	765
2013	239	172	720
2014	243	268	1,103
2015	225	224	996
2016	257	208	809

Source: Faostat [3]; INS [6]; Accessed 25.05.2018

Table 2. Absolute surface changes

Year	Surface (hectares)	Absolute changes (hectares)	
		With fixed base $\Delta t/t-1=yt-y1$	With chain base $\Delta t/t-1=yt-y_{t-1}$
2006	652	-	-
2007	440	**-212**	**-212**
2008	501	**-151**	**61**
2009	456	**-196**	**-45**
2010	215	**-437**	**-241**
2011	177	**-475**	**-38**
2012	226	**-426**	**49**
2013	239	**-413**	**13**
2014	243	**-409**	**4**
2015	225	**-427**	**-18**
2016	257	**-395**	**32**

Source: own processing based on statistical data

Table 3. Absolute changes in production

Year	Total production (tons)	Absolute changes (ton)	
		With fixed base $\Delta t/t-1=yt-y1$	With chain base $\Delta t/t-1=yt-y_{t-1}$
2006	435	-	-
2007	374	**-61**	**-61**
2008	257	**-117**	**-178**
2009	245	**-12**	**-190**
2010	232	**-13**	**-203**
2011	117	**-115**	**-318**
2012	173	**56**	**-262**
2013	172	**-1**	**-263**
2014	268	**96**	**-167**
2015	224	**-44**	**-211**
2016	208	**-16**	**-227**

Source: own processing based on statistical data

The largest areas for this crop were recorded in 2006, 652 hectares, in the same year, of course, the highest yields of 435 tons with a yield of 667 kilograms per hectare. Table 2 and Figure 3 show changes in both surface and production from year to year and compared to base year 2006.

It should be noted that although the yields were in constant decline compared to 2006, the yield per hectare hasn`t remained the same, we estimate that for 2010 and 2014 it was 1,079 kg/ha and 1,103 kg/ha and increased average by 8.92% (Figure 1).

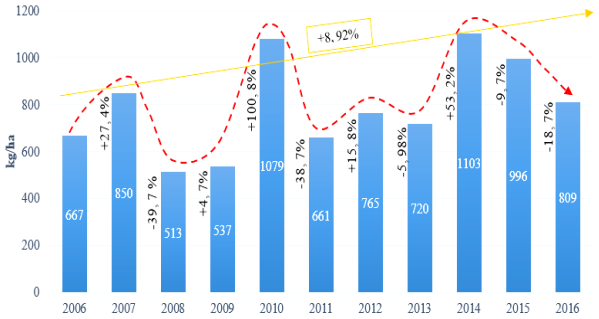

Fig.1. Average hops production in Romania
Source: data processing FAOSTAT, INS, 2018

Table 4. Relative surface changes

Year	Surface (hectares)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamics rhythm (hectares)	
		With fixed base It/1=yt 1/y1	With chain base It/t-1=yt1/yt-1	With fixed base Rt=It1*100-100	With chain base Rt/t-1=It/t-1*100-100	With fixed base At/1=y1 /100	With chain base At/t-1=yt-1/100
2006	652	-	-	-	-	6,52	6.52
2007	440	0.6748	0.6748	-32.52	-32.52		4.4
2008	501	0.7684	1.1386	-23.16	13.86		5.01
2009	456	0.6994	0.9102	-30.06	-8.98		4.56
2010	215	0.3298	0.4715	-67.02	-52.85		2.15
2011	177	0.2715	0.8233	-72.85	-17.67		1.77
2012	226	0.3466	1.2768	-65.34	27.68		2.26
2013	239	0.3666	1.0575	-63.34	5.75		2.39
2014	243	0.3727	1.0167	-62.73	1.67		2.43
2015	225	0.3451	0.9259	-65.49	-7.41		2.25
2016	257	0.3942	1.1422	-60.58	14.22		2.57

Source: own processing based on statistical data

Table 5. Relative production changes

Year	Total production (tons)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamics rhythm (hectares)	
		With fixed base It/1=yt 1/y1	With chain base It/t-1=yt1/yt-1	With fixed base Rt=It1*100-100	With chain base Rt/t-1=It/t-1*100-100	With fixed base At/1=y1 /100	With chain base At/t-1=yt-1/100
2006	435	-	-	-	-	4,35	4.35
2007	374	0.8598	0.8598	-14.02	-14.02		3.74
2008	257	0.5908	0.6872	-40.92	-31.28		2.57
2009	245	0.5632	0.9533	-43.68	-4.67		2.45
2010	232	0.5333	0.9469	-46.67	-5.31		2.32
2011	117	0.2690	0.5043	-73.10	-49.57		1.17
2012	173	0.3977	1.4786	-60.23	47.86		1.73
2013	172	0.3954	0.9942	-60.46	-0.58		1.72
2014	268	0.6161	1.5581	-38.39	55.81		2.68
2015	224	0.5149	0.8358	-48.51	-16.42		2.24
2016	208	0.4782	0.9286	-52.18	-7.14		2.08

Source: own processing based on statistical data

According to the average dynamics, which measures the percentage changes from time to

time, we can see that the most significant change of the surface (Table 2 and 4) was recorded in 2010 compared to 2009 when the area decreases by -52.85%. As for the absolute value of a percentage of dynamics this indicates that for the fixed base analysis the size of one percent (1%) of the hops in any year compared to the base year 2006 is equivalent to an absolute 6.52 hectares. Whilst the absolute value of a percentage of the mobile / chain base rhythm is variable.

According to the average dynamics, we can see (Table 3 and 5) that the most significant negative change in production is recorded in 2011 compared to 2010 when it drops by 49.57%. As for the absolute value of a percentage of dynamics this indicates that for the fixed base analysis the size of one percent (1%) of hops production in any year compared to the base year 2006 is equivalent to an absolute increase of 4.35 tons. Whilst the absolute value of a percentage of the mobile or chain base rhythm is variable.

The average surface area for the period 2006-2016 was 330.1 hectares and the hops area decreased for the analysed period by 39.5 hectares per year.

On average, the areas decreased during the period 2006-2016 by 0.911 times, and the average dynamic rhythm indicate that the areas have changed on average by -8.89% annually.

The average production level for the period 2006-2016 was 245.9 tons and the production of hops decreased annually for the analysed period by 22.7 tons.

On average, yields increased 3.1308 times.

Concerning economic indicators of hops culture, according to the study "Impact on Financing of the Agricultural Sector through Support Schemes Established on the Basis of European Regulations on the CAP and Funding of Support Schemes from the National Budget"[12], carried out by ICEADR, average purchase prices increased by 3% on average for the analysed period from 20 lei / kg in 2007 to 25 lei per kilogram in 2016.

The highest prices were recorded in 2011-2012 of 31.7 lei per kilogram, 18.72% higher than in 2010, while the average purchase price registered in 2016 is 21% lower than in the years in which this maximum was recorded.

Subsidies granted per hectare, according to the same work, increased gradually from year to year, thus from a subsidy of 570.3 lei / ha granted in 2007 a subsidy of 3,041.7 lei/ hectare was reached in 2016, more than about 4 times that of 2007.

Table 6. Economic indicators for hop culture (production, price, income, production cost)

Specification	Average production	Average purchase price	Income / ha without subsidies	Income / ha + subsidies	Production cost / ha
1	2	3	4	5	6
AN/UM	Kg/ha	lei/kg	lei/ha	lei/ha	lei/ha
2007	850	20	17,000	17,570.3	16,000
2008	513	21.2	108,75.6	11,551.8	10,500
2009	537	21.2	11,384.4	12,190.5	11,000
2010	1,079	26.7	28,809.3	29,665.2	25,000
2011	621	31.7	19,685.7	20,647.2	18,000
2012	473	31.7	14,994.1	17,057.5	14,600
2013	720	28.6	20,592	22,707.8	19,500
2014	951	27	25,677	27,846.3	24,000
2015	996	26.2	26,095.2	29,024.1	25,300
2016	809	25	20,225	23,266.7	20,000

Source: ICEADR ("Impact on Financing of the Agricultural Sector through Support Schemes established on the basis of European Regulations on CAP and Funding of Support Schemes from the National Budget") [12]

Table 7. Other economic indicators for hop culture (profit and subsidies)

Specification	Profit without subsidies	Profit + Subsidies	Profit rate without subsidies	Profit rate + subsidies	Subsidies
1	7	8	9	10	11
AN/UM	lei/ha	lei/ha	%	%	lei
2007	1,000	1,570.3	6.3	9.8	570.3
2008	375.6	1,051.8	3.6	10	676.2
2009	384.4	1,190.5	3.5	10.8	806.1
2010	3,809.3	4,665.2	15.2	18.7	855.9
2011	1,685.7	2,647.2	9.4	14.7	961.5
2012	394.1	2,457.5	2.7	16.8	2,063.4
2013	1,092	3,207.8	5.6	16.5	2,115.8
2014	1,677	3,846.3	7	16	2,169.3
2015	795.2	3,724.1	3.1	14.7	2,928.9
2016	225	3,266.7	1.1	16.3	3,041.7

Source: ICEADR ("Impact on Financing of the Agricultural Sector through Support Schemes established on the basis of European Regulations on CAP and Funding of Support Schemes from the National Budget") [12]

Thus, from Table 6, we can see that by capitalizing the productions at a farm price, a profit is achieved even without subsidies, which are oscillating from one year to

another, with net annual profits ranging between 225 lei / ha (year 2016 - year with the lowest non-subsidized profit) and 3,809.3 lei / ha (2010 with the highest non-subsidized profit). The rate of non-subsidized profit was between 1.1% (2016) and 15.2% (2010), which was directly proportional to the production levels.

These values change as the direct payment schemes are taken into account, coupled with the coupled support, therefore, following the application of the subsidies granted per hectare for this crop for the analyzed period, we notice that there is a higher profit (Table 6, columns 8) so the rate of subsidized profit is higher (Table 7, column 10).

Under these conditions, a higher rate of return is achieved, ranging from 9.8% (2007) to 18.7% (2010).

The revenue growth rate is higher than the growth rate of costs, so the average non-subsidized and costing revenue ratio is 1.0531: 1, while the average revenue-to-grant ratio is 1.1256: 1. [11]

Since hops cannot be consumed fresh but only after processing, we cannot take into account the consumption of this product per capita. So we can determine the importance of this culture at national level by highlighting the quantities imported and exported with hops by Romania.

As can be seen from the two tables below (Table 8 and Table 9), Romania has imported hops more than they exported for the entire analyzed period.

In terms of hops imports, we can see that the largest quantity was imported in 2008 of 1,257 tonnes of hops, the main supplier of hops on the Romanian market being Germany, this country being found throughout the analysis period, However, Romania has imported this product from other European Union countries and not only (Table 7). The quantity of hops impregnated in 2016 increases by + 15.05% in 2016 as compared to the previous year, but it is by some -31.5% less than in 2006. For the whole analyzed period we can say that hops imports have increased with an average of 8.65%.

The hop quantities that Romania exported during the analyzed period are insignificant and present data only for the years 2007, 2008, 2010 and 2011, the main importers being Germany, Czech Republic, Italy and Bulgaria.

Table 8. List of hop cones supplying the market, fresh or dried, even ground, powdered or in the form of pellets in Romania

Exporters	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Imported quantity, Tons										
World	**625**	**629**	**1,257**	**358**	**280**	**329**	**233**	**216**	**421**	**372**	**428**
Germany	**311**	**396**	**1,103**	**348**	**272**	**304**	**215**	**177**	**411**	**359**	**394**
Belgium	0	**197**	**7**	0	**5**	**17**	**13**	0	0	**1**	0
United States of America	**211**	0	0	0	0	0	0	0	0	0	0
Slovenia	**61**	0	**63**	0	0	0	0	0	0	0	0
Czech Republic	**34**	**29**	**16**	**6**	**4**	**8**	**4**	**5**	**9**	**12**	**5**
United Kingdom	0	**6**	**4**	0	0	0	0	**10**	0	0	0
Austria	0	0	0	0	0	0	**1**	0	0	0	0
Bulgaria	0	0	0	**3**		0	0	0	0	0	0
France	0	0	**4**	0	0	0	0	0	0	0	0
Hungary	0	0	**2**	0	0	0	0	**24**	0	0	0
Poland	**4**	0	**59**	0	0	0	0	0	0	0	**29**
Slovakia	**5**	0	0	0	0	0	0	0	0	0	0

Source: Trade statistics for international business development -Trade map [9]

Table 9. List of import markets for hop cones, fresh or dried, whether or not ground, powdered or in the form of pellets by Romania

Importers	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Exported quantity,										
World	0	**18**	**22**	0	**25**	**1**	0	0	0	0	0
Czech Republic	0	**6**	0	0	0	0	0	0	0	0	0
Germany	0	**12**	**21**	0	**25**	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	**1**	0	0	0	0	0
Italy	0	0	**1**	0	0	0	0	0	0	0	0

Source: Trade statistics for international business development -Trade map [9]

Thus, in terms of the quantities imported and exported by Romania to Romania, we can state that this culture is important at national level due to the quantities of hops imported annually.

Imported quantities of hops are proof that domestic demand cannot be sustained by our own production, having to resort to imports to meet demand for hop in different industries.

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CONCLUSIONS

The first part of this paper presents the technical indicators of this culture, representing both the areas and the productions obtained in the cultivation of hops in Romania for the last decade, 2006-2016, showing their evolution in terms of absolute, relative and average statistical indicators. With the help of the average dynamics indicators, it is noticed that the hops areas have changed on average by -8.89% annually, while the production has grown on an average of 3.1308 times.

In the second part of the study were presented economic indicators for the cultures represented by the average purchase price, subsidies, cost of production, income per hectare with and without subsidies and profit and rate of return. Through all these economic indicators it has been demonstrated that this culture is profitable even without subsidies, and the average of the revenue to cost ratio is 1.0531: 1 (without subsidies) and 1.1256: 1 (when grants are granted).

With all aspects listed and discussed above in order to determine technical and economic importance of this culture, we can say that although demand for hops at national level is quite high, growers Romanians do not consider the possibility of creating such a culture, evidence being areas that are continually decreasing.

Romanian farmers are encouraged to produce hops through subsidies increasing from year to year, although this culture is one profitable even without subsidies.

In conclusion, this crop could bring significant gains per hectare and the yields obtained can easily be capitalized on the national market.

So, it is imperiously needed to support this plant, this culture, on the national territory and awareness of the Romanian producer regarding the hop culture and the importance it holds at national level and not only.

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ECONOMIC EFFICIENCY OF CENTRAL AND EAST EUROPEAN FARMS BASED ON DEA - COST APPROACH

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Abstract

The paper addressed an approach on the economic efficiency of farms among ten Central and East European Countries by means of the technical and allocative efficiency, through the DEA-COST method. For the analyze we used two years from the FADN dataset (2013 and 2016): inputs - labor (AWU), land (UAA) and average capital; outputs - total output and farm net income; input prices - rent, wages and depreciation. The main results of our research showed that the average technical efficiencies for the farms sample over the analyzed period are relatively high (around or more than 0.90) and allocative and economic efficiencies are moderate (0.60-0.70) stressing that the farms have similar management practices and technologies but they are not fully cost efficient. In 2016, only farms from Romania and Latvia are completely efficient with respect to all three analyzed efficiency measures, while the most inefficient are the farms from Slovenia. Also, we observed that in the CEE analyzed countries the main cause for cost inefficiency is allocative (inefficient mix of inputs relatively to optimal level).

Key words**:** *data envelopment analysis, allocative efficiency, economic efficiency, farms*

INTRODUCTION

The development of farm economic efficiency (technical and allocative) and its connection with size and specialization in CEE countries was investigated in the last decade to assess the performance of agricultural sector. In 2004, Gorton and Davidova [2] made an empirical study on six CEE countries regarding farm productivity and efficiency by a DEA approach and concluded that corporate farms are "inherently less efficient for all farming activities than family farms" and that "in countries in transition where small family farms are well established and managed continuously by the present farm household, they appear to be less inefficient compared to larger cohorts as against countries where small family farms are a relatively new phenomenon". In addition, in 2007, Bojnec and Latruffe [1] showed that "farms producing a large output are highly efficient regarding their decision of input quantities used (technical and scale efficiencies), while farms using a large labor force are highly efficient also regarding the input quantities, but particularly regarding their choice of input mix in terms of their respective prices (allocative and cost efficiencies)". In 2016, Stetco [3] pointed out for 2007-2013 period a growth in economic efficiency of farms (case of Romania), but also denoted "the allocative inefficiency (inefficient mix of inputs) as major cause for not acquiring optimum levels in 2013 despite the improvement in technical efficiency (an increase in farm volume activities)".

MATERIALS AND METHODS

Although the overall situation of agriculture in CEE countries is similar (land defragmentation, low efficiency, etc.), there are some disparities in their process of transformation which affect the production structure. According to Záhorský and Pokrivčák (2017) [5] "some CEEc are dominated by family farms (Poland, Slovenia) while in others there are prevalent transformed cooperatives (Slovakia, Czech Republic). Mixture of large transformed cooperatives and family farms can be observed in Hungary or Romania". By applying DEA approach, the results obtained

by different studies revealed that "the most efficient countries were Hungary, Romania and Slovenia and the least efficient countries were Latvia and Slovakia" (Záhorský and Pokrivčák, 2016) [4]. Our paper aims to complete these studies by assessing the technical, allocative and economic efficiency of 10 CEE countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia). We selected these countries base on available FADN data for years 2013 and 2016.

At the CEE farm level, we noticed an average agricultural output of around 70 thou euro, with a small increase in the analyzed period and a clear inequality among the countries (from a minimum of almost 11 thou euro in Romania to a maximum of around 300 thou euro in Czech Republic) (Table 1). The gaps are due to the difference in physical dimension which oscillated between around 9 ha in Romania and over 200 ha in Czech Republic. Thus, for selected counties, the average physical dimension was around 60 ha per farm. The average farm capital varied between a minimum of 29 thou euro and over 500 thou euro in the mentioned countries. The differences are major including the input prices, the lowest prices being observed in Slovenia and Romania.

If we look closely to the data we observe also that Estonia and Czech Republic present the biggest UAA per farm, Croatia, Poland and Slovenia have farms between 10 and 20 ha and Romania and Slovenia farms under 10 ha. However, after Czech Republic, which has an AWU per farm over 5, we observe that Bulgaria, Estonia and Latvia have a moderate level of AWU per farm (over 2). Also, we observe a high level of the average farm capital in Hungary, Latvia and Slovenia.

In these conditions, due to all these differences, becomes very important to test the efficiency at farm level base on the report between input and outputs by data envelopment approach.

Table 1. Data at farm level, on selected CEE countries, 2013 and 2016

Year	Country	Inputs			Outputs		Input prices		
		Total labor (AWU)	Total UAA (hectare)	Average farm capital (euro)	Total output (euro)	Farm net income (euro)	Wages paid	Rent paid	Depreciation
2013	(BGR) Bulgaria	2.41	37.86	62,952	39,178	8,101	4,650	5,894	4,878
	(CZE) Czech Republic	5.79	201.99	715,048	293,428	47,882	57,043	12,399	33,941
	(EST) Estonia	2.05	136.95	224,668	117,833	17,086	16,228	2,499	17,201
	(HRV) Croatia	1.84	15.71	89,157	23,045	5,363	1,633	529	4,173
	(HUN) Hungary	1.58	48.72	135,220	68,104	18,293	8,545	3,609	6,315
	(LTU) Lithuania	1.75	48.55	88,751	38,925	12,903	2,049	1,105	7,336
	(LVA) Latvia	2.09	69.09	111,660	58,424	9,650	5,449	858	9,034
	(POL) Poland	1.70	18.81	85,337	30,203	9,867	1,403	355	4,781
	(ROU) Romania	1.19	9.27	28,556	11,795	5,525	554	458	1,223
	(SVN) Slovenia	1.38	10.56	101,921	22,839	4,950	543	355	7,481
	Minimum	1.19	9.27	28,556	11,795	4,950	543	355	1,223
	Maximum	5.79	201.99	715,048	293,428	47,882	57,043	12,399	33,941
	Average	2.18	59.75	164,327	70,377.4	13,962	9,809.7	2,806.1	9,636.30
	Std.	1.25	59.66	189,937.50	79,787.50	12,150.15	16,397.30	3,629.07	9,033.94
2016	(BGR) Bulgaria	2.24	38.97	69,254	37,146	6,215	4,716	6,842	5,509
	(CZE) Czech Republic	5.60	204.63	565,649	307,424	37,162	61,533	16,121	39,450
	(EST) Estonia	1.87	127.32	222,467	103,022	-1,889	16,922	3,744	16,679
	(HRV) Croatia	1.72	18.33	104,756	31,393	11,072	3,164	708	5,159
	(HUN) Hungary	1.57	47.93	148,132	76,341	20,878	8,838	3,822	6,607
	(LTU) Lithuania	1.66	47.94	90,715	33,822	10,553	2,430	1,514	8,729
	(LVA) Latvia	1.96	63.43	97,981	53,899	13,761	6,430	1,087	9,394
	(POL) Poland	1.63	18.78	83,815	26,246	7,723	1,406	421	4,849
	(ROU) Romania	1.06	9.36	29,023	11,896	5,166	470	545	1,459
	(SVN) Slovenia	1.22	9.78	109,143	23,917	4,881	415	285	7,508
	Minimum	1.06	9.36	29,023	11,896	-1,889	415	285	1,459
	Maximum	5.60	204.63	565,649	307,424	37,162	61,533	16,121	39,450
	Average	2.05	58.65	152,093.50	70,510.60	11,552.20	10,632.40	3,508.90	10,534.30
	Std.	1.23	58.91	146,098.61	83,096.52	10,286.12	17,612.97	4,655.44	10,353.01

Source: Own calculation.

DEA-COST models generated by Win4DEAP were used with an input-orientation, two outputs and three inputs. We generated the technical efficiencies (TE) and the allocative efficiencies (AE). AE shows the "ability of a DMU to utilize inputs in optimal proportion at a certain level of prices" or "the level of inputs at which a firm obtains the

minimization of production costs" [3]. By multiplying those two types of efficiencies we can measure the economic (cost) efficiencies (EE).

RESULTS AND DISCUSSIONS

Technical efficiency score (under CRS assumption) in 2013 was 97.5% and ranged from 84.8% to 100.0%. From the sample, 7 countries achieved full technical efficiency, 2 countries (Latvia and Lithuania) were technical efficient (over 90%) and Croatia presented a moderate score of 84.8% (Table 2).

At CEE farm level, the allocative efficiency was 77.9% (with a minimum of 36.7% in Slovenia and a maximum of 100% in Romania and Bulgaria). Thus, a CEE farm can obtain a saving in costs of 22.1% if it has an optimum level of allocative efficiency. The most inefficient country, Slovenia, the minimum costs were exceeded with 63.3%.

By multiplying TE and AE we obtain a medium level of economic efficiency of 76.3%, with a minimum of 36.7% in Slovenia and a maximum of 100% in Bulgaria and Romania. At CEE level we obtained 23.7% cost savings, but in Slovenia (the most economic inefficient region) the economic efficiency would have increased with 63.3% if the farms would have been operated at optimum level.

In all considered countries the inefficiency related to the costs is due in particular to an inefficient mix of inputs (low allocative efficiency). The most inefficient countries are Slovenia, Croatia and Czech Republic (they overcome the minimum costs with 63.3%, 56.4% and 34.1%). In Croatia, Lithuania and Latvia the inefficiency is due also to technical inefficiency but in lower proportion.

In 2016, technical efficiency score (under CRS assumption) was a little lower of 95.8% and ranged from 76.7% to 100.0%.

From the sample, 8 countries achieved full technical efficiency, 1 country (Bulgaria) was technical efficient (over 90%) and Lithuania and Poland presented moderates scores (76.7% and 82.9%) (Table 3).

Table 2. The technical, allocative and economic efficiency DEA-Cost Scores of CEE countries in 2013

	TE	AE	EE
Bulgaria	1.000	1.000	1.000
Czech Republic	1.000	0.659	0.659
Estonia	1.000	0.843	0.843
Croatia	0.848	0.514	0.436
Hungary	1.000	0.906	0.906
Lithuania	0.964	0.908	0.875
Latvia	0.940	0.894	0.841
Poland	1.000	0.701	0.701
Romania	1.000	1.000	1.000
Slovenia	1.000	0.367	0.367
Average	0.975	0.779	0.763
Minimum	0.848	0.367	0.367
Maximum	1.000	1.000	1.000
Cost savings			
Bulgaria	0	0	0
Czech Republic	0	34.1	34.1
Estonia	0	15.7	15.7
Croatia	15.2	48.6	56.4
Hungary	0	9.4	9.4
Lithuania	3.6	9.2	12.5
Latvia	6	10.6	15.9
Poland	0	29.9	29.9
Romania	0	0	0
Slovenia	0	63.3	63.3
Cost savings average	2.5	22.1	23.7
Cost savings for the most technically inefficient country	15.2	63.3	63.3

Source: Own calculation with Win4Deap 2

The allocative efficiency increased to 85.6%, with a minimum of 39.8% in Slovenia and a maximum of 100% in Romania and Latvia.

At an optimum level of allocative efficiency, a CEE farm can have a cost saving of 14.4% and in Slovenia (the most inefficient country) the cost saving would've been of 60.2% if the Slovenian farms would have reached the production frontier.

The situation reveals a slightly improvement in allocative efficiency which reflect in a higher level of economic efficiency (81.8%). However, we observed a minimum of 39.8% in Slovenia and a maximum of 100% in Romania and Latvia.

In these conditions, at CEE level, we obtained 18.2% cost savings, but in Slovenia (the most economic inefficient region) the economic efficiency remained over 60%.

Excepting Bulgaria and Lithuania, in all other countries the allocative inefficiency is predominant. The most inefficient countries were Slovenia, Poland and Croatia (they overcome the minimum costs with 60.2%, 38.8% and 35.4%) and the most efficient are the farms from Romania and Latvia.

Table 3. The technical, allocative and economic efficiency DEA-Cost Scores of CEE countries in 2016

	TE	AE	EE
Bulgaria	0.979	0.997	0.975
Czech Republic	1.000	0.988	0.988
Estonia	1.000	0.842	0.842
Croatia	1.000	0.646	0.646
Hungary	1.000	0.970	0.970
Lithuania	0.767	0.979	0.751
Latvia	1.000	1.000	1.000
Poland	0.829	0.737	0.612
Romania	1.000	1.000	1.000
Slovenia	1.000	0.398	0.398
Average	0.958	0.856	0.818
Minimum	0.767	0.398	0.398
Maximum	1.000	1.000	1.000
Cost savings			
Bulgaria	2.1	0.3	2.5
Czech Republic	0	1.2	1.2
Estonia	0	15.8	15.8
Croatia	0	35.4	35.4
Hungary	0	3	3
Lithuania	23.3	2.1	24.9
Latvia	0	0	0
Poland	17.1	26.3	38.8
Romania	0	0	0
Slovenia	0	60.2	60.2
Cost savings average	4.2	14.4	18.2
Cost savings for the most technically inefficient country	23.3	60.2	60.2

Source: Own calculation with Win4Deap 2

If we compare the situation on SO classes (economic dimension) we observe that the farms with higher dimensions overcame minimum cost with only around 23-26%. They are close of optimum that the others farms. Also, we observe the following results:

-Romania is the most efficient in almost all farms;
-Latvia reach full efficiency only in farms with 8,000-25,000 SO and Bulgaria only in farms with 100,000-500,000 SO;
-in Bulgaria, almost all farms are technical efficient which means that they are producing the maximum output with a minimum quantity of inputs; we encounter this situation only in Czech Republic in farms with 100,000-500,000 SO and in Latvia in farms with 25,000-50,000 SO (in 2016).

Also, analyzing the results we may conclude that we have a moderate efficiency (an overcame of minimum cost under 30%) in:
-8,000-25,000 SO – Bulgaria and Hungary (in 2013); Bulgaria, Estonia and Romania (in 2016);
-25,000-50,000 SO – Bulgaria (in 2013); Latvia (in 2016);
-100,000-500,000 SO – Estonia, Hungary, Lithuania, Latvia and Poland (in 2013); Czech Republic, Croatia, Hungary, Latvia and Poland (in 2016).

Romania is the only country full efficient (technical and allocative) in the both years, which means that almost all farms between 8,000 and 500,000 SO obtain an output adapted to their capacity and have an optimum mix of inputs.
If we compare the results by specialization categories we observe that milk farms are the most efficient in both years.

Table 4. The cost savings of CEE countries in 2013 and 2016 on SO classes

	2013								2016							
	8,000-25,000 SO		25,000-50,000 SO		50,000-100,000 SO		100,000-500,000 SO		8,000-25,000 SO		25,000-50,000 SO		50,000-100,000 SO		100,000-500,000 SO	
	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE
Bulgaria	6.1	0.0	20	23.0	31.1	36.7	0	0.0	22.8	36.0	47.1	42.5	50.3	56.1	0	0.0
Czech Republic	39.5	66.1	52	72.1	46.6	82.8	37.3	39.9	41.5	92.0	54.2	60.3	50.2	69.9	26	47.3
Estonia	31.1	69.1	31.1	100.0	48.9	100.0	29.9	100.0	29.4	91.5	49.1	72.7	53.7	100.0	34.4	100.0
Croatia	57.9	88.8	48.1	100.0	58	90.7	53.3	64.5	61.6	85.2	47.6	96.8	41.8	100.0	29.9	63.5
Hungary	23.9	100.0	31.6	100.0	39.8	100.0	29	83.4	30.4	100.0	35.5	100.0	32.7	100.0	18.7	100.0
Lithuania	31.2	43.6	35.3	72.5	45.2	93.4	24.6	100.0	44.3	60.7	51.2	59.6	45.7	78.8	30.2	83.1
Latvia	0	0.0	30.3	67.0	35.9	78.3	15.4	100.0	0	0.0	28.4	39.4	36.3	58.1	11.2	83.0
Poland	51.2	71.7	49.5	100.0	53.4	100.0	17	100.0	56.7	56.3	59.3	84.1	56.9	99.3	26.1	100.0
Romania	0	0.0	0	0.0	0	0.0	0	0.0	9.7	100.0	0	0.0	0	0.0	0	0.0
Slovenia	61.7	100.0	62.7	100.0	66.2	100.0	52.1	100.0	61	100.0	65.6	100.0	68.5	100.0	52.7	100.0
Average	30.3	77.6	36.1	86.1	42.5	89.6	25.8	82.2	35.8	79.9	43.8	74.7	43.6	85.8	22.9	86.0

Source: Own calculation with Win4Deap 2

They are close of optimum that the others farms and overcame the minimum cost with around 17-18%. The most inefficient are the farms from COP sector specialized in field crops.
Also, we may observe that:

-Romania and Bulgaria were the most efficient in 2013, but in 2016 only the milk farms from Romania are reaching full efficiency;
-in 2013 Estonia reach full efficiency in milk and mixed farms and, in 2016, the optimum is reached by field crops farms from Croatia, milk farm from

Latvia, Hungary and Romania and mixed farms from Czech Republic and Latvia;
-in 2016, the field crops farms from Lithuania, Latvia, Poland and Romania were moderate technical efficient (they produced the maximum output with a minimum quantity of inputs); we encountered this situation only in the milk farms from Latvia (2013) and from Czech Republic (in 2016).
Also, analyzing the results we may conclude that we have a moderate efficiency (an overcame of minimum cost under 30%) in:
-Field crops farms - Hungary and Latvia (in 2013); Bulgaria, Czech Republic and Latvia (in 2016);
-Milk farms - Hungary, Lithuania and Latvia (in 2013); Bulgaria, Czech Republic, Estonia, Croatia and Lithuania (in 2016);
-Mixed farms – Czech Republic, Hungary, Lithuania and Latvia (in 2013); Bulgaria, Estonia, Hungary and Lithuania (in 2016).
We may conclude that the milk farms are more efficient (technical and allocative) in the both years (the output is adapted to the capacity and inputs have an optimum or close to optimum allocation). The most inefficient are the farms from field crops sector.

Table 5. The cost savings of CEE countries in 2013 and 2016 on Specialization categories

	2013						2016					
	Field crops		Milk		Mixed		Field crops		Milk		Mixed	
	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE	EE	% of AE
Bulgaria	0	0.0	0	0.0	0	0.0	17.9	11.7	13.2	60.6	6.8	100.0
Czech Republic	32.5	100.0	43.2	78.9	26.6	100.0	11.9	100.0	6.5	4.6	0	0.0
Estonia	39.2	100.0	0	0.0	0	0.0	41.8	99.3	7.7	100.0	1.8	0.0
Croatia	43.2	83.6	33.9	93.2	47.2	59.7	0	0.0	23.9	90.0	43.2	62.0
Hungary	19.4	100.0	11.2	100.0	3.4	100.0	30	100.0	0	0.0	3.5	100.0
Lithuania	31.8	50.3	6.3	100.0	8.3	100.0	44.7	21.5	28.5	71.9	25	46.0
Latvia	24.7	83.0	7.5	24.0	3.9	59.0	25.1	34.3	0	0.0	0	0.0
Poland	41.4	100.0	37.7	100.0	34	67.4	58.4	41.4	42.9	100.0	47.2	42.6
Romania	0	0.0	0	0.0	0	0.0	35.5	0.6	0	0.0	40	100.0
Slovenia	64.8	100.0	47.9	100.0	65.9	100.0	71.2	100.0	50.3	100.0	62.1	100.0
Average	29.7	90.9	18.8	90.4	18.9	83.6	33.6	59.2	17.3	87.3	23.0	74.3

Source: Own calculation with Win4Deap 2

CONCLUSIONS

Based on 2013 data, we concluded that the allocative inefficiency was comprised between 63.3% and 0% with an average of 22.1% and the technical inefficiency was comprised between 15.2% and 0% with an average of 2.5%. In this way, we conclude that the major source of economic inefficiency was the allocative one (wrong mix of inputs). However, the economic efficiency over 70% suggests that farms from CEE countries were productive at a cost close to minimum. The farms from Romania and Bulgaria reached full technical and allocative efficiency. Also, the most efficient farms were the ones with higher economic dimension (over 100,000 SO) and the ones from milk sector.
In 2016, we obtained an allocative efficiency comprised between 60,2% and 0% (with an average of 14.4%) and a technical inefficiency was comprised between 23.3% and 0% (with an average of 4.2%). As we can observe, except Bulgaria and Lithuania, in all countries the main source of economic inefficiency was allocative. The full efficiency was reached only by Romania. The most efficient farms remained the ones with big economic dimensions and the ones from milk sector.
Our paper build on DEA-COST allowed us to compare farms from different CEE countries based on FADN data from 2013 and 2016 in connection to the structural changes. Although if we couldn't compare directly these two years, we may observe that the differences between countries are lower in terms of efficiency. Thus, it exists an obvious tendency to minimize the costs and to increase the efficiency, but there are still problems in technological capacities (the adaptation of inputs to the level of output) and especially difficulties in the allocation of inputs (an inefficient mix of inputs). The most efficient countries in 2016 were Romania and Latvia (followed closely by Czech Republic, Bulgaria and Hungary) and the most

inefficient country was Slovenia (followed by Poland and Croatia).

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ADAPTATION AND MITIGATION OF CLIMATE CHANGE IN MAINTAINING FOOD SECURITY BY TRADITIONAL COMMUNITIES

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Abstract

Ongoing climate change has affected individuals' lives in different parts of the world including the traditional communities. The accessibility of natural resources regularly utilized as a wellspring of occupation is so vulnerable against climate change. Alongside the event of an unnatural weather change that brought about outrageous climate change, different regular marvels that happen presently isn't the same any longer. Traditional communities may not comprehend the ideas of a global warming and climate change, yet they watch and feel their impact. Different saw impacts, for example, diminished precipitation, increment in air temperature, expanding the force of the sun and precipitation which isn't balanced out. Mostly food production is declining alongside different climatic changes. In a few simulation of climate change demonstrates of synthetic manure utilization, heat stress and water shortage can prompt a decrease in rice production up to 3.8% in Asia toward the finish of the 21st century. Adjustment and relief to climate change are done with different acclimations to decrease vulnerability or increase resilience to the climate change. Oblivious adaptation and mitigation practices of climate change have been honed by traditional communities through the cultivating frameworks they work. Different systems are completed not exclusively to address nourishment issues and to support their lives. Different discoveries demonstrate that the conventional cultivating framework keep running by the group is plainly ready to keep up their food security in the midst of the danger of dry season, heat stress and different interruptions caused by climate change.

Key words**:** *climate change, farming system, food security, traditional communities*

INTRODUCTION

Over the last few decades, human activities in meeting the needs of life have caused many emissions and trigger the occurrence of warming in all parts of the world. A variety of gases from anthropocentric activity are emitted into the air to form a thick layer called a greenhouse gas layer. The layers that are formed because the difficulty of the sun reflected by the earth's surface is passed back into space. The sunlight returns to the surface of the earth and causes intense warming and results in global temperature rise. The incident caused various new phenomena such as melting ice sheets in various parts of the world, rising sea levels to extreme climate change.

Recent climate change has had an impact on people's lives in various parts of the world including traditional societies. Heating and drought trends along with intense extreme climatic changes such as storms, floods, and hailstorms are prevalent throughout the world, especially the Asia and Pacific region in recent decades. This region is very important because it has the highest number of poor people in the world, whose poverty is closely linked to repeated exposure to climate change risks [24].

More than 60 percent of the population in the Asia and Pacific region depends on the natural resources that surround them. The availability of natural resources commonly used as a source of livelihood is so vulnerable to climate change. The community's dependence on these natural resources poses a threat to the sustainability of available natural resources as well as the livelihoods of these communities.

One of the most alarming threats is food security and the sustainability of agricultural practices in the community. Climate change leads to various failures in agricultural systems that have been used. Extreme changes

in rainfall, seasonal periods and other things create uncertainty so that agricultural systems used tend to be counter-productive. Crop failures and declining agricultural production are widespread along with the current extreme climate change.

However, these failures do not occur in some indigenous or traditional communities who still maintain the agricultural system they have been using for so long. Traditional farming systems adhered to by indigenous peoples have proven to adapt to various climatic changes and it is possible to be applied as a mitigation strategy for climate change in maintaining food security in the community.

MATERIALS AND METHODS

In writing this article, there were used important published articles and textbooks as mentioned in the list of references. A critical approach was managed by authors based on the collected information.

RESULTS AND DISCUSSIONS

Traditional Communities, Local Wisdom, And Climate Change

Traditional societies are often assumed to be people living in rural areas or close to natural resources. Meanwhile, in Indonesia, there is also known as indigenous peoples who are indigenous peoples who inhabit an area where bound by a rule known as customary law. Meanwhile, according to the AMAN (Alliance of Indigenous Peoples of the Archipelago) at the First Congress of 1999, the indigenous peoples are: Communities that live on the basis of ancestral origins on an indigenous territory, which has sovereignty over land and natural resources, socio-cultural life that is governed by customary law and adat institutions that manage the sustainability of community life.

Indigenous or traditional peoples largely inhabit economically and politically marginalized areas, whereas indigenous or traditional peoples have a very high dependence on natural resources. Various existing limitations encourage people's thinking ability to create local knowledge and knowledge in identifying various issues. Local knowledge is a unique, traditional, long-standing empirical knowledge in a given geographical area [7].

Local decisions about daily needs such as hunting and gathering, fisheries, agriculture, animal husbandry, water conservation, health and other activities are based on local knowledge owned by the community [21]. The knowledge they have is solely used to meet their basic needs equally within the limits set by the tradition including the management of natural resources around them.

Local knowledge on natural resource management is largely derived from the habit of observing the various activities that occur around them. Environmental changes are observed through various natural phenomena captured through the presence of certain bird species, breeding season of animals or flowering of certain plants that serve as a marker for time and season changes that are well understood by traditional societies. The various markers are also linked to the right time in utilizing natural resources including running an agricultural system.

But along with the occurrence of global warming that resulted in extreme climate change, various natural phenomena that occur now is not the same anymore. Traditional societies may not understand the concepts of global warming and climate change, but they observe and feel their influence. Various perceived effects such as decreased rainfall, increase in air temperature, increasing the intensity of the sun and rainfall is not stabilized. This caused a change in the natural phenomenon that has been used as a marker by traditional society. Traditional societies are therefore required to continue to identify changes and adapt to those changes [8].

Climate Change Impacts on Agricultural Practices

Agriculture is one of the important sectors in food security as it relates to the provision, access, and absorption of food. The agricultural sector is also a sector that is particularly vulnerable to various disruptions including climate change. To always maintain

food security, an agricultural system that can adapt to various disruptions including climate change so that availability, access to food absorption in the community can be guaranteed.

Since the green revolution, increased agricultural production through the intensification of many agricultural systems is enforced. Agricultural intensification has done a lot to change the traditional farming system done by the community. The monoculture system used in agricultural intensification also tends to exclude the diversity of crop varieties, especially the rice varieties owned by the community. Increased use of chemical fertilizers and land exploitation also occur to support agricultural intensification.

Unfortunately, the intensification of agriculture carried out leads to a decrease in environmental quality. Forests and a variety of cultivated land including sloping hills convert functions into agricultural lands and plantations that lead to an increase in the rate of soil erosion. Intensive farming practices also pose many problems to water and soil quality [19]. These problems threaten the sustainability of agricultural practices undertaken by the community. Meanwhile, other threats such as population increase, global warming, and extreme climate change are also a new nuisance to the sustainability of agricultural practices.

The impacts of climate change and extreme events that occur, shows the results of agricultural production in many Asian countries decline, partly influenced by the increase in temperature and extreme weather events. Production of rice, maize, and wheat in recent decades has shown a decline in most of Asia, due to rising water pressure, rising temperatures, increasing El Nino frequencies and decreasing rainfall [25][1][10][6][22][23]. [16] mentioned that rice yields decreased by 10% for every minimum temperature rise of 1°C at each growing season. The frequency of diseases triggered by climate change and heat stress in central, eastern, southern and South-eastern Asia has increased with increasing temperatures and rainfall variations.

Most food production is declining along with various climatic changes. In some simulations, climate change shows a combination of chemical fertilizer use, heat stress, and water scarcity can lead to a decline in rice production up to 3.8% in Asia at the end of the 21st century. Meanwhile, with the extreme climate change occurring, it is estimated that by 2050 rice and wheat production in Bangladesh has decreased by 8% and 32% [5]. The threat of this production decline not only affects agriculture with modern systems but also affects agricultural land run by traditional farming systems.

Traditional agricultural land with rain-fed irrigation threatened to decrease production in line with the global temperature rise that occurred. The rise in global temperatures up to 0.5 ° C proved to decrease 0.45 tons per hectare of wheat yield in India. Other simulations in South Asia show that a 2.5 ° C temperature rise could trigger a decrease in net rice and rainfed rice production by 9-25% [11]. Meanwhile, in China, a 2 ° C temperature increase could decrease rain-fed rice production by 5-12% [12]. Therefore, appropriate adaptation and mitigation strategies are needed in the face of extreme temperatures and climate changes that occur to avoid a decline in food production that threaten food security and the practices of sustainable agriculture.

Adaptation and Mitigation Traditional Communities towards Climate Change in Improving Food Security

The climate change adaptation and mitigation were carried out by reducing vulnerability or increasing the resilience towards the occurring climate change. Adaptation and mitigation can be done individually or planned with the impetus of policy determination. For individuals usually conducted by private or non-governmental parties for planned adaptation and mitigation is made through government-planned, conscious decision-making to reduce the negative or disproportionate impacts of climate change [18].

Improved adaptation and mitigation capabilities to climate change can be undertaken in line with modifications to agricultural systems, increased crop and livestock production through nurseries and

investments in new technologies and infrastructure. One example of adaptation is that of grassland management with actual environmental conditions where grazing rotation systems are carried out to maintain the sustainability of grassland resources. In addition, adaptation is also done by establishing irrigation systems and breeding of new rice varieties to minimize the risk of serious harvest failures caused by climate change [9].

Another way to improve adaptation to climate change is to make changes to the farming system and integrate it with other activities. This is similar to an integrated farming system by traditional societies. One example is integration of rice planting with fish ponds or agroforestry by combining livestock practices with planting food crops and tree planting. Agroforestry has shown positive results by utilizing forest land for activities that produce both food crops and livestock among forest crops and multipurpose tree species. Besides, the community can develop their cultivation technology with their local wisdom. Some local wisdom applied include the development of garden plants, gardens, maintenance of secondary forests and protected areas around the village to protect the water system and manage forest products by utilizing non-timber forest products such as sap, honey, agarwood [2].

In addition to the integration of agricultural systems with other activities through agroforestry, traditional societies always prioritize diversity in their cropping systems. The diversity of plant species to rotation patterns used can also play a role in climate change mitigation as it is expected to increase resilience to various impending disruptions including extreme climate change [14]. For example, farmers can plant two types of rice at the same time that are resistant to drought and flood resistant species. This is expected to reduce the risk of a greater loss of harvest failure if done with a monoculture system.

The mechanisms of adaptation and mitigation of climate change through traditional farming systems on a diversity basis are well known in local knowledge shared by communities. As traditional societies in the African Sahel have long practiced the mitigation of change through reducing carbon emissions by organic farming practices that do not use chemical fertilizers, maximizing pesticides and natural predators and conservation of C on the ground through the utilization of straw and foliage [20][15]. Mitigation and adaptation to drought conditions is also carried out by traditional communities in Ghana through the conservation of water resources and rotation of planting patterns. The prolonged drought that forms the traditional society has a habit of saving water. In addition, to maintain the water source there is also a gray for the community when approaching the river that became a source of irrigation from their farm. Farmers can predict well when rain comes and how to plan their growing season to coincide with rain. As a mechanism for adaptation to drought and water scarcity, farmers change the types of crops they cultivate such as replacing cacao plants with cassava that are more resistant to drought [8].

Unconscious adaptation and mitigation practices of climate change have been practiced by traditional societies through the farming systems they operate. Various mechanisms are carried out not only to meet food needs and to sustain their lives. Various findings prove that the traditional farming system run by the community is clearly able to maintain their food security amid the threat of drought, heat stress and various disruptions caused by climate change.

Mitigation and Adaptation towards Climate Change by Indigenous Peoples of Kasepuhan Ciptagelar, in Maintaining Food Security

Indigenous Peoples of Kasepuhan Ciptagelar, Sirna Resmi Village, District Cisolok, Sukabumi Regency which is one of the indigenous peoples who inhabit the area of Mount Halimun Salak National Park. The Sirna Resmi Village is a village geographically located between 106 ° 27 '- 106 ° 33' east longitude and 6 ° 52 '- 6 ° 44' LS. Sirna Resmi Village has an area of 4,917 ha with a height of 600-1,200 m above sea level, with hilly and mountainous topography characteristics. The average temperature in the dry season ranges from 28 °C while in the

rainy season around 21 - 25 °C. Sirna Resmi Village has rainfall that varies between 2120 - 3250 mm / year with 84% air humidity.

Ciptagelar's indigenous peoples are traditional communities with sustainable agricultural practices. Since 1386, the community has avoided crop failure by planting more than 125 local rice varieties [3]. Local rice planting can be spelled out longer than 4-9 months so it only allows harvesting once a year. To fill the grace period, rice cultivation is replaced by the cultivation of secondary crops, also known as traditional way to keep rice resistant to pests by using biopesticide [17]. These agricultural practices have proven to be synonymous with organic farming practices that allow agricultural systems to be adapted to climate change and sustainably [4]. This allows the land to produce optimally so that no overexploitation results in decreasing soil quality. In addition to the many varieties of rice with variations of planting patterns that do show mitigation is done to prevent the occurrence of various disorders including climate change.

The community also utilizes the hillsides by planting various types of woody plants, cloves, and coffee. In addition to reducing the movement of land, tree planting is also useful as a backup of firewood because the community is still required to cook with firewood and indirectly provide additional income. Although the whole community has a livelihood as a farmer, yet almost every community has other income from penetrating the forest. Non-timber forest products greatly assist the livelihood of communities through their roles as food, fuelwood, and other income supplements.

In addition, other mitigation behaviours are manifested in rules requiring storing one bundle of rice in a communal barn, so that each farmer has a reserve of rice stored in a barn for at least two years [13]. The rule indicates that the indigenous community of Kasepuhan, Ciptagelar has a mitigation mechanism to maintain food security and is proven by climate change in the present time that indigenous peoples can survive.

The role of Abah Anom as the leader of indigenous peoples Kasepuhan, Ciptagelar in maintaining various local wisdom inherited from the ancestors is still very strong. To deal with the extreme climatic changes that have taken place, Abah Anom allows modernization practices to be carried out so long as they do not clash with what their ancestors inherited. Acculturation of modernization is an adaptation mechanism that is done to avoid the emergence of changes that lead to the loss of local wisdom that led to environmental damage. It is also manifested in various aspects including agricultural systems by accepting various modern farming systems such as the use of organic fertilizers as necessary as long as it does not damage the existing agricultural system and interfere with the food security of indigenous peoples Ciptagelar [26].

Ciptagelar's indigenous peoples clearly demonstrate the mechanisms of mitigation and adaptation to climate change. The diversity of varieties and patterns of planting and storage of rice in communal barns is a mitigation that is done in addressing various threats of food security resulting from climate change. The diversity of agricultural crops, especially rice, shows the resilience of agricultural systems to various disruptions, both pests, and seasonal changes. Traditional agricultural systems with accurate acculturation of modern agricultural systems based on the principle of diversity are appropriate adaptation strategies and proven to sustain food security owned by indigenous Kasepuhan, Ciptagelar people in the midst of an era of climate change.

CONCLUSIONS

Traditional agricultural systems used for generations have proven to be effective as adaptation and mitigation strategies of climate change and can maintain food security from traditional communities that use them. However, given the recent extreme climate change, further studies on traditional farming systems are in place to enable a new, more powerful technology to cope with the potential climate change threats. The acculturation of traditional farming systems and modern technology are needed to

strengthen the adaptation and mitigation towards potential climate change threat so that food security can be maintained.

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WASTE MANAGEMENT PARADIGM TOWARDS INDUSTRIAL ECOLOGY, CLEANER PRODUCTION AND SUSTAINABLE DEVELOPMENT – A MINI REVIEW

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Abstract

In accomplish eco-friendly natural resource utilization, the concept such industrial ecology and cleaner production are proposed. The two terms are generally considered to have nearness and numerous likenesses. The time of advancement of environmental management in the late 1980s to the mid-1990s turned into the beginning of the two ideas. Recently the likenesses and contrasts between the two ideas are still bantered in connection to the multifaceted nature of the issues examined. Unfortunately, a few definitions and implementations had done as such far just spotlight on the economic and ecological perspectives just so there are other vital angles, for example, social viewpoints that are as yet immaculate. Environmental problem solving needed multi perspective approach including the concept of cleaner production or industrial ecology. Therefore, the new paradigm in cleaner production and industrial ecology request agreement with the idea of economic improvement through the thought of the three pillars (social, economic and environment) and in addition all-encompassing and exhaustive examination. The new approach is required to minimize the ecological effects, as well as to enhance individuals' expectations for everyday comforts through financial strengthening and social states of the network.

Key words**:** *industrial ecology, cleaner production, sustainable development, waste management*

INTRODUCTION

Industrial ecology and cleaner production are the proposed concepts to achieve eco-friendly natural resource management. Both terms are widely considered to have proximity and many similarities. [1] on [8] mentioned that the basic concept of industrial ecology was first expressed in the seminal paper 'Strategies for Manufacturing' published by American Scientific, as follows: *"Waste generated from an industrial process can serve as a raw material for other industries, thereby reducing the industry's impact on the environment*" [4].

In the meantime, cleaner production was firstly known as "Clean Technology" proposed by the Organization for Economic Cooperation and Development (OECD), as follows: *"A wide range of engineering technologies are undertaken with the aim of reducing and even directly from the source, the production of various disturbances, waste or pollution and to assist in the saving of raw materials, natural resources and energy"*.

Both concepts are born along with increasing awareness and desire to reduce the various environmental impacts caused by industrial economic system. The period of evolution of environmental management in the late 1980s to the mid-1990s became the beginning of both concepts (Figure 1).

Industrial ecology was first introduced in America (1989) and began to be applied in Japan (1990), while cleaner production originally known as clean technology (1987) was later changed to cleaner production in Paris (1989) and spawned in Europe by UNEP (United Nation Environment Program) in September 1990.

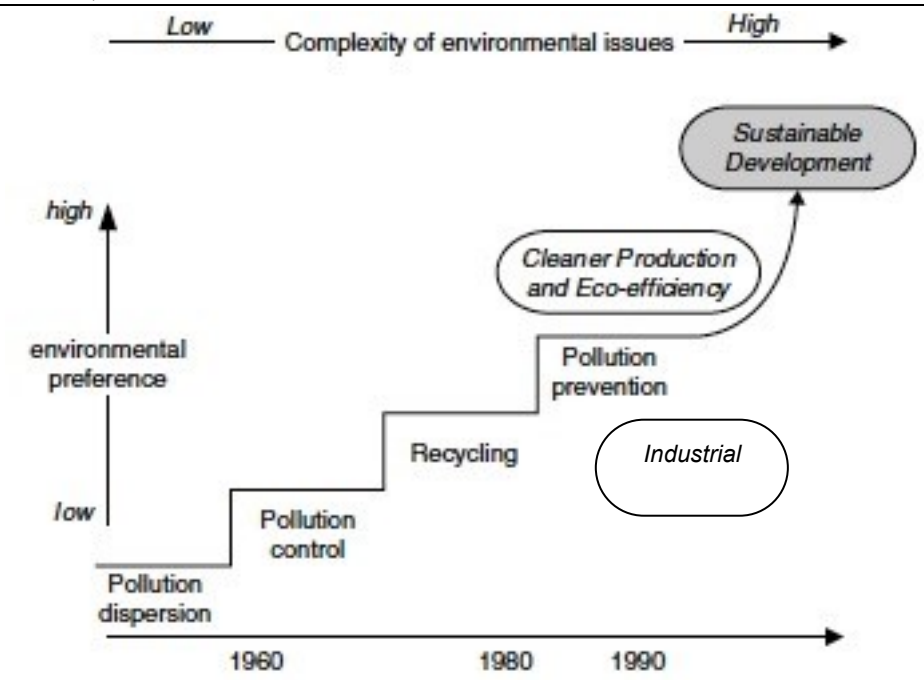

Fig. 1. Evolution of natural resource and environmental management paradigm [8]

MATERIALS AND METHODS

This paper is based on a large information from literature in the field, mainly on key textbooks and published articles from various sources.

RESULTS AND DISCUSSIONS

The Concept and Complexities of Industrial Ecology and Cleaner Production

Until now the similarities and differences between the two concepts are still discussed regarding the complexities studied. [1] states that the cleaner production concept has more focus on improving process technology than on issues related to consumption patterns or even reuse of recycled and by-products. This is also in line with the statement of [12] in the book Environmental Management Accounting for Cleaner Productions which states that cleaner production aims to increase production and productivity of the company through the use of raw materials, water and energy more efficiently so as to reduce waste and any emissions directly from the source and contribute to product design more environmentally friendly and cost-efficient over the entire production cycle. Achieving these goals can be done through:

(i)Minimize the use of raw materials, optimize the reuse and recycling of various raw materials both harmful and harmless.
(ii)Use raw materials in the production process in a more efficient way, reducing the number of required inputs and the amount of unwanted output.
(iii)Minimize risk and improve human resources through employee safety and hygiene programs
(iv)Increase monetary return by minimizing energy consumption and reducing material and handling costs.

While the concept of industrial ecology is regarded as a way to focus attention on the use or reuse of waste generated by an industrial process as input for its derivative processes [1]. As revealed by [14], industrial ecology is a system used to manage the flow of energy or material to obtain high efficiency and produce less pollution.

Implementation of the concept of industrial ecology can be done by:
-Optimize the use of existing resources;
-Creating a closed material cycle and minimizing emissions;
-Dematerialization process; and
-Reduction and elimination of dependence on non-renewable energy sources [3].

Unfortunately, some definitions and implementation done so far only focus on the

economic and environmental aspects only so there are other important aspects such as social aspects that are still untouched. Both concepts involve preventing pollution in order to protect the environment and improve economic efficiency. Cleaner production focuses more on the waste reduction aspect, while industrial ecology emphasizes the recycling of an unavoidably produced waste [14].

The complexity of environmental issues will be closely related to many things, including the social aspect. Therefore, to solve environmental problems with an industrial ecological approach in the future will require:

(a)The exact meaning of the study scope and the aims to be accomplished by the industrial ecology,

(b)The sustainable development meaning in order to help accomplish the targets of industrial technology,

(c)The collaboration of different fields including the social field in order to acquire more data in the settlement of ecological issues,

(d)Development of new instruments in managing ecological issues, and

(e)Improving government policy implementation so as to strengthen industry incentives to reduce environmental burden [5].

The statement demands a holistic approach to solving environmental problems through an industrial ecological approach. The broader interpretation states industrial ecology as an integrated system between industry and environment that conceptualizes industrial systems as producers of products and waste and analyzes relationships between producers, consumers, other entities and the universe [11]. This is in line with [10] which states that industrial ecology has shifted the concept of "end of pipe" into a more comprehensive strategy through the development of environmentally friendly industries through a holistic approach. The first textbook of industrial ecology confirms that industrial ecology is a cautious and rational way of human beings in maintaining the desired carrying capacity, given the ever-evolving economic, cultural and technological evolutions.

The concept of industrial ecology is closely related to cleaner production and is even considered as complementary to the other. After some time the idea of cleaner production has additionally developed with a more thorough approach through the contribution of social perspectives. The advancement of cleaner production idea with the mix of social aspect approach helps to overcome the problem of field implementation, the repetition of the method and the process scales [2].

Comprehensive approach to cleaner production approach and industrial ecology concept are needed to solve environmental issues. This is because in a sustainable system of nature, matter and energy form a complex web where each other is interconnected. With the goal that when discarded, the energy and materials can be reused in the process or as crude materials in fabricate of new items. If the focus is further expanded on all material and energy cycles, this approach will involve subjects in various disciplines ranging from humanities, the social sciences to the natural sciences and technology [7].

Achieving Sustainable Development through Waste Recycling, Cleaner Production and Industrial Ecology

The paradigm of solving environmental problems continues to evolve, from initially concentrating on pollution prevention to the present time concentrating on the idea of sustainable development (Fig. 1). The idea of cleaner production and industrial ecology are some approaches to solving environmental problems, which ultimately support the achievement of sustainable development [1]. Sustainable development demands the complexity of the issues studied and therefore is expected to further improve environmental performance as mentioned by World Commissions on Environment and Development/WCED (1987), the development to address the present issues without compromising the capacity of future generations to address their own needs.

Referring to these statements in other words, the decisions we take must consider the

potential impacts on society, the environment and the economy, while keeping in mind that our actions will impact elsewhere as well as in the future.

It is also important to note the importance of the three pillars expressed in OECD Insights: Sustainable Development that: *"The essence of sustainable development is the need to consider the "three pillars" collectively: society, economy and environment. Whatever the context the approach remains the same: people, habitats and economic systems are mutually interconnected*" [13].

Therefore, any decision making in the management of natural resources and the resolution of environmental problems should consider the three pillars, as follows:

(1)Social, there is equality of welfare, the satisfaction of different social services including wellbeing, education, gender equity, political responsibility and society participation.

(2)Economy, there is a guarantee of sustainable production of goods and services to maintain the level of management undertaken by the government by maintaining the balance of every sector including industry and agriculture.

(3)Environmental, stable resource guarantees, preventing over-exploitation of renewable natural resources and degradation of environmental functions. Includes maintenance of biodiversity, atmospheric stability and other undefined ecosystem functions as an economic resource [6].

It likewise applies to taking care of ecological issues through the execution of cleaner production and industrial ecology that should be possible through the material efficiency of production process. The concept of cleaner production and industrial ecology are conceived from the underlying idea of pollution prevention which then develops with different material efficiency approaches. The concept of material efficiency in cleaner production develops with waste minimization approach through optimization of production processes, while industrial ecology focuses on the waste recycling approach produced at the end of the production process [1]. However, [11] in the book The International Handbook On Environmental Technology Management states that recycling waste for raw materials of a production process is one of "preventative practices" in cleaner production. However, the waste management policy should include social, economic and environmental aspects to achieve sustainable development [9].

This recommends waste recycling is a method for tending to ecological issues through the implementation of cleaner production and industrial ecology. Figure 1 demonstrates that the improvement of the idea of cleaner production and industrial ecology is progressively prompting the idea of practical advancement that is always required to consider the three pillars. Therefore, in order to obtain a comprehensive environmental problem solving through waste recycling, the three pillars approaches that are social, economic and environmental are indispensable for the achievement of sustainable development.

CONCLUSIONS

Waste is one of the environmental problems that try to solve through various pollution prevention approaches. Industrial ecology and cleaner production are the pollution prevention approaches that have been developed over the past two decades. Both concepts offer pollution prevention through material efficiency so that it is expected to reduce the amount of waste disposed into the environment.

The number of definitions and understanding of the two concepts causes the resolution of the pollution problem to be less specific and targeted. At first the idea of industrial ecology more offers the utilization of waste from a production process to fill in as crude materials for different enterprises. Then the cleaner production idea developed from clean technology focuses more on engineering and technology on the production process so that material efficiency can be made and the amount of waste produced is less. Initial concepts of both have a fundamental difference in which industrial ecology is more focused on the finish of the procedure (end of

pipe) while cleaner production focuses around the efficiency of the process itself.

Along with the expansion of sustainable development paradigm in solving environmental problems, the approach of these two concepts also developed. Sustainable development requires every solution of environmental problems to consider the three pillars (social, economic and environmental) holistically and comprehensively. Therefore, some new comprehension of industrial ecology and cleaner production request harmony with the idea of sustainable development through the thought of the three pillars as well as holistic and comprehensive study. The new demands are expected not only to eliminate the environmental impacts, but also to improve people's living standards through economic empowerment and social conditions of the community.

In addition, these developments further narrow the differences between industrial ecology and cleaner production. Even the distance between the two concepts by assuming that waste recycling done at the end of the process can also be categorized as a cleaner production concept because it is a "prevention practice" of pollution and material efficiency so that it can minimize waste generated. This statement further demonstrates the similarity of the two concepts that focus on preventing pollution through the efficiency of materials that can be done including at the end of the process such as waste recycling. Waste management through recycling is also required to be able to consider the three pillars so that a holistic and comprehensive environmental problem solving is expected to help achieve sustainable development.

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SOCIAL FUNCTION OF AGRICULTURE SECTOR IN THE SLOVAK REPUBLIC

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Abstract

The article pointed out the relevance of the agricultural sector and its social function in the regions of Slovakia. Agriculture currently does not belong to high attractive, high productive and profitable sectors. Its importance for the country and the economy is indisputable. Agriculture performs several vital roles, e.g. food security of the population. From the perspective of environmental protection its functions of landscaping, soil and water protection is important. Equal, these two functions is the social function. Social function together with the production function is critical for the elimination of regional disparities. The article explores the relevance of the agricultural sector and its social function in terms of employment in regions of Slovakia.

Key words**:** *social function of agriculture, agricultural employment, agricultural production*

INTRODUCTION

Agriculture is the precondition of human society's existence and development. Nowadays, agriculture performs not only the traditional production function, but also many noneconomic functions, such as ecological and social function [16].

According to [17] "in today's world, the function of agriculture is more extensive because human needs have changed from the basic material to the aesthetic, including leisure, tourism, and other entertainment". Especially under such global threats to human development as environmental crises, energy crises, and food safety crises, people have begun to pay close attention to ecological protection of agriculture.

The transition from centrally planned economy to free market economy in Central European countries and following entry into the EU led to significant reduction of agricultural production and thereby to reduction of food self-sufficiency [3]. One of the symptoms of mentioned processes is an effort to link agriculture to rural development, so that both sectors will not contradict to each other, but complement each other [21]. The result of structural changes has been a dramatic decrease in the share of agriculture sector in GDP in transforming countries [6].

[11] stated that for the achievement of the connection between agriculture and rural development is the necessary pressure for the diversification of agricultural incomes for the benefit of alternative activities (cultivation of alternative crops) or non-agricultural activities (agritourism, direct sales support and processing of agricultural products, etc.).

Multifunctional concept of agriculture laid emphasis for its economic but also social and environmental aspects [14].

Depending on the quality of natural conditions for agricultural activities in the various regions should take into account the strengthening or weakening of individual aspects of multifunctionality. This means that e.g. productive functions of agriculture have to be preserved and promoted in areas with high fertile soil which will to be used for food production, on the other hand, the partial mountain conditions or marginal areas where soil quality is lower, is necessary to strengthen the environmental or social aspects of multifunctionality. Promotion of sustainable functions of agriculture in different regions in the context of their natural but also socio-economic assumptions is a challenge where agricultural policy plays a crucial role [22].

Studying agricultural multifunctionality can not only provide theoretical support for

construction of an agricultural system, but also offer a new way in practice to solve the problem of a weak and inefficient agricultural industry [4]. Current study on agricultural multifunctionality mainly includes both qualitative research and quantitative research.

Quantitative multifunctionality research is focused on the assessment of agricultural functions. It can be classified into two main categories: the first focuses on agricultural functions, e.g. ecological functions, agricultural externality, biological diversity, social functions and agricultural landscape [5], and the other is oriented on evaluation of integrated agricultural function [15].

The conception of multifunctional agriculture including the process of rural development can provide a solution for a large group of farmers. This process includes: "broadening", "deepening" or "re-grounding". "Broadening" can by characterized as development of new non-agricultural activities, which enlarge income sources of agriculture enterprises. [11]. The most common examples of such activities are agri-tourism and nature and landscape management [20].

Another type of "broadening" is social farming (also known as "Green Care"/"Care Farming") that involves:

-health services;

-education and therapy;

-rehabilitation and other social activities[13].

In literature we can find many definitions of social farming. It is not easy to be defined, because it includes a wide range of diverse practices. However, according to [12] two common aspects are always involved: it is practised on farms and it is aimed at disabled people.

According to [19] "social farming improves the welfare and social inclusion of the disabled people through the production of agricultural products and the promoting of solidarity and mutual assistance".

MATERIALS AND METHODS

We have used the following scientific methods:

-***Cluster analysis*** - was used for the purpose of classifying regions of Slovak Republic based on the share of agriculture in GDP; the employment in agriculture and the research and development indicator (R&D).

Cluster analysis is concerned with how objects (statistical units) should be grouped so that the greatest possible similarity is within groups and what is the greatest difference between the groups. The method is based on a combination of several variables [9]. In this paper cluster analysis was realized through Neuro XL Clusterizer program.

-***Location analysis*** - through the localization coefficient, we analysed the importance of employment in agriculture of different regions of Slovakia. To calculate the localization coefficient the following relationship was used:

$$LQ = \frac{\frac{e_i}{E_i}}{\frac{e_t}{E_t}}$$

or alternatively in the form [7]:

$$LQ = \frac{\frac{e_i}{e_t}}{\frac{E_i}{E_t}}$$

where:

e_i - regional employment in chosen sector;

e_t - total regional employment;

E_i - employment in chosen sector in the country;

E_t - total employment in the country.

This formula implies that if the localization coefficient reaches a value greater than 1, production of the selected sector in the considered region is exported to other regions. Otherwise, if the localization coefficient reaches a value less than 1, other regions' production of the sector is imported in the considered region [8].

The data used for processing the paper were obtained from the following sources:

-Statistical Office of the Slovak Republic - data is processed at the NUTS III level,

-book publications by domestic and foreign authors,

-internet resources focused on the employment analysis in agriculture,

-government regional policy documents bonded to agriculture.

RESULTS AND DISCUSSIONS

Agriculture until 1990 was consolidated and ensured the employment for about 350,000 employees, which is 17% of all the employees in material production. In the creation of gross domestic product, agriculture accounted for 10.7%. Since 1990, the sector has changed a lot.

Slowdown of dynamics in economic growth was reflected in employment trends. Disposal of jobs due to transformation and restructuring processes has not been compensated by creating new jobs in other parts of the economy [2]. High unemployment rate and low creation of new jobs are characteristic for the whole economy In spite of this agriculture and forestry are still offering many job opportunities in some regions [10].

The analyses of agricultural employment between 1989 and 2012 shows a breakthrough in the decreasing number of employees in the year 2004. Until this year the agricultural employment was constantly decreasing. In this period the reduction of employees stopped and the loss of employees due to their shift to the unemployed did not rise, because the loss was mostly natural (retirement). This decrease in employment has led to labour productivity growth. According to experts from agricultural enterprises [18] the situation until 2003 was mainly caused by:

-lack of support for employment increase in the agricultural sector. Projects supporting agricultural enterprises were focused primarily on purchasing new equipment to enhance productivity and reduce the need for manual labour, diversification of activities in agriculture was not supported along with the growth of jobs. Agricultural enterprises were supported by the Rural Development Programme and according to the agreed rules, they were not eligible for any funding from ESF – the European Social Fund;

-purchasing of products from abroad by newly created chain stores rather than from domestic production leading consequently to employment decrease in the food industry;

-extensive development of forestry enterprises;

-mismanagement of agriculture transformations, namely, restructuring of cooperative property did not create conditions for the development of intensive agricultural production.

Decrease in the number of employees is graphically presented in Figure 1. According to the Eurostat data, Slovak Republic belongs currently to the European countries with the largest decline in agricultural employment.

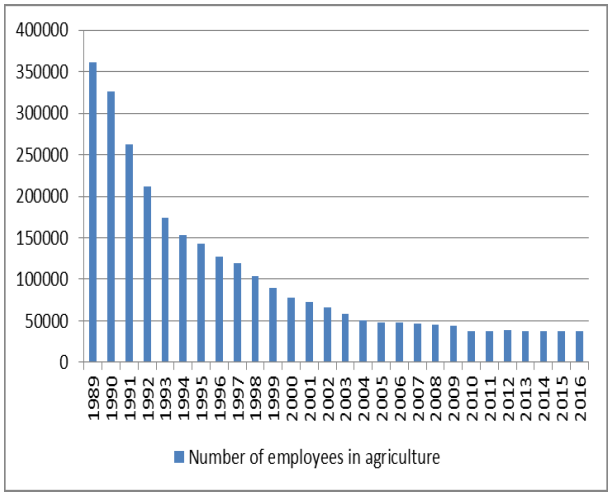

Fig.1 Development of agricultural employment since 1989,
Source: Statistical Office of the Slovak Republic, 2017

Economic performance of the agricultural sector in Slovak regions

Gradual recovery of the economy after 1989 led to an overall decrease in the importance of agriculture sector. Contribution of agriculture to GDP was 5.9% in 1993 and it fell to 2.7% in 2016. Financial results of agricultural production for the year 2016 presents figure 2. 7 of the 8 regions of Slovakia reached on average a positive economic result. Its highest level had Bratislava region (192 EUR/ha), then goes Nitra region (86 EUR/ha) and Trnava region (63 EUR/ha). Only one region of Slovakia was in loss, and that was Žilina region (-10 EUR/ha). Economic results increased annually in all Slovak regions with exception of Košice region where we can observe an annual fall of 206 EUR/ha.

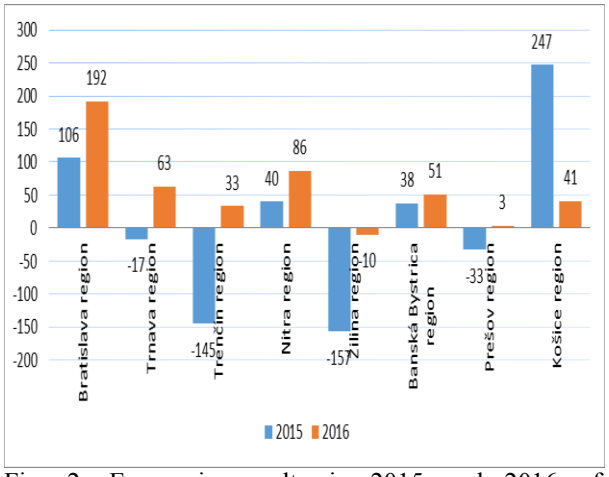

Fig. 2. Economic results in 2015 and 2016 of agricultural land, EUR/ha,
Source: Research Institute of Agriculture and Food Economics

When comparing years 2015 and 2016 the level of production increased annually in almost all regions (Fig. 3). Production above average of Slovakia reached Western Slovakia, the maximum volume was Bratislava region (2,167 EUR/ha agricultural land), where production on 1 ha was more than twice higher than in regions with prevailing less favourable natural conditions (Žilina, Prešov and Košice region).

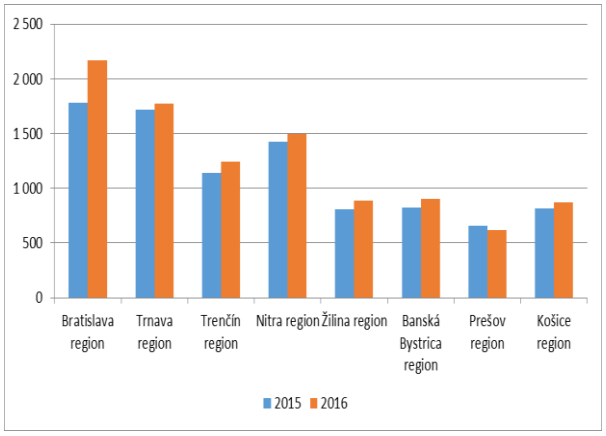

Fig. 3. Agricultural production in 2015 and 2016 of agricultural land, EUR/ha,
Source: Research Institute of Agriculture and Food Economics

Labour productivity per one employee decreased annually only in Prešov region. In all other region we can observe an increase. Bratislava region in the period under review reached 21.74% increase in labour productivity (Fig. 4).

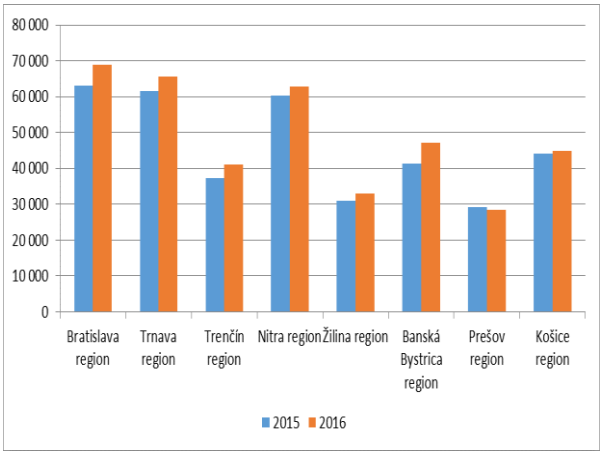

Fig. 4. Labour productivity of production per employee in 2015 and 2016, EUR
Source: Research Institute of Agriculture and Food Economics

In the following section we present the distribution of Slovak Republic regions at NUTS III level according to the results of cluster analysis. Input data for cluster analysis were data for the year 2016. Used indicators are mentioned in the methodology.
The bases of our analyses were values of the R&D indicator from [1]. This composite indicator reflects two indicators - gross domestic expenditure on research and development and the number of R&D employees. According to [1] for the values of R&D indicator applies following:
-value <0.2 - low level of knowledge creation,
-value from 0.2 to 0.8 - medium level of knowledge creation,
-value > 0.8 - high level of knowledge creation.

Table 1. Division of Slovak regions into clusters

	The employment in agriculture in %	The share of agriculture in GDP in %	R&D
Nitra region	**4.56**	**6.53**	**0.11239**
Trnava region	**4.36**	**5.75**	**0.09202**
Banská Bystrica region	**3.93**	**3.76**	**0.10658**
Trenčín region	**2.46**	**2.71**	**0.20786**
Žilina region	**2.53**	**1.47**	**0.13476**
Košice region	**2.13**	**2.24**	**0.23475**
Prešov region	**3.53**	**2.28**	**0.06701**
Bratislava region	**0.58**	**1.02**	**1**

Source: authors own calculations on the data from Statistical Office of the Slovak Republic.

Table 1, Figure 5 and 6 present the results of cluster analysis. The first cluster consists of Nitra, Trnava and Banská Bystrica, which are characterized by high values of the used indicators, except R&D indicator. The highest share of agriculture in GDP (6.53%), as well as the highest employment in agriculture (4.56%) was attained in the Nitra region. But in terms of the R&D indicator Nitra region belongs to regions with low level of knowledge creation.

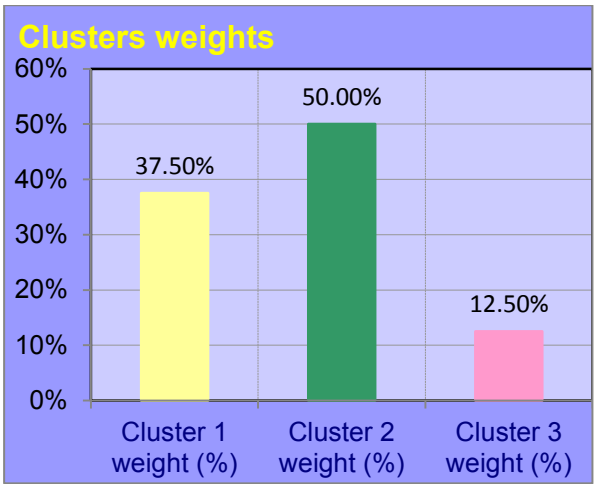

Fig. 5. The results of cluster analysis,
Source: processed by authors, program NeuroXL Clusterizer output

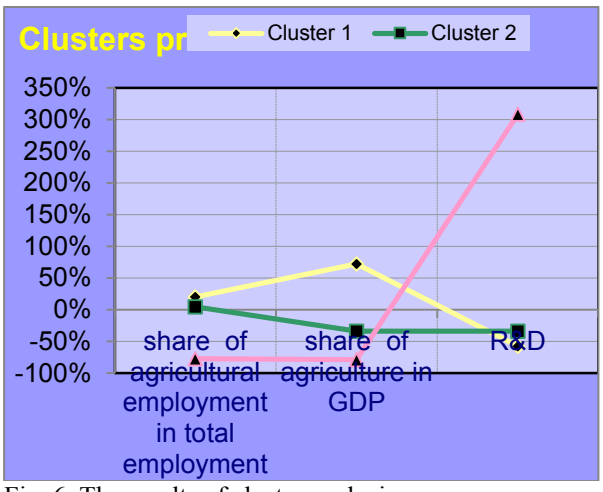

Fig. 6. The results of cluster analysis,
Source: processed by authors, program NeuroXL Clusterizer output

The second cluster includes Trenčín, Žilina, Košice and Prešov region. Within this group of regions the hugely highest share of employment in agriculture (3.53%) is in the Prešov region. Based on the R&D indicator, Trenčín and Košice regions had medium level of knowledge creation. The third cluster consists of Bratislava region which achieved the lowest share of agriculture in GDP (1.02%) among all the regions of Slovakia.

Based on the location analysis results presented in Figure 7, we can state that in Nitra region agriculture is the most important exporting sector. The agricultural sector is also the exporting sector in Trnava, Banská Bystrica and Prešov.

The most common activity on the territory of the Nitra region is agriculture. Agriculturally, the region belongs to the most used ones in Slovak Republic. It has very good natural and climatic conditions for growing almost all crops. Therefore, the development of this region is closely related to the production but also social function of agriculture on its territory. The need to increase the competitiveness of agricultural enterprises requires the implementation of innovations.

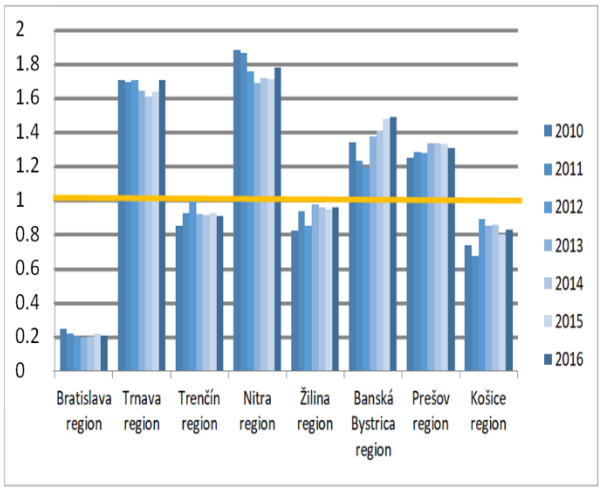

Fig. 7. Localization coefficient of the agriculture sector in 2010–2016,
Source: authors own calculations on the data from Statistical Office of the Slovak Republic

Agriculture, being tied to the land, creates conditions for the development of all the regions of Slovakia, allowing developing also the least developed regions. Therefore, the first task is to support the use of land in the ways useful for the area in terms of both production and ecology.

CONCLUSIONS

While in the previous period, the priority was to ensure economic growth and focus was on continual production increase without taking into account the possibility of production capabilities of the country or a particular region, currently economic activities are limited by the requirements of sustainable development.

Despite the low share of agriculture in creating economic value and employment, agriculture has an important role in the economic structure of the country as it generates the multiplier effect for other sectors. Per one employee in agriculture there are 1.3 employees in the supply industry, services, manufacturing and trade, and this increases agriculture's participation in GDP. Diversification of production structure of agricultural enterprises valorises the unique potential of rural settlements and contributes to the development of social function of agriculture by creation of new job opportunities for local residents.

Social and economic functions of agriculture are critical from the point of view of mitigation regional disparities. In the past, these functions should have ensured equal conditions for all; the same standard of living, today these functions are modified and oriented rather to reduce the economic and social disparities between regions and between urban and rural areas which are still characterized by unequal productivity and unequal economic developments. Modified alternative forms of agricultural production can ensure strengthening of the effect of production functions, profit-making and more efficient production processes.

To increase competitiveness, sustainability, economic and innovation performance it is required:

-to place greater emphasis on promoting the interests of Slovak farmers in decision-making and governing EU bodies,

-to activate its potential for use of local resources. The rural area has a lot of problems which agricultural enterprises could help to solve through diversification activities. In the old EU Member States help farmers to solve the lack of services for growing population of post-productive population in rural areas, problems with marginalized population groups (women with children, the physically and mentally disabled people) through so called. "Green care" farms.

-to focus on support of direct sales of agricultural products. Due to this the agricultural producers can get a larger share of the added value from the final product and achieve higher trade margin.

-to support cooperation and partnerships between self-government and agricultural enterprises which can effectively solve waste management problems, through the use of local renewable natural resources able to supply energy to other subjects in a municipality.

Rural development policy should respect greater diversity of rural environment in Slovakia and peculiarities of individual regions. This requires detailed knowledge of the problems in individual regions. In some EU Member States (Italy, Germany, and France) rural development policy is delegated to the regional level. Regional authorities are better at recognizing local development problems, they are able to specifically identify problems of their territory. It is for consideration whether in Slovak conditions the decentralized model of rural development policy tools implementation would be more effective or not.

As another option of development and strengthening of social function and economic performance in the agricultural sector in Slovakia we propose the creation of conditions for emergence of the so-called "green care farms" based on "care farming", which have long tradition in several European countries (UK, Netherlands, Italy, Belgium etc.).

"Green care farming" represents the concept which use farms, agricultural works, animals and plants to improve quality of life and human health. It is the use of labour in agriculture for therapeutic purposes and provisions of social respectively health area. This innovative approach is combining multifunctional agriculture, and social services / health care at the local level. It contributes to the increase of employment, diversification and economic performance of

farms, as well as to promotion of overall sustainable development.

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INVESTIGATION AND ANALYSIS OF DEVELOPMENT OF ORGANIC AGRICULTURE IN IRAN

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Abstract

Organic farming is a holistic production management system that enhances agro ecosystem health in terms of biodiversity, the natural cycle of nutrients and microbial and biological activity of soil. Organic farming systems can help to maintain and even improve water quality by reducing the amount of chemicals used in agriculture. In organic farming, chemical fertilizers and pesticides which have chemical compounds are prohibited. The main objective of this study was to investigate and analyse the problems for the development of organic farming and offering effective solutions for its development in West Azerbaijan province in Iran. The population of this research consisted of (N=1171) Farmers who produce organic products in West Azerbaijan province. By using Cochran formula the sample size determined (n=150). This research was carried out using the descriptive-survey research method. The data were collected by questionnaire and processed using factor analysis SPSS21 software. The results showed that the majority of surveyed respondents were older than 50 years, 68 % literate, 47 % of high school, 78% have used of wells and rivers for irrigation. Then the examined items were classified in the form of government support, economy, education and social welfare. The results showed that the factor of government support solutions with eigenvalues of 4.68 was selected as the most important factor from an agricultural perspective. In fact, this factor has explained 25.82 % of the problems of development of organic farming that the sum of these four factors is equal to 65.535 %. According to results in this research the following recommendations have been made: (i)enhancing and establishing the extension-education courses in the field of organic agriculture for farmers and encourage them to participate in these classes; (ii) by using training courses and mass media encouraging farmers to cultivation organic products and;(iii)government support for organic farmers work and for their products insurance; (iv)create and develop local markets for organic products and economic analysis and identification of global markets for export of organic products; (v)create places for the storage of organic products; (vi) provide adequate means of transportation equipped with cold storage facility for organic products and also providing useful information on the management and control of weeds, pests and diseases of agricultural products.

Key words**:** *problems, development, organic agriculture, solution, West Azerbaijan, Iran*

INTRODUCTION

Organic farming is in the event of sustainable agricultural development and is said to the set of operations which are come into force aimed at reducing consumption of abnormal inputs and in it the use of fertilizers and chemical pesticides, synthetic preservatives, synthetic drugs produced by genetically engineered organisms and waste water be excluded. Studies show that the universal acceptance of organic farming is promising that some of its reasons are to increase the concerns about pollution of base resource, food safety, human and animal, as well as more attention to nature and landscape values.

Now passes over three decades of global concerns about environmental protection and about two decades of debate surrounding sustainable development. Before this time, in all development projects, purely economic perspective and the creation of income and greater economic efficiency, were considered. But in the 1970s this mentality in the minds of policy makers and development planners proposed that such economic growth finally contributes to environmental degradation, social inequality, reducing resources and compensation these problems in the long run will cause vast economic losses [9].

Organic farming is in the event of sustainable agricultural development and is said to the set of operations which are come into force aimed at reducing consumption of abnormal inputs and in it the use of fertilizers and chemical pesticides, synthetic preservatives,

synthetic drugs produced by genetically engineered organisms and waste water be excluded. Studies show that the universal acceptance of organic farming is promising that some of its reasons are to increase the concerns about pollution of base resource, food safety, human and animal, as well as more attention to nature and landscape values. [6]. Although the yield on organic farms is usually ten to thirty percent less than non-organic farms, but by planning principles, yield, production and incomes of organic farms can be more than non-organic farms. For example, organic paddies yield have been reported six Tons in the Philippines. Experiences in the field of organic farming projects has shown that in low-yielding areas using organic farming practices the performance enhances two to three times.

Moreover, in developed countries, factors such as the readiness of consumers to buy at a higher price, subsidized by the state and development of ecotourism, provides increased income for organic farming. Studies in developed countries have shown that consumers are willing to pay ten to forty percent more to buy organic products than non-organic products. Today, a large number of chain stores offer organic produce and market is booming for these products and the potential demand exceeds supply.

It is expected supply shortage of organic products demand growth continued in the future so this creates opportunities for developing countries to enter the market and allocate their share of it. In general, the main objectives of organic production systems are optimizing production, improving environmental quality and social welfare [8].

Khaledi and Amjadi [6] in their study showed that unlike most modern methods and technologies, economic factors alone do not have an essential role in the admissions process and the development of organic farming. But also to develop organic farming, the role of other factors such as: awareness, attitudes and personal preferences and technical skills, technological and managerial, social issues, and institutional factors, such as: regulation, markets and government support governments and policy makers must receive serious consideration.

Moradi and co-workers in their study identified factors including farmers' lack of knowledge, lack of government support and guarantees the market for organic products at affordable prices as barriers to organic farming [10].

Hasheminejad and Rezvanfar showed that in front of organic agriculture development, there are obstacles and problems such as lack of proper market, lack of inputs and supportive and helpful organ and no clear standards to produce these products [3].

Sharifi-Moghaddamfar in their study were introduced the major obstacles to the adoption of organic farming including manufacturing, natural, attitude and knowledge, infrastructure, institutional and economic barriers [14].

Khaledi and co-workers also showed that conventional agricultures have little information about the arable areas by organic products, and related institutions related to organic agriculture can be very helpful in providing information for organic Farming. Also, they have shown in their study that lack of knowledge and skills in managing an organic farm, a lack of market opportunities for organic products and a lack of faith and a positive attitude to organic farming, can be obstacles of organic farming [7].

Salazar in examining the obstacles to the development of organic farming among farmers in the Philippines, found that low-income farmers successfully guided to the organic farmers when they have knowledge in the field and receive adequate training in this area and as well, have confidence market inputs [13].

Hatirli and co-workers reported numerous obstacles in their study to switch to organic production among farmers in Virginia that from them we can mention such as things like, uncertainty organic process, lack of marketing information and information about organic production [4].

Parra Lopez mainly attributed the reason of their distance from organic farming to infrastructure and economic factors. In his study, he showed that support for farmers is

an important factor in the adoption and development of organic farming [11].

Khaledi and co-workers also knows the lack of knowledge and skills in managing organic farming as the cause of rejection of organic agriculture by farmers [7].

Despite growing global attention to sustainable agriculture and biologic and with agricultural, geographical, climatic, cultural, historical, social special features and largest in Iran's rich and diverse resources, unfortunately, this type of production system in Iran's agricultural systems have virtually no place.

In this context, the overall goal of this study was to analyse the problems affecting the development of organic farming and provide solutions for its development in West Azerbaijan province that Specific objectives include investigating personal features of farmers and analysing the effect of social, economic, governmental support, training problems and identifying effective solutions in the development of organic agriculture.

MATERIALS AND METHODS

In this study, research methods are descriptive-survey and survey tools are questionnaires. The survey research is implementation of a questionnaire survey on a sample of respondents who are elected from among the crowd.

And the aim of this study was applied research, Because we used theories, laws and principles and techniques that are developed in basic research to solve executive and real problems and also, this research based on the nature and methods, due to exploring and discovering the relationship between independent variables and dependent variable, it is causal relationship and also due to describing the research variables, was descriptive. Necessary data were collected through observation, interviews, and questionnaires extracted from documents and others like them; and were investigated by using factor analysis techniques in the software SPSS21. The population size of the beneficiary farmers of the investigated province was 207,575 farmers (the city of Urmia, Mahabad, Miando'ab, Oshnavieh, Piranshahr and Naghadeh) that the sample size was calculated using the Cochrane formula and it was equal to 150 beneficiary farmers.

Regarding Data Analysis, it was used descriptive statistics and factor analysis. In conjunction with descriptive statistics, values such as: mean, variance, mode, standard deviation, maximum and minimum values was used and generally can be said to explain the phenomenon and subject of study with an statistical language. Illustration is described in the text.

RESULTS AND DISCUSSIONS

This section with respect to the gender, age, education level, how access to water, the land amount, the production amount, the type of sale market were examined and the results for each of the items listed below have explained in detail.

The average age of studied farmers is 50 years, the highest age among farmers is 70 and the minimum age is 24 years and also, The results also show that most farmers 5.44 percent) are older than 51 years. Most of the surveyed farmers, more exactly 144 people (96 %) were male. Most of the farmers 115 people, (68 %) were literate and 30 people (20 %) are illiterate. Most farmers surveyed (47%) holds a diploma, in fact, between what can be concluded from the table is that the farmers who are literate, 54 of them have a diploma. Most farmers surveyed (52.3 %) providing water supply for agricultural activities use wells and river water. The average of surveyed agricultural land is 2 hectares, the largest land between farmers is equal to 15 hectares and the least is equal to 1 hectare and also, the results show that most of the participants (103 people) have less than 3 hectares of land.

Most surveyed farmers, 90 people (74.4 percent) sale their products in the domestic market and 31 people (25.6 percent) export their products. Most surveyed farmers, 115 people (88.46 percent) have not participated in courses related to organic farming .15

people (11.54) have participated in these courses. Other results are shown in Table 1.

Table 1. Frequency distribution of personal attributes of farmers

		Frequency	Percent	Mean	Min.	Max.
Age	Less than 30	11	8			
	40-30	28	20.4	50	24	70
	50-41	37	27			
	Up than 50	61	24.5			
Gender	Male	144	96			
	Female	5	3.3			
Education	Literate	115	68			
	Illiterate	30	20			
Education level	Elementary	16	13.9			
	Guidance	12	10.4			
	High school	11	9.6			
	Diploma	54	47			
	Collage Education	22	19.1			
The way of access to water	River	44	29.5			
	Agricultural water well	23	15.5			
	Qanat well	4	2.7			
	River and well	78	52.3			
Agricultural farm amount Hectare	Less than 3	103	69.6			
	4-6	25	16.9	2	1	15
	7-9	12	8.1			
	Up than 10	8	5.4			
Sale products	Domestic market	90	74.4			
	Export	31	25.6			
Participated in courses related to organic farming	Yes	115	88.46			
	No	15	11.54			

Source: Research finding

Prioritize economic problems of organic farming development from the perspective of farmers

As we can see in Table 2 among the economic problems mentioned for organic farming development, the items such as uncertainty of performance and access to the market after delivery (CV = 0.180), low demand for organic products (CV = 0.227) and requires more labour and increased production costs (CV=0.244) respectively, got more importance and value compared to other items.

Table 2. Prioritizing economic problems of organic agriculture development from the farmers' perspective

Variables	Average	Standard deviation	CV	Rank
The uncertainty of performance and access to the good market after de livery	3.96	0.715	0.180	1
Low demands for organic products	3.88	0.881	0.227	2
Requires for more labour and increased production costs	3.72	0.909	0.244	3
The higher costs of organic products vs. not-organic products	3.61	0.892	0.247	4
Long return time of investment	3.53	0.879	0.249	5
The high cost of certification process especially for small holder farmers	3.48	0.925	0.265	6

Source: Research findings

The farmers stated these three items as the most important economic problems of organic agriculture development. As well as the high cost of the certification process, especially for smallholder farmers (CV = 265.0) had less value than the value of the other items.

Prioritize social problems of organic farming development from the perspective of farmers

As we can see in Table 3, among the cited social problems of organic agriculture development, items such as the conservative mood among farmers and producers of

organic products (CV=0.229), non-conforming organic farming with the wishes of farmers (CV =0.245) and misconceptions about converting their farms to organic farming method (CV =0.278) respectively, got more importance and value than others items, it means that agricultures stated these three items namely as the most important social problems of organic agriculture development and also, uncertainty in the decision making about using organic farming (CV =0.346) relative to other items got less importance and value.

Table 3. Prioritizing of social problems of organic agriculture development from the perspective of farmers

Variables	Mean	Standard deviation	CV	Rank
The conservative spirit among farmers and producers of organic products	3.70	0.849	0.229	1
Organic agriculture being non-conforming with farmers wants	3.73	0.914	0.249	2
Misconceptions between farmers about transformation of their farms to organic farms	2.97	0.828	0.278	3
Hard access to correct and essential information	3.52	0.798	0.280	4
Absence of local leaders of organic agriculture acceptance	3.29	1.088	0.330	5
Deserving and blaming of organic products users by rural community	3.85	1.318	0.342	6
Uncertainty in decision- making for deployment of organic agriculture	3.60	1.246	0.346	7

Source: Research Findings.

Prioritizing government support problems in the organic farming development from the perspective of farmers

As we can see in Table 4 among the problems of government support in the development of organic farming, items of lack of bank facilities to farmers for the cultivation of organic products (CV =0.234), lack of legal advices from the government to farmers who wish to cultivate organic products or are growing (CV =0.253) giving feasibility from government to farmers for the cultivation of organic products (CV =0.274) respectively, has more importance and value than the other items, it means that the farmers mentioned these three items as the most important government supporting problems in the development of organic farming and also, making desirable the present situation of organic farming by governmental organs(CV=0.434) has less importance and value than other items.

Table 4. Prioritizing of government backups in organic agriculture development from the perception of farmers

Variables	Mean	Standard deviation	CV	Rank
Lack of banking facilities for farmers for cultivation of organic products	4.36	1.012	0.234	1
Lack of legal deliberation from government to farmers who wants to cultivate organic products ar who are cultivating these products	3.52	0.840	0.253	2
Giving facilities from government to farmers for cultivating organic products	3.39	0.929	0.274	3
Lack of organs and companies producing the essential needs for cultivating organic products	3.41	1.119	0.328	4
Attracting farmers reliance about managing suggestions of government to beneficiary farmers of organic products	3.28	1.197	0.364	5
Making available situation of farmers appropriate by governmental organs	2.78	1.208	0.434	6

Source: Research Findings

Prioritizing training problems of organic agriculture development from the perspective of farmers

As we can see in Table 1-5 among the mentioned training problems of organic agriculture development, the items such as lack of information about organic farming (CV=0.299), Lack of training and promotion courses about the method of production and marketing of organic products (CV =0.302), lack of qualified experts to assist and educate farmers about organic farming (CV =0.324) respectively, got the most importance and value than the other items. It means that farmers mentioned these three item as the most important training problems of organic agriculture development and also, The lack of awareness of the harmful use of chemical fertilizers and pesticides (CV =0.385) has less value and importance than the other items.

Table 5. Prioritizing of educational problems of organic agriculture development from the perspective of farmers

Variables	Mean	Standard deviation	CV	Rank
Lack of information about organic agriculture	3.56	1.067	0.299	1
Lack of educational and promotional courses about the way of producing and marketing of organic products	3.56	1.075	0.302	2
Lack of proficient experts for helping and educating of farmers about organic agriculture	3.45	1.122	0.324	3
Educational courses about organic agriculture for enhancing the farmers information's not being disposed	3.34	1.156	0.346	4
Not visiting the farms which is cultivating with organic agriculture method	3.32	1.181	0.355	5
Not being informed about disadvantages of using chemical fertilizers poisons and toxins	2.92	1.124	0.385	6

Source: Research Findings

Prioritizing effective solutions in the development of organic farming from the perspective of agriculture:

As we can see in Table 6, among the effective approaches in the development of organic farming, items such as making organic products affordable to buy by consumers (CV =0.235) adoption some measures to support producers in marketing line and delivering organic products to market (CV=0.239), lack of qualified experts to assist and educate farmers about organic farming (CV =0.271) respectively, got the most importance and value than other items. It means that, farmers mentioned these three items as the most important effective solution in organic agriculture development and also, observing the proper packaging method of organic products for market (CV =0.328) got less importance and value than the other items.

Table 6. Prioritizing the efficient solution in organic agriculture development from the perspective of farmers

Variables	Average	Standard deviation	CV	Rank
Making affordable buying organic products by users	3.44	0.809	0.235	1
Direct supervision of government on presentation of organic product to users	3.62	0.868	0.239	2
Adopting measures for supporting producers in marketing and delivery to market for organic products	3.68	0.999	0.271	3
Providing and establishing facilities for easy access of users to the organic products	3.18	0.984	0.309	4
In forming about the importance of using healthy food products in health and growth of children	2.98	0.934	0.314	5
Presence of offering and administrator companies of organic products	3.18	1.008	0.317	6
Presence of experts for cooperation and helping and educating farmers in all stages of production and sell	3.09	1.1	0.356	7
Publishing press, radio and TV and some papers for informing about organic agriculture	2.96	1.056	0.357	8
Observing the appropriate method of organic products packaging for offering to marking	2.94	1.118	0.382	9

Source: Research Findings

Factor analysis is a general name for some multivariate statistical methods whose main purpose is to summarize the data. It checks the internal consistency of a large number of variables and ultimately, classifies and explains them in the form of limited public factor.

Table 7. KMO Amount

KMO and Bartlett's test	1217.341
KMO	0.760
Sig.	0.000
DF	153

Source: Research Findings

In this research, because the independent variables are not measurable, they will be analysed in factor analysis method and grouped in four clusters and depending on the type of questions, they cluster solutions in the economic, social, educational and supportive of the government.

Factor analysis of farmers' perspective on the problems of development of organic farming in Western Azerbaijan province.

According to Table 1-7, we can see that the KMO value is equal to 0.760 and sig =0.000 showing the fact that the internal consistency of the data was appropriate and Bartlett 's statistic is significant at 5% level that represents the data for input to factor analysis is very appropriate.

According to Table 8 , the results of the factor analysis of variables related to farmers' views in the province of West Azerbaijan on the most effective approach in the development of

organic farming shows that the maximum amount is particularly relevant to first factor and is about 4.680 and 25.822 percent and includes variables such as the high cost of the certification process, especially for smallholder farmers, organic products being more expensive than non-organic products, lack of legal advice from the government to farmers who wish to grow organic products, or farmers who are cultivating these products, lack of inputs producing organs and companies for the cultivation of organic products, optimizing the current state of organic farming by government agencies, providing facilities from the government to farmers for the cultivation of organic products, gain the trust of farmers by offering the administration advises to the beneficiary farmers of organic products. The second factor with special values equal to 2.803 and 15.571 variance percent, explained effective approaches in the development of organic farming and includes variables such as Long return time of investment, require more labour and more production costs, the uncertainty of the performance and post-delivery good market access, low demand for organic products, nonconforming the organic farming with the wishes of farmers, hesitation in deciding to use of organic farming and lack of banking facilities to farmers for the cultivation of organic products.

Table 8. Clearing and explaining factors

Factors	Special amount	Variance percent of special amount	Percent of all factors
1	4.680	25.822	25.822
2	2.803	15.571	41.570
3	2.322	12.955	54.525
4	1.982	11.010	65.535

Source: Research Findings

Table 9. Factors and along items related to each factor with their coefficient amount

Factor names	Variables	Coefficient amount
(1) Government Supporting factors	Expensive and high costs of certificating process specially for smallholder farmers	0.656
	Organic products being expensive more than non-organic products	0.658
	Lack of legal deliberations from government to farmers who wants to cultivate organic products or who are cultivating these products	0.649
	Lack of organic and companies producing the essential needs for cultivating organic products	0.758
	Making available situation of farmers appropriate by governmental organs	0.781
	Giving facilities from government to farmers for cultivating organic products	0.780
	Attracting formers reliance about managing suggestions of government to beneficiary formers of organic products	0.730
	Giving facilities from government to farmers for cultivating organic products	0.655
(2) Economical factors	Long return time of investment	0.601
	Require for more labour and increased production casts	0.608
	Uncertainty of performance and access to the good market after delivery	0.757
	Low demands for organic products	0.656
	Organic agriculture being non-conforming with farmers wants	0.534
	Uncertainty in decision-making for deployment of organic agriculture	0.618
	Lack of baking facilities for farmers for cultivation of organic products	0.544
(3) Educational factors	Misconceptions between farmers about transformation of their farms to organic farms	0.755
	Hard access to correct and essential information	0.647
	Lack of educational and promotional courses about the way of producing and marketing of organic agriculture	0.722
	Lack of proficient experts for helping and educating of farmers about organic agriculture	0.655
(4) Social factors	The conservative spirit among farmers and producers of organic products	0.617
	Deserving and blaming of organic products users by rural community	0.621
	Lack of local leaders for acceptance of organic products	0.630
	Making available situation of formers appropriate by governmental organs	0.503
	Not being informed about disadvantages of using chemical fertilizers and poisons (toxin)	0.521

Source: Research Findings

And other factors with eigenvalues and variance percent of them can be seen in Table 1-8 that, considering the studied items, we called them State support factors, economic factors, educational factors and social factors respectively and the sum of these factors is equal to 65.536 percent and it expressed this subject that these factors explain 65.535 percent of the factors affecting effective approach in the development of organic farming.

In Table 9 we can observe the related items to any of factors that its load factor in a greater than 0.5 is meaningful for that item. In fact, the factor load is explaining correlation

between an original variable and its related factor.

CONCLUSIONS

The basic problem of organic farming is probably lack of a good market for organic products because consumers know organic products as luxury goods and high prices due to higher production costs causes that consumers will prefer non-organic products that the government can reduce these costs and make prices come down for organic products that this results are consistent with the results of Asadi and Naderi research 1 Most farmers believe that organic products can have a negative impact on customers as they believe that organic products are expensive for them and also believe that organic fruit in flavour and usefulness are in a lower place than other fruits, and domestic consumers in general tend to consume foods that are not organic.

This requires a culture among domestic consumers to familiarize consumers with the benefits of organic products has encouraged them to use organic products and these results are consistent with the results of Ghorbani and co-workers [2]. Most farmers believe that the high cost associated with the production of organic products and also selling these products in the domestic market due to consumer's perspective is not affordable and users prefer to buy non-organic products with lower prices and this is not nor the problem of users neither the producers, but is the problem of high costs paid for producing organic products. If government supports farmers

And the farmer does not incur high production costs

It could be the same price or a little more to reach consumers, in fact, as the developed countries are doing and the results of this investigation are consistent with the results of Ghorbani and co-workers [2] and Karimi and co-workers [5] studies.

Most farmers believe that government support in the field of organic farming is not in a manner that consistent with the wishes of farmers. Farmers are always looking for ways that produce their product at a low cost and sell them in a reasonable price and market their product fit and active that In the case of organic products has been not this way, in fact, government put organic farming on the farmers so that they produce organic products with their own cost, time and work and then also, try to sell it. Unfortunately, organic agriculture in our country still has not been replaced and mostly only try in producing better quality work and are unaware that excessive use of agricultural pesticides and the excessive use of the land would have lots of problems for future agriculture.

Farmers misconceptions about organic farming should be resolved by reducing the production costs and create favourable market etc ... that these results agrees the results of Karimi and co-workers [5] and Popzen and Sheri [12] From the perspective of farmer's state aid in relation to organic farming practices can transform this industry into a major economic hub. State aid must be such that farmers do not have any problems and can survive and succeed in this way. Long-term loans with low interest could be successful in agriculture. Assistance and government policies to improve the situation of organic farming can be very influential. Reduce production costs through subsidies to farmers and facilitate market conditions, one of the important problems in this context, can shed light on the role of government and its policies. Government as a project executive and creator of the right conditions for doing works, has a tremendous role in this context that the research results agrees Karimi and co-workers [5] and Popzen and Sheri [12] research results.

Training is an issue of great importance for a farmer, because every day studies grow in the field of agricultural and information and technologies be more and more and better so that training and awarding one farmer can be an important task for improving agriculture. So that farmers can improve their industry with all up to date facilities.

And organic farming is something that requires education and explanation because farmers are farming for years in non-organic and traditional farming way. Always when inserting a new technology or any new idea in

society, it is essential to enhance the knowledge in society. In fact, until our farming community are at the lower level related to the marketing knowledge, will not be able to adopt new technologies in the areas of production for making its products market - friendly.

Because accepting it requires a series of skills and the skills acquired through training and education. Creation schools and counselling to increase knowledge and skills among farmers and getting to know the advantages and disadvantages of organic farming and how to work, can be important and useful in this regard.

To fix the problems in the field of trade, organic products certification standards and criteria development and implementation is necessary. Training agricultural extension workers to promote organic farming as well as promoting public awareness is essential. Research centres need to solve technical issues, economic and social strategy and reassuring new, cooperative efforts to take action. In fact, we can say that planners by providing solutions in the field of agriculture should facilitate the export of organic agricultural products, supporting leading farmers in organic farming, Informing and Carry out promotional activities to use existing capacity in the country, directing agricultural research from chemical fertilizers to organic and biological fertilizers special attention to organic farming in agricultural research and strategic plans and appropriate pricing system for organic products provides areas for development and promotion of the sustainable agricultural system that the results of this research is consistent with the results of Karimi and co-workers [5] and Popzen and Sheri [12] researches.

Some recommendations:

(i)Extension-education courses in the field of organic agriculture for farmers and encourage them to participate in these classes

(ii) Training farmers to promote cultivation organic farming through the mass media and public organizations.

(iii)Government support for organic farmers work, their products insurance,

(iv)Create and develop local markets for organic products and economic analysis and identification of global markets for export of organic products,

(v)Create places for the storage of organic products

(vi)Provide adequate means of transportation equipped with cold storage facility for organic products

(vii)Provide useful information on the management and control of weeds, pests and diseases of agricultural products.

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STUDIES ON STILBENES IN RED WINE

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Abstract

Stilbenes are non-flavonoid phenolic compounds that are synthesized in the form of monomers and oligomers of numerous plant species, including the Vitaceae family. The interest of researchers in stilbenes is due to their many biological activities, including the prevention and treatment of various chronic diseases associated with aging. More than 100 stilbenes have been identified in black grapes and red wine; of these, E-resveratrol is the most interesting compound due to its biological activities in vitro and in vivo. The effect of resveratrol on health (protection against cardiovascular disease, neurodegenerative diseases, cancer prevention, cellular aging, antioxidant effect, anti-tumor protection, etc.) was highlighted in the early 1990s, when a connection between red wine consumption and positive effects of resveratrol in the human body.

Key words**:** *stilbenes, E-resveratrol, red wine, Vitis*

INTRODUCTION

Phenolic compounds in grapes are secondary metabolites of the vine but play an essential role in plant metabolism [7]. With a strong antioxidant effect, polyphenols are a very important class of chemical compounds [16].
Red wines, as compared to other alcoholic beverages, contain polyphenols, some of which are high in quantity, such as anthocyanins and proanthocyanidols. In white and rose wines these phenolic compounds are found in small quantities [37].
Recently, stilbenes, a class of non-flavonoid polyphenols, have evoked monomer, *E-resveratrol* being the most studied [23]. Phenolic compounds in red wine come from several sources; the largest source of polyphenols is found in black grapes. The concentration of polyphenols in red wine depends on several factors, but primarily on the vinification technique (the maceration-fermentation stage) [18].
Also, during the fermentation process the wine is enriched in polyphenols and because of the levies that release tyrosol in wine, the phenolic compound produced from tyrosine (by the action of tyrosine decarboxylase - RsTyrDC) or a para-coumaric acid precursor [13; 26]. Another source of polyphenols in wine is the wood vats it matures, the wood enriching wine in elagotanins.
Lately, numerous researches have been done on the biological activity of stilbenes and their neuroprotective, anti-cancer and antioxidant effects [5; 31]. Most research has focused on isolated stilbenes from the vineyard (*Vitaceae* family in general), but also from other species rich in these compounds: *Cyperaceae, Fabaceae, Moraceae, Paeoniaceae, Iridaceae* etc. [21]. Of the approximately 60 species of the *Vitis* genus, 20 species have been investigated, with more than 100 stilbenes identified, many of which are contained in red wine [30].
Research on phenolic compounds in general and stilbenes, took the lead in the early 1990s, when studies of cardiovascular disease gave birth to the concept of "French paradox" [24]. This theory is based on the findings of cardiologists that the French have the lowest incidence of cardiovascular disease and even cancer despite their high saturated fat diet, diet that can be associated with diabetes, hypercholesterolemia, hypertension, etc. [20; 33]. Numerous studies lead to the explanation

of this paradox, with the French being accustomed to regular and moderate consumption of red wine (150-300 mL/day) rich in polyphenols and especially in stilbene [34].

Stilbenes, especially resveratrol, seem to have the ability to inhibit the oxidation of low density lipoproteins (LDL). Lipoproteins are structural complexes composed of lipids and apoproteins, with an important role in metabolism. These perform the transport of cholesterol, triglycerides and phospholipids in plasma. A fraction of cholesterol is transported by LDL lipoproteins; this fraction, called "bad cholesterol", is an indicator of the risk of coronary artery disease [14; 27].

The interest of researchers in stilbenes is due to their many biological activities, including the prevention and treatment of various chronic diseases associated with aging [25]. Of the 100 identified monomers, dimers and oligomers stilbenes, E-resveratrol is currently the most interesting compound due to its biological activities *in vitro* and *in vivo*.

All about resveratrol is also said to have an antiestrogenic effect in the case of excess estrogen [4]. The excess of these hormones is due either to a hormonal imbalance or food, or to foreign body chemicals (xenoestrogens) such as certain components of plastics (bisphenol A). Thus, the antiestrogenic effect of resveratrol can limit the risk of certain cancers (especially breast cancer).

MATERIALS AND METHODS

To highlight the importance of stilbenes and the various aspects of these polyphenols, several bibliographic databases have been extensively studied.

RESULTS AND DISCUSSIONS

From a chemical point of view, phenolic compounds are a non-homogeneous class of organic compounds with different chemical structures but sharing one or more phenol functions present in their molecule [22;25]. There are four main categories of phenolic compounds that can be grouped into:

-non-flavonoid phenolic compounds, which are simpler compounds and include: phenolic acids; coumarins, naphthoquinones and stilbenoids*;*

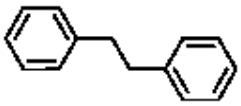
-phenolic flavonoid compounds, classified in:

-compounds with a more complex structure, containing in their molecule a heterocycle: flavonoids, isoflavonoids, anthocyanins;

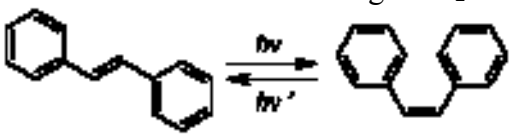
-phenolic compounds with macromolecular structure: tannins.

Stilbenoids represent a subclass of non-flavonoid polyphenols, with a more complex structure than phenolic acids and containing two aromatic nuclei in their molecule, linked by an ethylene bridge. By the nature of the bonding bridge between benzene nuclei, three classes of stilbenoids are distinguished:

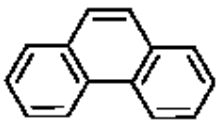
a. *Dibenzyn*: bridge C_2: –C-C-



b. *Stilbenes*: bridge C_2: –C=C-



c. *Phenanthrene*: bridge C_2: ciclizat



Description of stilbenes:

The most important class of stilbenoids is stilbenes. These are phenolic compounds derived from the secondary metabolism of the plants, via the phenylpropanoid pathway; are found in the form of monomers and oligomers, synthesized in numerous plant species: *Vitaceae, Pinaceae, Cyperaceae*, *Fagaceae, Fabaceae, Moraceae, Dipterocarpaceae, Poligonaceae, Paeoniaceae*, etc [6]. Produced in response to the attacks of various pathogens in the plant

kingdom, the presence of stilbenes is limited to species that have acquired during their evolution the ability to synthesize these molecules [2].

The vine varieties resistant to mana (a disease produced by the *Plasmopara viticola* fungus) produce stilbene in response to the attack of this microrganism [19].

Generally, the synthesis of stilbene occurs at the onset of any stress, either chemically, physically (ultraviolet radiation), biological (pathogens) or even lack of water [8; 11].

The production of stilbene in different species of the genus *Vitis* occurs in different parts of the plant in response to certain external stimuli. For example:

-in berries: *Vitis labrusca, Vitis vinifera*;

-berries and wine: *Vitis vinifera, Muscadinia rotundifolia, Vitis labrusca L*. (Concord grape);

-in roots: *Vitis vinifera, Vitis acerifolia, Vitis berlandieri, Vitis cinerea, Vitis riparia, Vitis rupestris, Vitis solonis longii, Vitis solonis richter, Vitis thunbergii*;

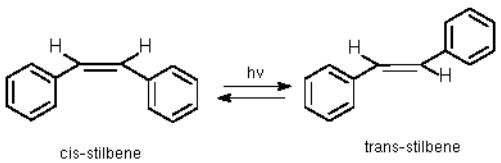
-leaves: *Vitis vinifera, Vitis amurensis, Vitis labrusca, Vitis riparia*;

-stems: *Vitis betulifolia, Vitis amurensis, Vitis davidii, Vitis flexuosa, Vitis labrusca, Vitis thunbergii, Vitis vinifera, Vitis wilsoniae*;

-whole plant: *Vitis chunganensis, Vitis coignetiae* [30].

Physical properties and isomers

Stilbenes have a structure consisting of two benzene rings connected by an ethylene bridge. In nature, stilbenes are found as two stereoisomers: *trans*-1,2- diphenyl ethylene (called (E)-stilbene or trans-stilbene) and *cis*-1,2- diphenyl ethylene (called (Z)-stilbene or cis-stilbene), the latter being less stable. The *trans*-1,2- diphenyl ethylene isomer is the most stable and bioactive form, so that in the nature stilbenes are found especially under this isomeric form [17].



Stilbene has a strong fluorescence under the action of ultraviolet radiation (the name of stilbene comes from Greek: "brilliance"), which leads to their characterization by various chromatographic methods (thin-layer chromatography, liquid chromatography, High-performance liquid chromatography, HPLC, using a UV detector), fluorescence in UV light [1]. They have a high absorption at wavelengths between 220 and 307 nm.

Resveratrol ((E)-3,5,4'-trihydroxystilbene), the base unit of stilbens is a hydroxystilbene which, alongside other stibins (viniferine from *Vitis vinifera*, pinosilvin from *Pinaceae*, danielona from papaya) are phytoalexins, substances synthesized by the plant in response to an attack of microorganisms, especially fungal infections (ex. *Botrytis cinerea*, gray rot of vines).

Resveratrol was discovered in 1939 in a toxic herb, *Veratrum Album* (steregoaie), which has a rich alkaloid content (among which o-acetyljervine, cevadine, cyclopamine, jervine, protoveratrine, veratramine etc). In black grapes (in grape skins) resveratrol was identified after about 40 years, and in red wine in the early 1990s by Siemann and Creasy [35]. After identifying the red wine of this compound, studies on polyphenols and especially the stilbene class have become important. Renaud S. and Lorgeril M. [33] are the first to show that moderate consumption of red wine can protect against coronary heart disease and Frankel E.N. [14] argues that the cardioprotective effect of resveratrol is due to the compound's ability to inhibit LDL oxidation [15].

Antioxidant effect.

The human body has several antioxidant, cellular and extracellular protection systems: antioxidant enzymes (catalase, thioredoxin reductase, glutathione reductase and transferases); vitamins (A, C, E, carotenoids, etc); polyphenols, mostly from food. In a healthy body these systems are sufficient for cellular protection against free radicals of endogenous and exogenous origin.

Free radicals are unstable chemicals, reaction intermediates formed by cleavage of a chemical bond; these oxidized substances cause premature aging of cells and oxidative

alteration of proteins, lipids and nucleic acids [28; 29]. Free radicals alter DNA and RNA by binding them to the nucleic acid chains, the future chains containing mutations; then multiplied by unhealthy cells, resulting in serious disease of the body.

Resveratrol and especially its glycosylated form (piceide) are found in higher concentrations in red wines compared to white wines. The effect of this compound on human health (protection against cardiovascular disease, neurodegenerative diseases, cancer prevention [3], cellular aging, antioxidant effect, anti-tumor protection, etc.) was highlighted in the early 1990s when a link between red wine consumption and the positive effects of resveratrol in the human body [32].

Synthesis

The synthesis of stilbenes varies within fairly wide limits, depending on the resistance of the variety to a particular pathogen; for example, Pezet R. [31] showed that in varieties susceptible to mildew (disease produced by *Uncinula necator* fungus), resveratrol synthesized by the plant is glycosylated in a non-toxic compound (piceid) as compared to varieties resistant to this microorganism, to which resveratrol is oxidized in a toxic compound, viniferine.

Stilbins are synthesized via phenylpropanoids, organic carbon-containing compounds C6-C3 [9; 10; 12].

The synthesis of resveratrol is carried out in grapes, at the epicarp of the grains, in the growth stage before maturation; later, with the baking of the grapes, the synthesis of resveratrol is stopped. From a biochemical point of view, resveratrol is formed starting from phenylalanine, biosynthesis being achieved by an enzymatic cascade in four steps:

-oxidative deamination of phenylalanine by the action of the enzyme phenylalanine ammonium lyase, with cinnamic acid production and the release of an amino group; this stage is common to all higher plants and is a "key" step by which the flow of carbon from primary metabolism is directed to secondary metabolism [36].

-cinnamic acid hydroxylation, catalyzed reaction of cinnamate hydroxylase, and para-coumaric acid;

-conversion of p-coumaric acid into p-coumaryl-CoA by the action of coenzyme A under the action of CoA ligase;

-condensation of para-couaryl-CoA with 3 malonyl-CoA molecules under the action of stilbensinase [19].

The other stilbens in grapes are synthesized starting from resveratrol.

Other stilbene

In grapes, there are various other stilbenes, with more or less similar to resveratrol, which are in the hydroxylated and metoxylated form. Recent studies have revealed their action mechanisms and differences from the basic shape - resveratrol.

Pterostilbena, another stilbene phytoalexin, has a structure similar to that of trans-resveratrol, which is distinguished by the presence of two methoxylated groups (in the 3 'and 5' positions); research has shown that this form of stilbenes has a good availability for the human body, far superior to resveratrol [20].

Piceatanol, another stilbene originated from resveratrol, has a structure similar to resveratrol, making it a further hydroxyl group in the 3 'position. Present in the grapes, the stilbene is contained in the wine, but in much smaller quantity.

Pinosilvine, a stylephene of which it is derived from *Pinus silvestris*, in which it is found to be larger, has a structure similar to trans-resveratrol, which differs from its structure by the absence of the hydroxyl group at the 4 'position;

Combretastatin A4 is a stilbene having a cis-resveratrol-like structure with a single hydroxyl group and four methoxy groups;

Oligomers of resveratrol are a subfaily of stilbenes with variable structures; of these compounds in grapes were highlighted: viniferines (α, δ, γ, ε), and palidol.

CONCLUSIONS

Although they are secondary metabolites, phenolic compounds play an essential role in the metabolism of the vine. Highly present in

black grapes, but especially in red wines, phenolic compounds have a strong antioxidant effect.

Of the phenolic compounds the most interest is represented by stilbenes, a class of non-flavonoid polyphenols, the monomer *E-resveratrol* being the most studied. Of the studied species, the most interesting species of the genus *Vitis* was present, in which over 100 stilbenes were identified.

Studies on the biological activity of stilbenes have demonstrated their neuroprotective, anti-cancer and antioxidant effects. Stilbenes, especially resveratrol can inhibit the oxidation of low density lipoproteins (LDL) and to prevent various chronic diseases associated with aging. It also shows an anti-estrogenic effect in the case of excess estrogen.

The synthesis of stilbenes varies within wide limits, depending on the resistance of the variety to a pathogen. The synthesis of resveratrol is carried out in grapes, at the epicarp of the grains, in the growth stage before maturation; later, with the baking of the grapes, the synthesis of resveratrol is stopped. From a biochemical point of view, resveratrol is formed starting from phenylalanine, biosynthesis being achieved by a four-step enzymatic cascade.

In grapes, there are various other stilbenes which are found in the hydroxylated and methoxylated form: pterostilbene, piceatannol, pinosilvine, combretastatin A4, oligomers of resveratrol.

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ENHANCING FOOD CROP PRODUCTION THROUGH ROTATORY CREDIT SAVINGS AMONG SMALL HOLDER FOOD CROP FARMERS IN DEMSA LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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Abstract

Enhancing Food Crop Production through Rotatory Credit Savings among Small holder Food Crop Farmers in Demsa Local Government Area of Adamawa State, Nigeria was the focus of this research. A random sample of 120 respondents were collected and data subjected to descriptive and inferential statistics. Findings revealed that 81.67% of the respondents fall within the age range of 25 to 49 years with mean age of 35 years, males dominated the association (66.67%), 70.83 % were married with mean annual saving of N31, 345.50. Regression analysis revealed that about 71.21 % of the differences in the savings of respondents were explained by the variables included in the model (R^2=0.7121). Age, education, income and farm size were the determinants of savings among respondents.

Key words**:** *rotatory savings, formal credit, financing, small scale, regression*

INTRODUCTION

The rural sector, with the abundance of human and natural resources, has remained the treasury base of Nigeria because of substantial contribution to gross domestic product (GDP) by its major activity, agriculture [6] yet, it receives a share of less than 5 percent of the total banks' credit to the private sector annually. Programmes and schemes were also established to address the issue of provision of rural finance. Amongst the policies employed to make credit available by formal financial institutions to the rural and micro entrepreneurs were the sectoral allocation of credit and concessionary interest rate. Succesive government efforts towards financing agriculture were through agencies like the Nigerian agricultural and co-operatives bank (NACB), the peoples bank of Nigeria (PNB), the rural banking scheme (RBS) and family economic advancement programme (FEAP). Subsequently, in 2010, bank of agriculture limited (BOA) was established [7].

Agricultural credit is used to finance agricultural transaction. Various types of financing could be adapted by farmers according to their needs and purpose of production. Agricultural credit are classified into short, medium and long term [2, 5].

Previous studies indicate that paucity of credit had stiffled agricultural development in Nigeria [9]. Yustus *et al.* (2010) [10] reported that most agricultural innovations were not developed on farmers' fields and needed to be purchased. Farmers require capital or financial resources to purchase inputs and impose the need for credit to enable them adopt these innovations. Asset endowments of farmers are one of the variable factors associated with the adoption and continued use of improved technologies. With more income, farmers are likely to expand their scope of production and employ labour and other saving technologies. The study was conducted on enhancing food

crop production through rotatory credit savings among small holder food crop farmers in Demsa Local Government Area of Adamawa state, Nigeria. The specific objectives were to identify and describe the socio-economic characteristics of the respondents and to identify factors influencing rotatory savings among respondents [8].

MATERIALS AND METHODS

The Study Area

The study was conducted in Demsa Local Government Areas of Adamawa State. Mayah District was purposively selected based on large number of small scale farmers involvement in rotatory credit savings popularly referred to as local bank for the poor (*Bankin Talaka*). A total of five villages namely Tagombali, Bali, Kpasham, Dakli and Kpankwai were purposively selected. List of rotatory credit contributory groups were obtained out of which 130 members were selected in proportion to their population and served with structured questionnaires, 120 questionnaires were correctly filled, returned and were used for analysis.

Methods of Data Analysis

Data collected were subjected to descriptive and inferential statistics. Exponential function gave the best fit and is explicitly stated as:

$$LnY = \beta_o + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5$$

where:
Y = Amount saved (naira),X_1 = Age of farmers (years) X_2 = Farm size (hectare),
X_3 = Income (₦),
X_4 = Education (years spent in school)
X_5 = Membership of cooperative society (1 if member, 0 not a member).

RESULTS AND DISCUSSION

Socio- economic Characteristics of the Respondents

Table 1 shows the socio-economic distribution of respondents and revealed that 81.67% of the respondents were within the age range of 25 to 49 years with a mean age of 35 years. This shows that the farmers are relatively young. The preponderance of young farmers engaging in rotatory credit savings association portends positive signal as their productivity are likely to be higher resulting to increased production. Males dominated the association (66.67%). This result is a further confirmation of empirical evidences that men are more favoured than the women in agricultural production (Adebayo *et al.,* 2010) [1]. Marital status distribution of the respondents indicated that 70.83 % were married. The above result shows that married people are more into rotatory savings than those who are single. Family sizes of farmers provide sources of labour for production especially in African agriculture where production is not mechanized. Analysis in Table 1 revealed that 58.33 % of the respondents had between 1 and 6 family members with a mean family size of 5 people. Large family size of respondents could be used as a vital source of labour for food crop production and other productive activities, but can put pressures on family heads in devising means of obtaining income to meet family needs.

Also, all the respondents (100%) were educated and had one form of formal education or the other. Ogundari and Ojo (2007) [7] reported that education provided a measure of managerial ability of the farmers through which the Nigerian agricultural productivity could experience a push into new direction of growth and development. Of course such reposition depends on the right policy measure that addresses human capital development of the farmers which can be achieved through education. Respondents' farm size showed that 63 % had farm size between 1.5 to 1.99 hectares while about 37 % had 2 and above hectares of farm land. The mean farm size was 1.15 hectares. This implies that farmers operated at different levels of farm sizes which tend to affect their production levels. This result indicates that majority of the farmers are small holders. The result is line with several studies conducted which showed that small scale farmers produced the bulk of food and cash crops in Nigeria [3]. Adebayo *et al.* (2010) found that access to productive resources especially land

served as a source of collateral security in the acquisition of credit for farmers in Africa [1]. Distribution of respondents based on occupation indicated 78% had farming as their major occupation.

Table 1. Socio- economic Distribution of Respondents (N= 120)

Variable	Frequency	Percentage
Age Range (years)		
≤ 25	10	8.33
25 – 39	38	31.67
40 – 49	60	50.00
50 – 59	10	8.33
> 60	2	1.67
Sex		
Male	80	66.67
Female	40	33.33
Marital status		
Married	85	70.83
Single	35	29.17
Family size		
1-6	70	58.33
7- 10	35	29.17
> 11	15	12.50
Education		
Primary School	30	25.00
WASCE/ GCE	80	66.67
OND	10	8.33
Farm size		
≤ 1.5	40	33.33
1.6 – 1.99	35	29.17
2.0 –2.99	23	19.17
3.0 – 3.99	8	6.67
> 4.00	14	11.67
Occupation		
Farming	93	77.50
Trading	13	10.83
Civil service	6	5.00
Technician/ Artisan	8	6.67

Source: Field survey, 2015.

Respondents' Savings and Purpose of Savings

Table 2 shows the annual savings of the respondents.

Mean annual saving was N31, 345.50.

Those that saved below N 20, 000.00 were 8.33% , 46.67% were from N 21,000.00 to N 30,000.00, followed by 22.50% and had savings between 41,000.00 and 50,000.00.

Furthermore, analysis in Table 3 showed that majority of respondents saved for agricultural purpose followed by petty trading in the study area.

Table 2. Distribution of Respondents based on Annual savings

Range of amount saved (Naira)	Frequency	Percentage
≤ 20,000.00	10	8.33
21, 000 .00 - 30, 000.00	56	46.67
31, 000.00 - 40, 000.00	27	22.50
41, 000.00 - 50, 000.00	15	12.50
51, 000.00 - 60, 000.00	8	6.67
61, 000.00 - 70, 000.00	3	2.50
>70, 000.00	1	0.83
Total	120	100.0

Source: Field survey, 2015.

Table 3. Utilization of Annual savings from local banks

Type of activity	Frequency	Percentage
Farming	90	75.00
Petty Trading	12	10.00
Others	8	6.67
Total	120	100.0

Source: Field survey, 2015.

Determinants of Savings

The determinants of savings among respondents were evaluated using production function analysis. Exponential function gave the best fit and the result is presented in Table 4.

The coefficient of multiple determination (R^2) was 0.7121 implying that about 71.21 % in the differences in the savings of respondents were explained by the variables included in the model.

The F. value was statistically significant at 1% signifying model fit. The coefficient for age was statistically significant ($p>0.01$). This implies that age is positive and influences savings among respondents. Farm size was statistically significant ($p>0.01$) and positively related with rotatory savings. Farm size has been found to be one of the most important factors of production and critical in the adoption of innovations in agriculture [4].

The coefficient for education was statistically significant at one percent. Educated farmers are innovative and the transformation processes by extension agents are likely to be easier. Education obviously will improve production efficiency as it will enable farmers to access improved technology and best practices available to them. The estimated coefficient for income was statistically significant ($p>0.05$).

Table 4. Result of multiple regression on the determinants of savings among Food crop Farmers

Variable	Coefficient	Std. Error	t-Statistic
X_1 Age	0.0004906	0.0001447	3.39***
X_2 Farm size (hectare)	0. 005369	0.0011647	4.61***
X_3 Income (₦)	0.0007863	0.0002862	2.75**
X_4 Education (years spent in school)	0.0729896	0.01087	6.71***
X_5 Membership of cooperative	6.54e-08	3.33e-07	0.20
C	3.127112	0.0621198	50.340***

Source: Field survey 2015 R- square 0.7326 Adjusted R-square 0.7121 F. value = 25.98***
S.E. of regression 0. 10027 ***, ** indicate significance at 1% &5% probability levels.

CONCLUSIONS

Males dominated rotatory credit savings, who are, experienced and are mostly smallholder farmers with a mean farm size of 1.15 hectares. Education, age, farm size and income were the determinants of savings among respondents. Government should encourage rural banking to enhance farmers access to formal credit to enhance food crop production.

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