Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 3, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

LABOR PRODUCTIVITY IN ROMANIA'S AGRICULTURE IN THE PERIOD 2011-2020 AND ITS FORECAST FOR 2021-2025 HORIZON

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Abstract

The paper analyzed labor productivity in Romania's agriculture in the period 2011-2020 and established the forecast for 2021-2025 horizon using the Eurostat data. The processing procedures included fixed basis index, average growth rate, average annual growth, regression models, determination coefficient, descriptive statistics (mean standard deviation and variation coefficient), comparison methods and forecast modeling. The results proved that agriculture productivity is increasing with a lower growth rate, being deeply influenced on output value, gross value added and labour input. Per 1,000 AWU, agricultural output value decreased by 6.77%, gross value added increased by 12.47% and factor income raised by 20.65%. However, for its level of output value and GVA, Romania comes on the last position and for factor income level it comes on the 15th position in the EU. For agriculture development, labour productivity must be increased paying attention to the key determinants: farm structure and size, labour input, technical endowment, and investment.

Key words**:** *labor productivity, agriculture, dynamics, forecast, Romania*

INTRODUCTION

Economic growth in agriculture depends on labour productivity [2]. Labor productivity is determined by a large range of factors among which the most important ones are: agricultural output, gross value added, employment and its type in agriculture: full or part-time [11], farm structure, average farm size, average economic farm size [9], farm specialization and production structure [26], mechanization degree, the production potential of the used varieties and animal breeds, chemicalization degree (fertilizers, herbicides, pesticides) [3], the share of production for onfarm consumption, labour input [27], investment level, farmers' training level, age and experience, natural conditions (soil, climate etc.). Agriculture needs special farm inputs for increasing production performance, but the increasing trends in purchasing price has raised production costs and diminished profit, an aspect which justify why farmers are complaining [12] The discrepancies from a country to another in labour productivity are mainly determined by the regional specificity, farm structural conditions and availability of part-time jobs [4, 10, 25]. In the rural areas population is enough high from a numerical point of view, but its economic performance is lower than in the urban areas taking into consideration employment, labour input, GDP and GVA per inhabitant, labour productivity, education level [1]. As agriculture is a highly labour-intensive sector, productivity level in negatively influenced by labour input data while gross value added has to be intensified to contribute to the growth of agricultural output and gross value added [27, 13, 14].
More than this, the seasonality of agricultural processes has a deep influence on the type of

work especially on part-time work required in the peak of production, and this is the reason why labour input is measured in annual work unit (AWU) reflecting the working time of one person engaged in agriculture on a full-time basis in a year [24].

Romania is one of the EU member states where rural population has a high share and also agriculture has still a high labour input [22], agriculture has a high contribution to GDP [16, 18], agricultural production has increased [20, 21], labour productivity is increasing but with a lower growth rate than in other countries [15, 17]. However, agricultural production has become more and more affected by climate change which produced considerable damages to farmers and production losses [19, 23]. Despite that, Romania is still one of the main contributors to the EU agricultural output value. In this context, the purpose of the paper was to analyze the dynamics of labour productivity in Romania's agriculture in the period 2011-2020 in order to identify how agricultural output, gross value added, factor income per 1,000 AWU have changed during the last decade and to establish the forecast for the horizon of the next five years.

MATERIALS AND METHODS

Labor productivity was analyzed using three specific indicators: agricultural output value, gross value added and Factor A (factor income) all of them per 1,000 annual work unit (AWU).

The statistical data were provided by Eurostat for the period 2011-2020, which have been processed utilizing the following methods:

- The dynamics index with fixed basis, $I_{FB} = (X_n/X_1)x100$, for establishing the increase/decrease in 2020 compared to 2011 level;
- Average annual growth, $\bar{\Delta} = (X_n/X_1)/n$, where: X_n is 2020 and X_1 is 2021.
-Descriptive statistics including mean, standard deviation and coefficient of variation;
-Graphical illustration of the dynamics pointing out the regression model and the coefficient of determination;
-Forecast model based on the result in the last year of the time series and average annual growth, according to the mathematical formulas: $X_{F2021} = X_{2020} + \bar{\Delta}$, $X_{F2022} = X_{F2021} + \bar{\Delta}$ etc.

The results have been commented and presented in graphics and tables and finally there were drawn the main conclusions.

RESULTS AND DISCUSSIONS

Agriculture output value per 1,000 AWU

In the analyzed period 2011-2020, in Romania's agriculture, labour productivity in terms of agricultural output value per 1,000 AWU increased by +6.77% from Euro 11.8 million in 2011 to Euro 12.6 million in 2020 (Fig. 1).

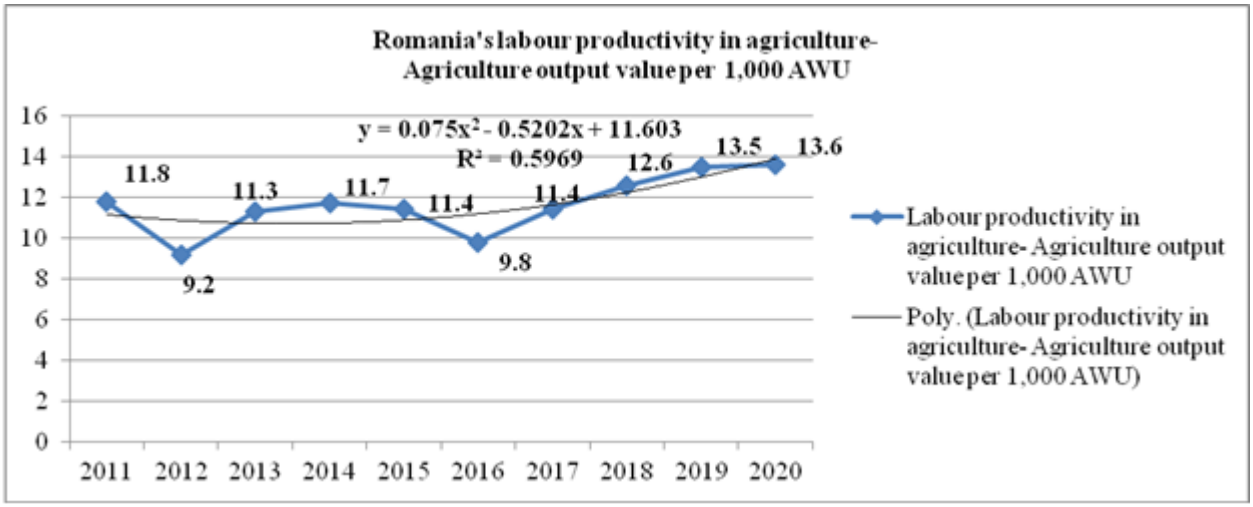

Fig. 1. Agriculture output value per 1,000 AWU, Romania, 2021-2020 (Euro Million)
Source: Own design and calculation based on Eurostat [5, 8].

This growth rate on the whole interval was 3.76 times lower than the growth rate at the EU level which accounted for +25.5% during the studied decade.

In 2020, the labor productivity in Romania in terms of agricultural output value per 1,000 AWU represented 25% of the EU average which was Euro 50.2 million and placed the country on the last position among the member states.

Therefore, we can't consider that Romania has a high performance in agriculture regarding labour productivity.

The causes which have determined this situation were the following ones, looking at the two factors: agricultural output value and labor force input:

-In the period 2011-2020, *the agriculture output value* declined from Euro 18,048 million in 2011 to Euro 16,847 million in 2020, meaning by - 6.66%. This means a contribution of only 4.08% to the EU agriculture in 2020.

However, Romania is situated on the 7th position for its contribution to the EU agricultural output value after France, Germany, Italy, Spain, Netherlands and Poland [20, 21].

The decrease of agriculture output value was caused by the negative impact of climate change in terms of extreme weather phenomena like severe and long drought (in 2012, 2015, 2016, 2019 and 2020) in the period of vegetation for the main agricultural crops, low temperatures and cold rains in the period of fruit trees blooming, and fast, short but huge rainfalls with hail producing important damages. In addition, the irrigation systems are assured just on a small surface of the agricultural land.

The South Muntenia and especially the Eastern Romania were the most affected regions by drought with a negative impact on production level [19, 23].

More than this, Romania's agriculture is dominated by small size farms, especially family farms which have a low technical endowment, apply traditional technologies, farmers have a low training level and are over 60 years old, are lacked of a corresponding fixed and financial capital.

-*Labour force input* in Romania's agriculture is very high compared to other EU countries. In 2020, Romania had 1,331 thousand AWU labour input, being situated on the 2nd position after Poland. However, labour input registered a considerable decline accounting for -13.25 in the last decade from 1,532 thousand AWU in 2011 to 1,331 thousand AWU in 2020.

Labour input in Romania represents 15.66% of the total labour input in the EU's agriculture in 2020, being ranked the 2nd after Poland which had 19.72% market share.

Despite that labour input is higher in agriculture, it is characterized by aging and low training level. Just a few farmers, managers of commercial companies which represent about 1% of all the agricultural holdings are well trained and the holdings are endowed with modern equipments which allow the application of modern technologies.

Family work is dominant and part time workers are rarely used, in fact agriculture suffers of a lack of part time workers especially in the field of viticulture and fruit tree growing especially at harvesting.

Gross value added per 1,000 AWU

The level of GVA per 1,000 AWU in Romania increased by =12.47% in the analyzed period from Euro 5.29 million in 2011 to Euro 5.95 million in 2020, and the level of the last year represented 28.56% of the EU average which accounted for Euro 20.83 million per 1,000 AWU.

For this reason, Romania occupied the last position in the EU like in case of agricultural output value.

GVA had substantial fluctuations from a year to another at the beginning of the decade, but starting from 2015, it registered a continuous growth till 2019 and then it declined in 2020, due to the unfavorable last years (Fig. 2).

For its growth rate of 12.47% in the studied period, Romania came on the 23rd position in the EU reflecting a contribution of only 1.3% to the EU GVA from agriculture.

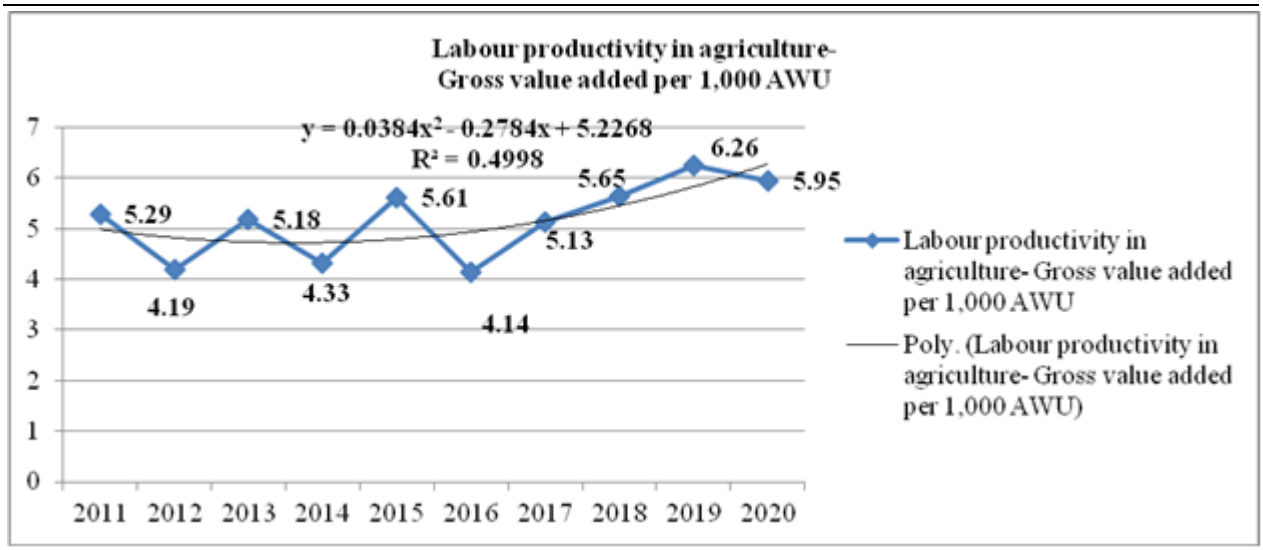

Fig. 2. Gross value added per 1,000 AWU, Romania, 2021-2020 (Euro Million)
Source: Own design and calculation based on Eurostat [5, 7].

Factor income per 1,000 AWU

The level of this indicator in Romania accounted for 120.65% in 2020 being by +20.65% higher than in 2010, considered equal to 100. This means a difference of -3.45% compared to the EU average of 124.1% in 2020 (Table 1 and Fig. 3).

Table 1. Factor income per 1,000 AWU in Romania compared to the EU, 2011-2020

	EU	Romania	Difference RO vs EU
2010	100.0	100.0	-
2011	108.3	129.06	+20.76
2012	107.3	96.13	-11.17
2013	111.2	113.56	+2.16
2014	112.6	123.94	+11.34
2015	109.7	116.22	+6.52
2016	111.7	119.99	+8.29
2017	125.2	136.01	+10.81
2018	123.9	138.37	+14.47
2019	128.8	139.97	+11.17
2020	124.1	120.65	-3.45

Source: Own calculation based on Eurostat [6].

For the level of Factor income, Romania came on the 15th position in the EU after Bulgaria, Hungary, Slovakia, Latvia, Czechia, Croatia, Spain, Poland, Ireland, Italy, Portugal, Slovenia and Cyprus.

Descriptive statistics for labour productivity in Romania's agriculture in terms of mean, standard deviation and variation coefficient is presented in Table 2.

The variation coefficient varying between 10 and 20% reflects relative homogenous values for all the indicators in the time series. Therefore, the means are could be considered representative.

Forecast of labour productivity in Romania's agriculture for 2021-2025 horizon

Taking into account the average annual growth for each of the three indicators characterizing labour productivity, it was set up the forecast for 2021-2025 horizon.

In the interval 2011-2020, the average annual growth per 1,000 AWU accounted for Euro 0.08 million in case of agricultural output value, Euro 0.066 million in case of GVA and 2.06% in case of Factor income.

Taking into consideration the level of each indicator in 2020 and the average annual growth, the forecast for the next 2021-2025 is shown in Table 3.

The results show that in 2025, Romania will reach a labour productivity per 1,000 AWU of Euro 13 million agricultural output value, Euro 6.30 million gross value added and 130.95% factor income.

The figures do not show too much progress but they had to be predicted in order to have an image of what we could expect to happen in the next five years.

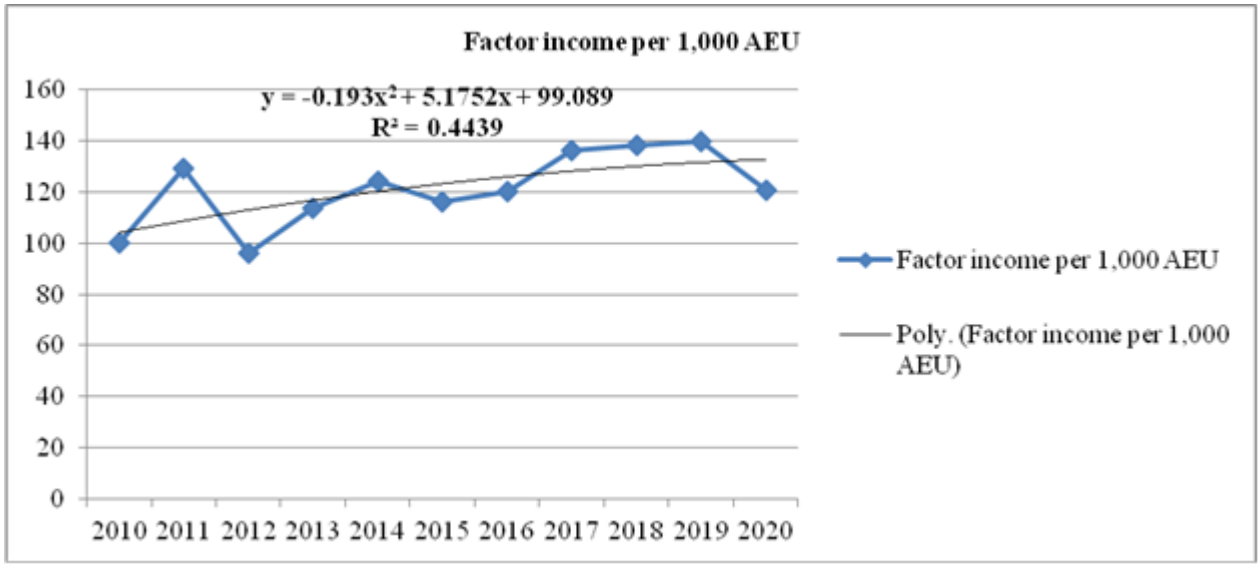

Fig. 3. Factor income, Romania, 2011-2020 (%)
Source: Own design based on Eurostat [6].

Table 3. Forecast for Romania's agriculture labour productivity for 2021-2015 horizon

	Agricultural output value/1,000 AWU	Gross value added/ 1,000 AWU	Factor income/1,000 AWU
2021	12.68	6.02	122.71
2022	12.76	6.09	124.77
2023	12.84	6.16	126.83
2024	12.92	6.23	128.89
2025	13.00	6.30	130.95

Source: Own calculations.

CONCLUSIONS

Romania has still a low productivity in agriculture due to the high labour input, lack of agricultural production concentration, small farm size, unefficient technologies and obsolete endowment.

This was proved by the obtained results per 1,000 AWU in the analyzed period.

However, agricultural output value decreased by 6.77%, gross value added increased by 12.47% and factor income increased by 20.65%.

That is why Romania is situated on the last position for agricultural value and gross value added per 1,000 AWU and on the 15th position for factor income.

Therefore, the improvement of labour productivity in agriculture requires: a higher concentration of agricultural production, a better farm structure, a lower labour input, technological modernization, a new technical endowment, a higher training level for farmers, and encouraging young people from the rural areas to develop business in agriculture.

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