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STATIC AND DYNAMIC ANALYSIS OF PRODUCTIVITY OF BEARING FRUIT VINEYARDS – A BASIC FACTOR FOR THE ECONOMIC GROWTH OF THE VINE AND WINE SECTOR OF THE REPUBLIC OF MOLDOVA

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Abstract

The paper presents a static and dynamic analysis of bearing fruit vineyard areas and productivity at 1 ha in the Republic of Moldova. The linear trend of the productivity development of the bearing fruit vineyard plantations during 2010-2016 and the prognosis of the level for 2022 have been determined and analysed.

***Key words*:** *vine and wine sector, economic growth, vineyard, forecasting, productivity, linear trend*

INTRODUCTION

The vine and wine sector of the Republic of Moldova is of strategic importance for the national economy given that, first of all, viticulture has a high level of capitalization of the slope agricultural land, being the base of raw materials for winemaking and the food industry. Secondly, the attractive and tasteful appearance of the grapes, also gives them the value of the energy-appreciated food, vitaminized, mineralized to which dietary and therapeutic qualities can be added.

At the same time, the annual vine and wine sector contributes to the annual increase of revenues in the country by about 205 mil. EUR from the export of its production, ensures breakdowns in the state budget through excises, VAT and income tax of more than 400 mil. MDL annually, provides profit of 5-85 thousand MDL for 1 ha of bearing fruit vineyard, ensures permanent job places, etc.

The wine-growing heritage in the Republic of Moldova (in all categories of households) as at 01.01.2017 accounted for 135.3 thousand ha.

The purpose of this study is to analyze statically and dynamically the vineyard plantations and the global grape production, which represents the raw material for industrial processing that ensures the high quality of the wines and the economic growth of the vine and wine sector.

MATERIALS AND METHODS

In the research, the authors have used the materials of the legislative framework in the field of wine sector development, data from the National Bureau of Statistics of the Republic of Moldova and the specialized literature.

In the scientific research process, the following research methods have been applied: method of comparison, table method and graphical presentation of the studied phenomena, average and relative size method, mathematical method of analytical levelling and determination of trend of change of phenomena in dynamics.

RESULTS AND DISCUSSIONS

The Republic of Moldova is one of the main vine-growing countries. Viticulture has a well established place in the national economy.

The morphological characteristics and agri-biological traits of the vine allow it to occupy and efficiently utilize light sandy-clay or clay-sandy soils, because the quality of grapes is higher.

On 01.01.2017, the country's viticulture heritage in all categories of households constituted 5.4% of the total amount of the agrarian land area (Table 1).

Table 1. Distribution of agricultural land and vine plantations on forms of ownership, on 01.01.2017 in the Republic of Moldova

Indicator	All forms of ownership - total		Of which:			
			Public		Private	
	Thous. ha	*Share, %*	*Thous. ha*	*Share, %*	*Thous. ha*	*Share, %*
Surface of the agricultural land - total	2,499.8	100	646.5	25.8	1,853.3	74.2
Vine plantations - total	135.3	100	8.0	6.0	127.3	94.0

Source: Data calculated by authors based on the Annual Statistical Yearbook of the Republic of Moldova 2017, p. 290.

Out of the total area of vine plantations, 127.3 thousand ha or 94% are managed by private sector households and only 6% by the public sector.

The analysis of the 2010-2016 dynamics of the share of bearing fruit vineyard plantations in the total amount of vineyards shows a slight increase from 91.6% to 95.4%, i.e. by 3.8 pp (Figure 1).

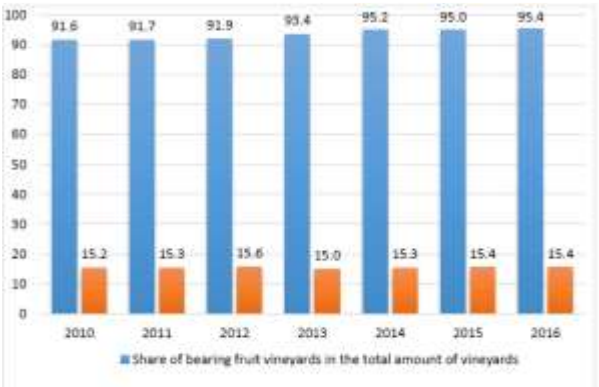

Figure 1. The share of bearing fruit vineyards in the total amount of vineyards in all categories of households in the Republic of Moldova

Source: Own calculation based on the data from Statistical Office, Rep. of Moldova.

However, the share variation of table grapes vineyards in the amount of bearing fruit vineyards is even more modest. It represented 15.2% in 2010 and 15.4% in 2016. The varieties for wine are about 80%. The share of the main varieties of wine such as: Aligote, Isabella, Sauvignon, Cabernet-Sauvignon, Merlot, Pinot Noir in the structure of the bearing fruit vineyard plantations is about 6.5-15.0% each.

The regulation and organization of the production activity in the vine and wine sector in the Republic of Moldova is conducted in accordance with the State Policy elaborated and promoted by the Ministry of Agriculture, Regional Development and Environment, as well as the legislative framework (Law of the Vine, 2006; Government Decision, 2009; Operational Procedure, 2015] [9, 10].

The objectives planned for the period 2000-2006 were achieved, except of the grubbing up of vineyards. Analysis of the biological status of plantations reveals that 26.1% of the vine had to be grubbed down by 2010 and 57.3% - by 2020.

Results of the researches carried out (Table 2) show that on all types of vine plantations, since 2010, the areas have decreased or diminished in average by 0.5-1.2%.

In 2016, 4.6 thousand hectares of vine plantations with a low agro-technical and phytosanitary status were grubbed up, and the absence of a large number of young vines caused colossal losses. For the next 4 years (2016-2020) it may be possible to plant about 20 thousand ha if new investment projects from abroad are attracted. The planting material should be multiplied with varieties and rootstocks included in the catalogue of plant varieties of the Republic of Moldova and should not be attacked by diseases and pests that may diminish the productive potential of the vine [Rusu D., 2017 and 2018] [11, 12].

The aspects of the technological scheme for the production of the vine planting material in the Republic of Moldova have been elaborated in various laws and regulations [Moldovan Standards 207:2010; Moldovan standards-206/2010] [7, 8]. which obliges the producers to respect the particularities of the planting material according to the standards and the technical norms in force, so that the process of producing the grafted vineyards will be high, will have a normal growth in the formation of the horns, which directly influences productivity at 1ha.

Table 2. Analysis of the dynamics of the vineyard plantations in the Republic of Moldova for the period 2010-2016

Indicator	Annual							Average growth / decrease rate
	2010	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	
All categories of households. Vine plantations - total, thous. ha	144.9	139.9	140.7	136.7	140.4	135.4	135.3	X
Growth (decrease) rate in chain, %.	100	96.5	100.5	97.2	102.7	96.4	100	98.8
Of which bearing fruit vineyards, thous. ha	132.8	128.4	129.4	127.7	133.7	128.8	129.1	X
Growth (decrease) rate in chain, %.	100	96.6	100.8	98.7	104.7	96.3	100.2	99.5
Of which vineyards, table grapes, thous. ha	20.2	19.7	20.2	19.2	20.5	19.9	19.9	X
Growth (decrease) rate in chain, %.	100	97.5	101.5	95.0	106.8	97.0	100	99.8

Source: Data calculated by authors based on the Annual Statistical Yearbook of the Republic of Moldova 2017, p. 302.

Analyzing the results obtained in dynamics (Table 3), we conclude that the productivity of bearing fruit vineyard plantations in all types of households on average annually, increased by 5% over the last 7 years. In peasant farms and households of the population with smaller areas due to lack of monetary funds, producers do not have the possibility to grub up the vine that does not correspond according to their biological state and therefore, there is attested a slower growth rate of productivity.

Table 3. Analysis of the dynamics of the productivity of bearing fruit vineyard plantations by categories of households in the Republic of Moldova

Indicator	Annual							Average growth rate
	2010	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	
Productivity of the bearing fruit vineyards, q/ha	All types of households							
	34.9	45.5	38.6	47.3	43.7	45.6	46.9	X
Growth (decrease) rate in chain, %.	100	130.4	122.5	92.4	104.3	102.3	102.8	105.0
Productivity of the bearing fruit vineyards, q/ha	Agricultural enterprises							
	23.7	46.0	41.9	64.6	53.5	54.9	65.3	X
Growth (decrease) rate in chain, %.	100	194.0	91.1	154.2	82.8	101.8	118.9	118.4
Productivity of the bearing fruit vineyards, q/ha	Peasant farms							
	26.7	33.4	29.0	32.8	33.8	40.4	32.1	X
Growth (decrease) rate in chain, %.	100	125.1	86.8	113.1	103.0	119.5	79.5	103.1
Productivity of the bearing fruit vineyards, q/ha	Households of the population							
	56.0	63.5	51.0	58.1	51.0	47.4	56.3	X
Growth (decrease) rate in chain, %.	100	113.4	80.3	113.9	87.8	93.0	118.8	100.0

Source: Data calculated by authors based on the Annual Statistical Yearbook of the Republic of Moldova 2017, p. 304.

In the agricultural enterprises from the Southern and Central Industrial Region of the Republic of Moldova where the planting of vineyards is carried out in accordance with the agro-technical guidelines approved by the Ministry of Agriculture, Regional Development and Environment and on the basis of the projects developed by the licensed design offices specialized in the field of perennial plant design, the yield per ha of bearing fruit vineyard increased from 23.7 q / ha to 63.5 q / ha in 2016.

The analysis of the researches on the distribution of vine plantations at the regional level, in the average of the years 2014-2016, shows that their share in the South region accounts for 47.7%, TAU Gagauzia - 23.5%, the Centre region -23.3% and Chisinau municipality - 4.3%. Nowadays, in the enterprises from these regions, viticulture has experienced a modest recovery, as the productivity of bearing fruit vineyards has increased by 18.4% in the dynamic average of 2010-2016 and in 2016 the global harvest amounted to 515.7 thousand tons. These achievements allow for the global grape production as a raw material for industrial processing to ensure the high quality of the wines.

Further, analyzing the productivity dynamics per 1 ha for the period 2010-2016, (Table 4) it was established that it has a tendency to change in the form of the linear function:

$$\overline{yt} = a_0 + a_1 t$$

where: a_0 și a_1 - function parameters,

t - time mark.

This is confirmed by both the minimum deviation and the coefficient of variation.

Table 4. Determination of the tendency in changing the productivity of bearing fruit vineyard plantations in the Republic of Moldova and the forecast for 2022, q / ha.

Types of households	**Equation of linear trend** $\overline{N_t} = a_0 + a_1 t$	**Average indicator level in 2010-2016**	**Forecasted level for 2022**	**Deviation of the level of 2022 compared to the average 2010-2016 (+ ;-) q / ha**
All types of households	$\overline{N_t} = 43.2 + 1.47t$	43.2	56.4	+13.2
Agricultural enterprises	$\overline{N_t}$=50.0+5.51t	50.0	99.5	+49.5
Peasant farms	$\overline{N_t}$=32+1.25t	32.0	43.2	+11.3
Households of the population	$\overline{N_t}$=54.7-1.12t	54.7	44.62	-10.08

Source: Calculated by authors based on Table 3 data.

Thus, the pattern of linear function adjustment most closely corresponds to the objective trend of productivity growth at 1 hectare in all households. The exponential function and the parabolic function of the second degree proved to be more distant from the real evolution of the indicator during the studied period.

Parameter of the Linear Function a_1 indicates that in the 2010-2016 period, the yield per hectare of bearing fruit vineyard plantations tends to change on an annual average in the following way:

-in all categories of households - increase by 1.47 q / ha;

-in all agricultural enterprises - 5.51 q/ha increase;

-in all peasant farms - increase by 1.25 q / ha;

-in households of population - decrease by 1.12 q / ha.

On the basis of the linear trend model, the prognosis of the productivity dynamics per 1 ha by 2022 was performed. The extrapolation method reflects the forecasting calculations, which show that if trends of change in the directions and sizes obtained by calculation will persist in the future, then the yield of grapes per hectare of bearing fruit vineyard by 2022 will be as follows:

-in all categories of households - 56.4 q/ha, with an increase of 13.2 q/ha;

-in agricultural enterprises - 99.5 q/ha, with an increase of 49.5 q / ha;

-in peasant farms - 43.3 q/ha, with an increase of 11.3 q / ha;
-in households of population - 44.62 q/ha, with a decrease of 10.08 q / ha.
It should be noted that in agricultural enterprises with large agricultural land areas, from 50 ha to 5-7 thousand hectares, the increase in productivity per hectare, on average annual, was the highest - 5.51 q / ha, and the forecast for 2022 is an increase of about 2 times of the productivity per 1 ha. We believe that this level can be reached and even higher if effort is made to achieve a remarkable correlation between the vine variety, soil, technologies and climatic conditions in which the harvest is formed. In addition, support from the state, rigorous observance of the Government's decisions, regulations, agrarian policy of the Republic of Moldova and of the common agrarian policy, development strategies, etc., in the field of the development and growth of the wine sector are required.
Particular attention should be paid to the establishment of new plantations in strict compliance with agro-hedging and climatic factors and to take into consideration the experience gained by producers in the field of wine-making.
In order to obtain the most qualitative and demanded wines on the internal and external markets, it is necessary to increase the areas planted with native varieties (Feteasca Alba, Feteasca Regala, Fetească Neagra, Rara Neagra, Pinot gris, Pinot Noir, Pinot Blanc, Sauvignon (white) as well as Syrah, Sangeoveze and the classic traditional (red) ones. The quality wines obtained from the new intra-specific varieties cultivated successfully on different wine-growing areas of the Republic of Moldova with a productivity of 100-150 q / ha, from varieties such as Viorica, Bianca, Legenda, Riton ,Solearis etc.present a significant interest [Gaina Boris, 2017; Cuharschi M, 2018; Cuharschi M., Ceban V., 2017] [2, 3, 4].
The results obtained from the researches carried out at the Scientific-Practical Institute of Horticulture and Food Technologies (SPIHFT), the “Plopi” branch, Cantemir District, KVINT (from Doibani, Donduseni) and "Mold-Nord" L.L.C. shown that the Viorica variety is highly productive (the amount of grapes reaches up to 160 q / ha, with a sugar coefficient of 172 g/dm^3 and acidity up to 9 g/dm^3 and more) [Cuharschi M.et.a. 2018] [2].
Together with the liberalization of the EU wine market for Moldovan products, the export of high-quality table grapes, wines and spirits based on the protected geographical indications and protected designations of origin (PDO) system will be increased in accordance with the requirements of European regulations [Council Regulation/2009, Regulation (EC), 2009; Government Decision, 2015] [1, 5, 6]. At present, the share of wine products with a typical wine-growing area is still low.

CONCLUSIONS

The research pointed out that of 135.3 thousand ha of vine plantations, 94% are managed by private sector households and only 6% by the public sector.
In the 2010-2016 dynamics, the wine-growing area in the country diminished by 1.2% on average annually, and for the years 2017-2020, it is possible to plant about 20 thousand ha, if the own monetary sources of producers will increase and new investment projects will be attracted from abroad.
When producing vine planting material, the standards and technical regulations in force must be followed.
Dynamic research over the last 7 years has shown that productivity per 1 ha on average has increased in all households by 5% and in agricultural enterprises by 18.4%. It has been established that the change in productivity at 1 hectare has a linear function, which has an increase of 1.47 q / ha in all types of households and in agricultural enterprises by 5.51 q / ha in the yearly average. The forecast shows that if the growth trend in the calculated quantities is maintained in the future, the productivity per hectare will increase to 56.4 q / ha by 2020 and 99.5 q / ha respectively.

The economic growth of the wine sector is possible if effort is made in relation to a remarkable correlation between the basic factors such as: vine variety, soil, technologies and climatic conditions in which the productivity of the bearing fruit young plantation is formed, as well as the grape quality, then it will influence most vineyard plantations with native varieties (Feteasca Alba, Feteasca Neagra, Sauvignon (white) etc.), new intra-specific varieties with productivity of 100-150 q / ha, Viorica, Legenda, Riton etc., and most of the high quality wines and spirits with the name (PGI) and (PDO) in order to meet the requirements of the European partners.

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