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THE PRINCIPAL COMPONENT ANALYSIS AS RURAL DEVELOPMENT LEVEL ASSESSING METHOD IN THE REPUBLIC OF MOLDOVA IN THE CONTEXT OF REDUCING SOCIAL EXCLUSION

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Abstract

The purpose of the paper is to define the principal component analysis method for assessing the rural development level in the Republic of Moldova. The results of mathematical processing of primary data obtained as a result of surveying 9 rural localities using the Date Envelopment Analysis are presented. Applying the rating method as a key indicator of sustainable development it provides a comprehensive approach to the rural area issues. Socio-economic and ecological characteristics of the evaluated sample are also evaluated.

Key words**:** *rural development, data envelopment analysis, sustainability, principal component analysis*

INTRODUCTION

The National Strategy for Sustainable Socio-Economic Development of the Rural Areas in the Republic of Moldova explicitly stipulates the need to maintain the macroeconomic balance. The implementation of adequate and coherent economic policies that will be in line with the agreed EU objectives, in particular the revised Lisbon Strategy ensures the achievement of sustainable economic growth as well as of the operational objectives of the Horizon 2020. It is clear that mathematical modeling of macroeconomic processes represents a necessity at the present stage of assessing Moldova's rural development level, which will allow the choice and particularly the adjustment of this strategy depending on the real regional situation.

The evaluation of sustainable socio-economic development level is based on the analysis of the rural environment of the Republic of Moldova (socio-demographic indicators, data on the living conditions in rural areas, income and consumption structure) using official statistical data. This analysis is required by the need to shift the agriculture from subsistence to efficiency, the introduction of the EU Community policy in the Republic of Moldova, as well as by the need to implement the information and communication technology as a prerequisite for sustainable rural development, which are represented by the flows (materials, information, knowledge transfer) established according to the macroeconomic benchmarks, so that it would be possible that starting from the current situation to achieve the expected objectives [2].

The study was focused on the following objectives:

-developing a new concept according to which the sustainable rural development in the Republic of Moldova, regarded as the ultimate objective of the modern society development, represents a Nash equilibrium between the three systems that interact, namely the economic, social and environmental system;

-developing a nonparametric model for assessing the level of socio-economic development of rural areas;

-defining the mechanisms and policies for attracting and absorbing the subsidies and grants for research-development-innovation, with a focus on attracting private sector funds as an alternative to the financing from the state budget [3].

The objectives proposed and the monitoring of their progress could be achieved using specific indicators of the two characteristics related to the strategic management approach.

The close link between the established objectives and the monitoring indicators allow for a new approach, such as the strategic management of the sustainable rural development in the Republic of Moldova, which is more appropriate than the rigid planning approach that has proved inefficient. Sustainable development indicators enable for long-term monitoring of progress towards achieving objectives, being an indispensable tool for agricultural policies that set the strategy and development level concomitantly informing the general public about the achievements, including the failures or compromises made during the dynamical evolution of sustainable socio-economic development process.

MATERIALS AND METHODS

In recent years, several studies have been conducted to assess the rural development level in the Republic of Moldova using the method of Data Envelopment Analysis (DEA) [8].

The level of rural development can be defined as the weighted sum of outputs to the weighted sum of inputs as follows:

$\theta_0\ (u, v) = \sum_r\ u_r\ y_{r0}\ /\ \sum_r\ v_i\ x_{i0}$

where:

θ_0: relative rural development level of the rural locality

u_r: output weight, r= 1, 2.

v_i: input weight, i= 1…6

$$\min \varepsilon\ \theta - \varepsilon \left(\sum_{i=1}^{2} s_i^- + \sum_{r=1}^{2} s_r^+ \right)$$

$$\sum_{j=1}^{6} x_{ij}\ \lambda_j + s_i^- = \theta\ x_{i0}$$

$$\sum_{j=1}^{6} y_{rj}\ \lambda_j - s_r^+ = y_{r0}$$

$$\lambda_j \geq 0,\ j\ = 1 \ldots 6$$

The main objective of this research was to identify and assess the level of rural development by including the three basic components – the economic, social and environmental one. The sample was created as a result of surveying 938 economic agents located in 9 districts of three different geographic regions. of the Republic of Moldova in 2016. The survey included information on the economic and social structure of localities and data on the ecological condition of the environment presenting both qualitative and quantitative data. The mathematical processing of primary data was carried out with the support of DEA_UASM software, developed within the Faculty of Economics of the State Agrarian University of Moldova.

RESULTS AND DISCUSSIONS

Establishing these goals and measuring their progress through nonparametric methods using some indicators represent two highly correlated characteristics specific to strategic approaches. Strategic management approaches and strategic processes have become more and more popular in the past two decades, both in the public and private sectors, once the rigid planning inefficiency has become obvious. The methodology used in this investigation represents the comparative analysis of the classic sequential model with a more recent model of economic, social or ecological efficiency, coming from a highly dynamic field - Information Technology - namely the cyclic model of convergence. Sustainable socio-economic development indicators of rural areas have proliferated since the Rio de Janeiro Summit in 1992. Thus, the Sustainable Development Strategy adopted by the European Council in Gothenburg in June 2001 explicitly stated its intention to regularly monitor the indicators of sustainable development in order to achieve the fundamental objective of „meeting the needs of present generations without diminishing the chances of future generations to meet their own needs" [7].

There are about 1,614 villages in the Republic of Moldova with a population of 2 million 42 thousand people per year, which is 57.5% or more than half of the country's population. In

recent years, there has been a gradual decline in the rural population number. Moldova faced a serious demographic crisis, which leads to the disappearance of about four villages per year, the equivalent of minus 10 thousand inhabitants. Types and characteristics of families as a percentage are presented in Figure 1.

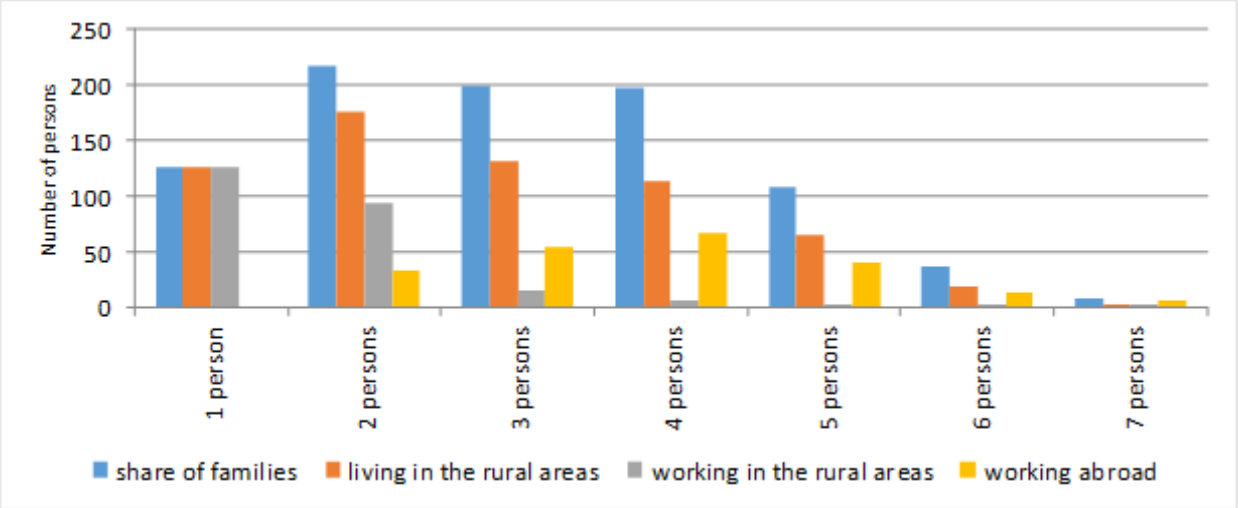

Fig. 1. Family composition, (persons)
Source: Own calculations based on data of the Survey

According to Figure 1, there is a change related to the concept of family size. If earlier a family with three or four children was a common occurrence, now its share does not reach even 10%. Most families consist of 2-3 persons.

Families with 2 family members are common and represent 24% of the total share of families. The share of such families reaches a critical maximum and is about 70%, while the share of families consisting of 7 persons reaches only 0.90%. One of the reasons that led to the decline of the birth rate is the financial situation in the family. Demographers state that every fifth family is faced with the problem of maintaining their own children. According to the authors, current amounts of government support are insufficient. Although the amount of lump-sum childbirth allowance has increased 10 times over the past 15 years, it is not sufficient to cover all necessary expenses [1].

The share of families consisting of 3 or more persons takes the decision to get a job not in the country, but abroad. Therefore, this share of families records the highest rate of migration: 3 persons - 26% and 4 persons - 32%. There weren't observed outflows of nationals to other countries in the share of families consisting of 1 person, who are retired. Namely these families record a high level of job security in rural areas, which is more than 50%.

Among the reasons determining Moldovan citizens to leave the country we could mention: higher wages in the host countries, higher standard of living, expanded opportunities for personal development and the presence of "successful" migrants and social networks created by them abroad (relatives, acquaintances and close friends). Thus, in 2007, the income transferred by Moldovan migrants from abroad reached its peak, constituting 36% of GDP.

The manager (household manager) is the person who takes important decisions concerning everyday activities. The manager of an agricultural enterprise can be an individual, a group of individuals or a legal entity on behalf of and by which the agricultural enterprise operates and which is responsible for the economic and legal activity of the agricultural enterprise protecting it from economic risks resulting from the activities carried out by the agricultural enterprise.

The analysis of the figure 2 shows that most household managers are retired or near retirement age. Thus, 29% of respondents are classified in the 51-60 age group, which makes up 29% of the total population interviewed. Almost the same number of interviewees fall into the age groups adjoining the above mentioned: 61-70 and 40-50 years old, each group representing about 23% of the statistical population. If we sum up the population of the last three age categories, which generally corresponds to the retirement population, this figure reaches about 63% of the total surveyed household managers.

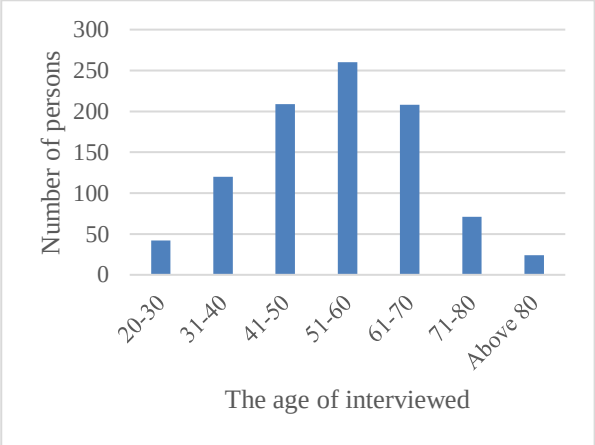

Fig. 2. The age of interviewed household managers from rural areas.
Source: Own calculations based on data of the Survey

The demographic situation in the rural areas continues to decline. There is a reduction in the population number accompanied by the population ageing and decreased life expectancy. In 2015, the population aged 60 years or over numbered 500.4 thousand people. It should be noted that the pace of Moldova's population ageing is much higher and accelerated than in developed European countries. The share of elderly people in the overall population structure has almost doubled in only 50 years. Based on the example given in Figure 2 one can observe the average age of the enterprise manager [5].
Most household managers are men.
As a rule, women as household managers fall into the older age category, as they are more longest-livings than men. Also, in some cases, women take the position of household manager if their husbands go to work abroad to support the family.

Table 1. Distribution of household leaders/managers by gender

N	Household manager by gender	Number	Percentage share, %
1	Man	668	75
2	Woman	224	25
	Total	892	100

Source: Own calculations based on data of the Survey.

For the Republic of Moldova, the presence of a large number of entrepreneurs aged between 41 and 70 years (75%), and a very low number of young entrepreneurs involved in agricultural production (5%) are typical. Thus, the opinion that the largest number of people who are trying to open their own business are young people has not been proven to be true, since the main group of entrepreneurs are people aged more than 30 years. This phenomenon points out to an intensive urbanization of a large part of the young population, as well as to a significant migration flow.
A large share of entrepreneurial activity falls into the age category from 30 to 50 years old - 36%, from 50 to 60 years old - 29% and over 60 years old - 34%. According to the Law on State Social Insurance Pensions, the retirement age in Moldova is 57 for women and 62 for men. That is, a significant share of family enterprises are headed by people of the pre-retirement and retirement age from 50 to 70 years (52%).
In 2015, the minimum payment amount for the old-age security pensions for agricultural workers was 844 MDL. As a result, less well-off rural people, namely pensioners, are involved in the management of farms. Farm activities can be easily combined with regular household work. At the same time, it allows to provide the family with fresh food products, as well as with an additional source of revenue.
It has been established that most family-owned enterprises are headed by men, the family-owned firms headed by women being 5 times fewer, and there is also a "mixed"

variant, when the managers are representatives of both sexes [4].

As it is presented in the Table 1 the number of farms headed by men is higher and makes up 75%, while the share of women involved in farm management constitutes 25%. But if we compare economically active people by sex, then there are no big differences. The share of women is 49.2%, while the share of men slightly exceeds 50.8%. Thus, women represent a significant share of the economically active population involved in the agricultural sector.

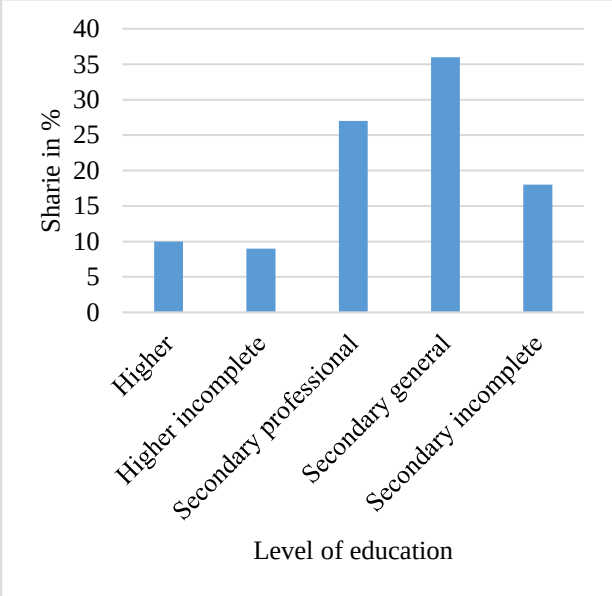

Fig. 3. Classification of household managers by the level of education
Source: Own calculations based on data of the Survey

Many rural women who are "statistically" classified as "economically inactive" may actually work as farmers for themselves or as unpaid family workers in small farms or in vegetable gardens, but they claim that they are not employed in the agricultural sector. Therefore, the share of women's involvement in farm management exceeds the figure obtained as a result of the accomplished surveying.

The qualification of population plays a decisive role in the socio-economic development of rural localities. In this context, the level of education is the determinant factor of employee qualification. Despite the expectations, the share of population with incomplete and general secondary education, i.e. without specialized professional training, exceeds half of the household managers, which affect the income level of families in rural areas.

Education level is the most important factor closely connected with the productive capacities of farms and the level of farms' income. All this ultimately affects the welfare of farms and overall economic growth across the country. The well-being of developed countries is based on a high education level of their population, as education represents an important tool for empowerment and capacity building. A number of empirical studies have shown that wages increase significantly as workers' degree of education rise. Based on the example of investigated farms, we can consider the level of education of managers Figure 3.

According to Figure 3, less than 20% of all farm owners have incomplete secondary education. As for the incomplete higher education, here the maximum gap is achieved being less than 9%, while for the higher education it is 10%. It is worth noting that 36% of all agricultural enterprise owners indicated that they have a secondary general education, which is the largest share. Also, a considerable share is occupied by the category with secondary professional education - 27%.

We believe that the education level of a manager reflects the quality of farm management, which leads to positive results.

Unlike the previous periods, the number, but also the share of rural population involved or employed in the agricultural sector decreased considerably as in Figure 4. Although the number of people employed in the non-agricultural sectors is relatively high, reaching 36%, their number does not even compensate for the loss of jobs in the agricultural sector. The number of unemployed people reported is 13%. If, however, we add those who have reported work in the household management, the number of unemployed could constitute about 45%, which is an alarming situation.

The non-agricultural sector includes all other activities carried out in rural areas, except for activities in agriculture, fishing and hunting. Non-agricultural activities include any non-

agricultural activities. It may include the work of farm family members in a city or in another country [6].

Figure 4 provides an overview of employment data of farm managers. The data show that 37% of managers receive income from rural activities, which is equivalent to non-agricultural employment. Part-time non-agricultural employment is the main source of employment and constitutes about 36%, which is 4% more than the employment rate presented in farm.

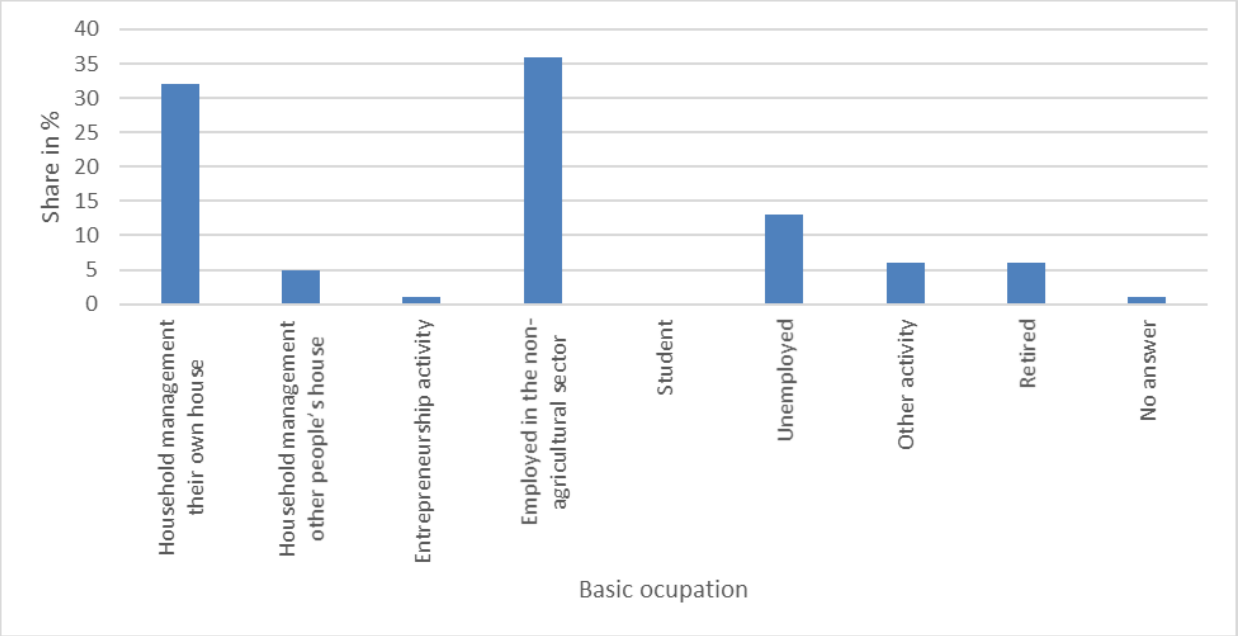

Fig. 4. Classification of household managers by their basic occupation
Source: Own calculations based on data of the Survey

Specialized literature highlights two groups of factors that influence the non-agricultural employment. These are demand-pull factors and distress-push factors:

-*Demand-pull factors* - describe what happens when there is a profitable opportunity for employment in the non-agricultural sector for those employed in agriculture;

-*Distress-push factors* - describes what happens when insufficient incomes in agriculture force you to look for another additional source of income in the non-agricultural sector.

In other words, the rural population switches to non-agricultural activities under the pressure of two types of factors: either the demand for the results of this activity leads to an increased income which is above the level of income from agriculture, or the population is looking for possible additional sources of revenue in scarcity conditions.

CONCLUSIONS

As a result of analyzing the primary information on the level of rural development in the Republic of Moldova, the following conclusions can be drawn in order to optimize the agricultural policy in this field:

-theoretical approach to assessing rural areas involves the development of appropriate mathematical models describing sustainable regional development based on the principle of economic, social and environmental balance;

-the techniques for assessing the level of rural area development based on linear programming require to define some rating of localities using the method of Data Envelopment Analysis (DEA).

This ranking represents an instrument that has proven to be very useful in assessing sustainable development when the parametric methods (econometric approaches) do not cope with the complexity of agricultural

problems. The criteria for evaluating optimal solutions in the sustainable development of the rural areas are based on the elasticity of the economic, social and environmental factors that determine the performance of the agricultural policies in this field.

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