STATISTICAL APPROACH FOR DETERMINING THE STATE AND THE LEVEL OF EMPLOYMENT IN AGRICULTURE, FORESTRY AND FISHERY

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Abstract

The current article presents a statistical approach for determining the state and the level of employment in agriculture, forestry and fishery during the period 2008 – 2019. The information is taken from the website of the Bulgarian National Statistical Institute. The number of employees for each month of the considered years has been extracted and stored in a separate Excel file. The investigated data have been processed, evaluated and summarized.

It can be concluded that the lowest value of surveyed indicator was established in 2008. The period from 2012 to 2016 is characterized with a gradual increase of the employment in agriculture, forestry and fishery. The reverse process has been observed over the last three years (2017-2019). The reduction was about 6.26%. During the period 2012 – 2013 the employment level in agriculture was almost unchanged.

Keywords: employment, agriculture, forestry, fishery

INTRODUCTION

Agriculture plays a strategic role in the process of economic development of the country. It has already made a significant contribution to the economic prosperity of advanced countries and its role in the economic development of less developed countries is with even more vital importance (Praburaj, 2018).

In order to create the preconditions for development and the necessary resources for sustainable and competitive agriculture, governments apply series of actions and programs. Some of these policies are focused on human resource development.

The new CAP 2021-2027 proposals are oriented to targeting on several directions – greening and young farmers (Beluhova-Uzunova, D. Atanasov, M. Shishkova, 2020). The use of both traditional and innovative tools for development of human resources in agriculture is essential and key element for production growth (Stanojević et al., 2015). It also contributes for the quality and safety of food products. In this connection, the analysis of information on employment in the field of agriculture makes it possible to present relevant conclusions about indicators of dynamics for certain periods.

The aim of this article is to present a statistical approach for determining the state and the level of employment in agriculture, forestry and fishery during 2008–2019. This would allow understanding of human resource trends (monthly and yearly) in Bulgarian agriculture since its integration to the European Union.

MATERIALS AND METHODS

The necessary data related to the number of employees by economic sectors is published on the website of the National Statistical Institute (NSI) (http://www.nsi.bg). This paper examines the indicated information from the field of agriculture, forestry and fishery in Bulgaria.

The number of employees for each month of the considered period has been extracted and stored in a separate Excel file. The investigated period includes the years between 2008 and 2019. Information has been evaluated and summarized, using the following variables:

- The variables $X_{i\,j+1}$ and $V_{i\,j}$

$$X_{i\,j+1} = \frac{z_{i\,j+1}}{z_{i\,j}} \qquad (1)$$

where $z_{i\,j+1}$ and $z_{i\,j}$ - the number of employees for current and previous month of i-th year, $1<=i<=12$, $1<=j<=11$;

$$V_{i\,j} = \frac{z_{i\,j}}{z_{i-1\,j}} \qquad (2)$$

where $z_{i\,j}$ and $z_{i-1\,j}$ - the number of employees for j-th month of current and preceding year, $2<=i<=12$,

$1<=j<=12;$

- The differences - $S_{i\,j+1}$ and $F_{i\,j}$

$$S_{i\,j+1} = z_{i\,j+1} - z_{i\,j} \quad (3)$$

$$F_{i\,j} = z_{i\,j} - z_{i-1\,j} \quad (4)$$

- The variable - $\bar{x}_i$

$$\bar{x}_i = \frac{\sum_{j=1}^{p} z_{i\,j}}{m} \quad (5)$$

where $z_{i\,j}$ - the number of employees in j-th month for i-th year, $1<=i<=12$, $1<=j<=12$, m=12.

The pace of growth (respectively the pace of decrease) of the surveyed indicators during each of the years has been established. In case of requests for monthly information, it is possible to be reached.

Using the capabilities of Microsoft Excel (Iliev et al., 2006, Levine et al., 2016), the examined information could be processed. The obtained results enable the users to present the relevant conclusions for the considered period. The processed data are displayed mainly in graphical

form. This allows to track much more quickly the dynamics of change of indicators for arbitrary selected intervals (Dimova, 2016).

RESULTS AND DISCUSSION

- Structuring the information in the xlsx file and using lists of data and filters in Excel (Mihaylov, 2016), users can visualize only a certain part of the examined elements. In this case, they include:
- Number of employees in agriculture, forestry and fishery for preselected months of a given year;
- The number of employees in the chosen month for all surveyed years;
- Employees in the mentioned sector for n-year period (2<=n<12);
- Indicated values of the considered variable (number of employees) during the studied time interval;

The current paper analyzes data from the field of agriculture, forestry and fishery during 12-years period. The obtained results of the calculations show the following:
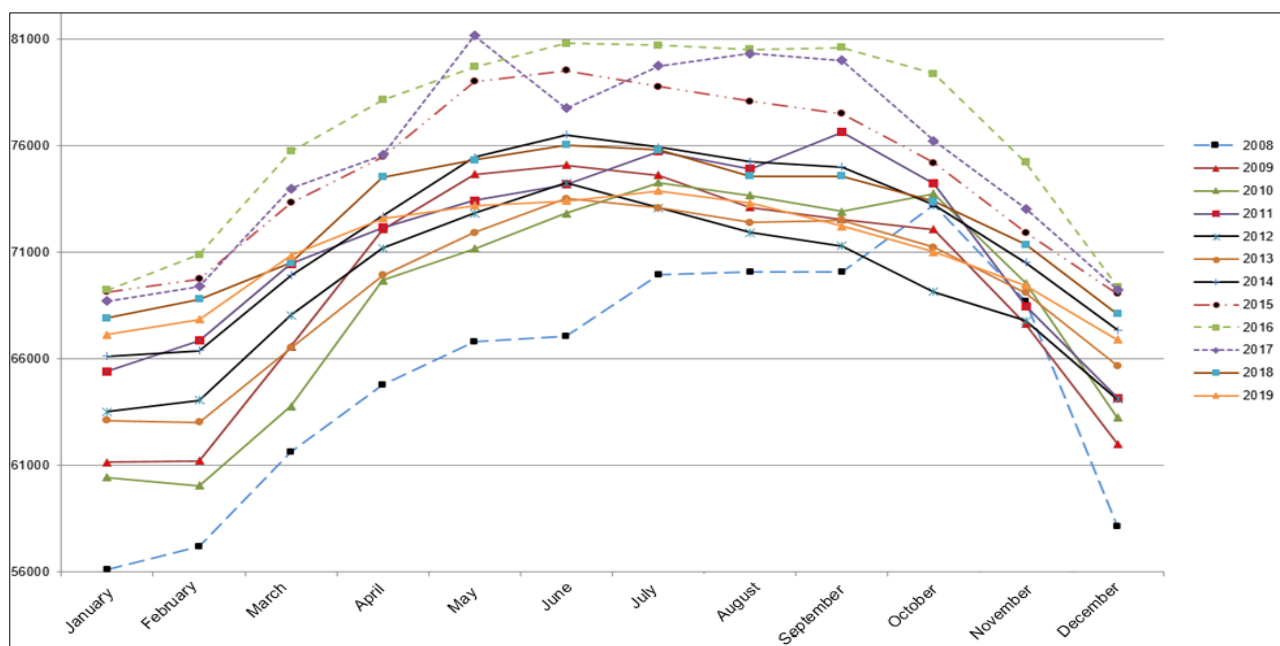

Fig. 1. *The change of the surveyed indicator (number of employees) during the indicated period*

Source: Data from National Statistical Institute

- A continuous increase of the number of employees in the mentioned sector has been established for the first six months

(from January to June) in the time intervals 2008-2009, 2011-2012, 2014-2016, and 2018-2019. In this case, the calculated

values of the variable X_{ij+1} are greater than 1. The same process has been observed in July during 2008, 2011, 2019, as well as in August for the first considered year of the studied period. It should be noted that a certain growth was obtained from January to April for 2017 (fig. 1);

- Quite naturally, the values of this studied indicator gradually decreased during the last three consecutive months (October-December) for each year in the period from 2011 to 2019. A similar situation for the investigated data was obtained in 2009. An interesting fact should be noted. A slight decline in the employees in agriculture, forestry and fishery has been calculated only in 2008 for the months - September, November and December. For the rest of the surveyed years during the period a reduction of this indicator's value was established for certain months;

- Compared to July, the number of employees in the examined sector in August decreased for each year from the interval 2009-2016 and 2018-2019. In this case the values of the investigated variable X_{ij+1} are less than 1;

- Over the next months from each listed year the indicator goes up and down or vice versa;

- The highest number of the employees in agriculture, forestry and fishery has been registered in June for 7 years of the indicated time interval. These values of the mentioned indicator for the other 5 years of the period was observed in May, July, September and October, as can be seen from the diagram presented on fig. 1.

Information concerning the number of employees in the considered field for each separate month over these 12 years has also been evaluated and summarized. In this connection, the results of the data processing show:

- The variable V_{ij} ($7 <= i <= 9$, $1 <= j <= 12$) for the examined months (January-December) in 2014-2016 has values greater than 1. Therefore, the number of employees for the indicated month of the current year is higher in comparison to the one for the indicated month of the preceding year;

- A relatively small percentage change of the employees for the above considered 3 years is obtained in December (fig. 2). It is about 2.58% for 2014, as well as 2.52% and 0.47% for the rest two years (2015-2016). As can be expected, a much smaller increase of the mentioned variable was calculated in January 2016. It was about 0.14%;
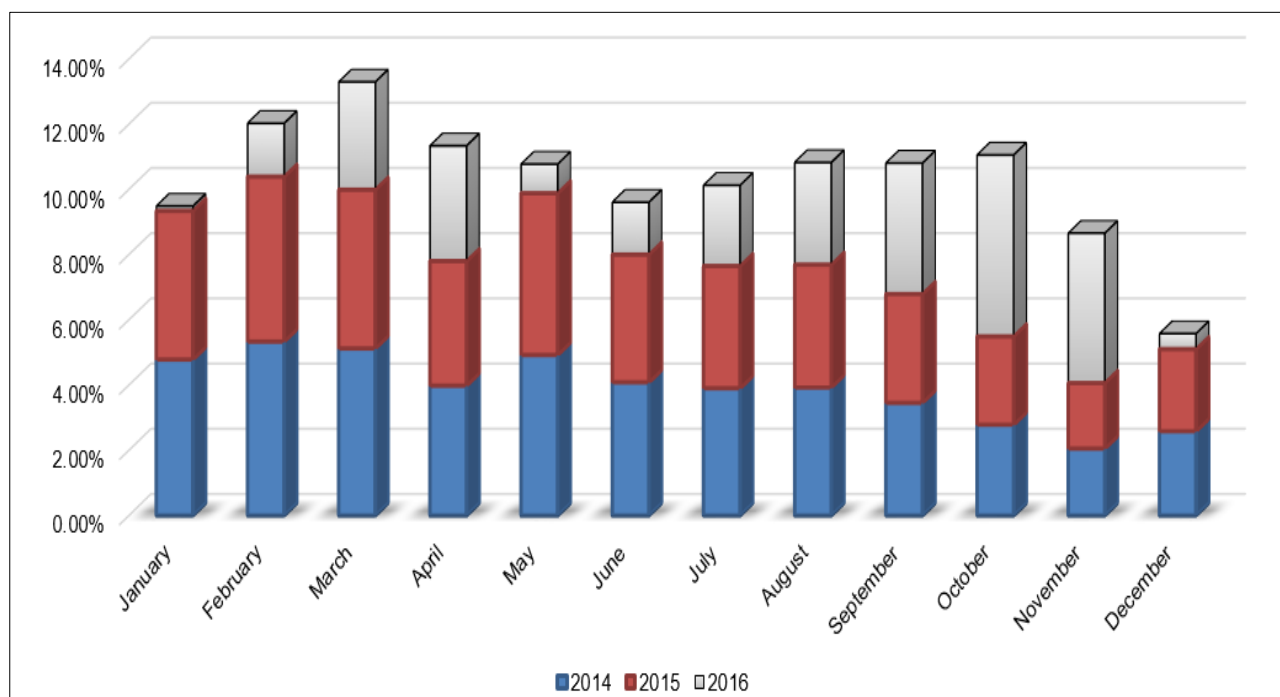

Fig. 2. *Visualization of the calculated values for each of the studied months*

Source: Own calculations on the basis of data from National Statistical Institute

● The situation was quite different for December during 2009-2011, 2013-2016 and 2019. A continuous growth of the employees in agriculture, forestry and fishery for the presented month was observed. A certain decline was registered for the rest three years – 2010 and 2017-2018;

● The highest value of the examined indicator was established in May 2017, while the lowest was presented in January 2008. Compared to January, the number of employees in February increased by about 11.37% for the year 2011. In this case, the obtained percentage change is significantly higher;

● The values of the variable S_{ij+1} for some calculated differences are quite small. Therefore, the number of the employees in agriculture, forestry and fishery remained almost the same for two consecutive months of the examined year. This situation is observed for January-February during 2009, as well as 2013. A similar conclusion can be presented for August-September in the following years: 2008 and 2018. In addition, the pace of decrease was faster in the last three months of 2008, 2014-2017. An interesting fact should be noted. The calculated value of the variable F_{ij} (i=6; j=7)

is -10. Compared to July 2012, the studied indicator in July 2013 decreased only with 10 employees from the examined sector. In the case, the change of the indicated variable is insignificant. Approximately the same number of employees is maintained in June for 2011 and 2012, in December again for the two listed years, in January 2015 and 2016. The highest value of the variable F_{ij} was obtained in June 2009. Then the calculated increase of the number of the employees was about 11.92%.

● The growth pace of this studied indicator is faster for the first four months in the time intervals 2008-2009, 2011-2012 and 2014-2019, as can be seen from the diagram on figure 1.

The current paper calculates and examines the average number of employees ($\overline{x}_i$) for each year of the considered period. The analysis of the investigated data shows the following (fig. 3):

● As can be expected, the lowest value of the mentioned indicator is obtained in 2008. Compared to the year 2009, the number of the employees increased by about 6.24%. A similar situation is obtained for the next two years. In this case the growth of the variable is more than 3.79%;
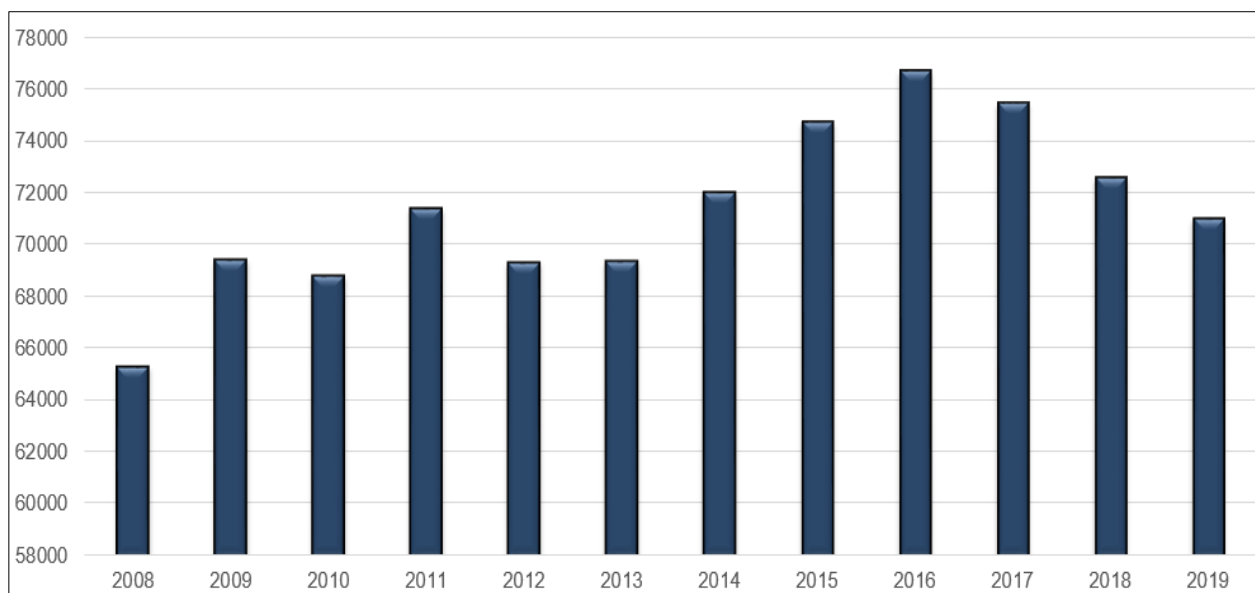

Fig. 3. *Graphic analysis of the indicator (average number of employees) for the examined time interval*

Source: Own calculations on the basis of data from National Statistical Institute
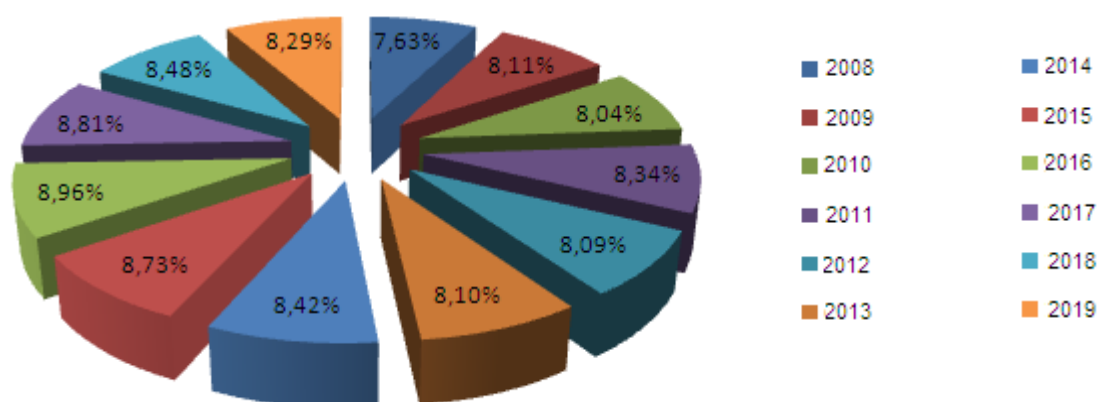
Fig. 4. *Presentation of the results about the calculated relative shares*

Source: Own calculations on the basis of data from National Statistical Institute

- The period from 2012 to 2016 is characterized with one gradual increase of the employees in agriculture, forestry and fishery. Quite naturally, the highest value is established for the last year of this indicated subinterval. The calculated growth of the indicator is about 1.2 times for the first 9 year of the considered period;

- The reverse process has been observed over the last three years (2017-2019). A reduction of about 6.26% is obtained. In the last year of the considered interval the values of this studied variable are approximately the same with those for 2011.

This study also calculates the share of employees for each year as compared to the total number of employees for examined time period. The results are shown on figure 4. Approximately equal percentages are obtained for two of the studied years. In this case, these are 2012 and 2013. Therefore, the employment levels in the surveyed field are almost the same for this time interval. For the other years of the period there are some differences.

CONCLUSION

1. This paper presents a statistical approach for determining the state and the level of employment in agriculture, forestry and fishery. The data have been extracted from the website of the National Statistical Institute. The number of employees for the studied time interval has been presented in an xlsx file. The examined period includes the years between 2008 and 2019. The processed information is displayed in graphical forms.

2. The results showed that the growth pace of the examined indicator was faster for the first four months in the time intervals 2008-2009, 2011-2012 and 2014-2019.

3. The lowest value of the number of employees in agriculture, forestry and fishery was registered in 2008. The period from 2012 to 2016 is characterized with a gradual increase of the considered indicator. The reverse process has been observed for the period from 2017 to 2019. A reduction of about 6.26% has been established.

4. As a whole, in the last year of the investigated period, the indicator value was approximately the same with the one for 2011.

5. The employment levels in the surveyed sector are almost the same for two of the examined years (2012-2013). There are certain differences for the other years of the period.

REFERENCES

Beluhova-Uzunova R., D. Atanasov, M. Shishkova 2020, Distribution of Direct Payments in Bulgaria - Policy Lessons and Prospects Beyond 2020, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 20, Issue 2, 2020 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

Dimova D, 2016, An Algorithm for Determining and Comparing the Levels of Economic Development in the Districts in Bulgaria,

Journal of the Technical University - Sofia Plovdiv branch, Bulgaria "Fundamental Sciences and Applications", vol. 22, pp. 177-182, Available at: http://www.tu-plovdiv.bg/content/files/Journal%20FSA%20v.22_final_805_970.pdf

Iliev M., J.Nikolova, 2006.Experience in Using Excel in Teaching Applied Statistics at Universities and Colleges, Journal of the Technical University at Plovdiv "Fundamental Sciences and Applications", Anniversary Scientific Conference' 2006, Bulgaria, pp. 39-44, Available at: https://manualzz.com/doc/4731802/methodology-of-teaching-in-higher-education, [in Bulgarian].

*Levine D. M., D. F. Stephan, K. A. Szabat,*2016 Statistics for Managers Using Microsoft Excel, 8th edition, Pearson.

Mihaylov, D., 2016. Excel 2013, New star, Sofia, [in Bulgarian]

National Statistical Institute, Bulgaria: Available at: http://www.nsi.bg

Praburaj L, 2018, Role of Agriculture in the Economic Development of a Country, Shanlax International Journal of Commerce, vol. 6, no. 3, pp. 1–5, Available at:https://www.researchgate.net/publication/334645070_Role_of_Agriculture_in_the_Economic_Development_of_a_Country

Stanojević J, B. Krstić, S. Đekić, 2015, An Analysis of the Labour Productivity of the Agricultural Sector in the Republic of Serbia, Economic Themes, 53 (4), pp. 467-482, Available at: http://ekonomsketeme.rs/pdf/et2015en4_02.pdf