

Depopulation of the country and rural areas of Bulgaria and development of digital and precision agriculture in them

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Abstract. During the last decades and years of transition, Bulgaria has seen extremely unfavorable and negative trends in its natural growth. It is entirely negative and reinforced by the rate of net migration and the widespread aging of the country's population leads to very unfavorable results for the population in the rural areas of the country. At the same time, the prerequisites for implementing precision and digital agriculture are being successfully developed in the world, Europe and Bulgaria. The purpose of the present study is to analyze the situation in the country from a demographic point of view, to determine whether the declining population in rural areas is not a prerequisite for the faster emergence of the process of digitization and precision agriculture in rural areas of Bulgaria. For the purposes of our research, scientific, statistical methods, as well as methods of induction, deduction, comparative analysis, GAP analysis were used, and its results can be successfully used and applied by all interested parties.

Between 2000 and 2020, the population of Bulgaria shrank by 1.05 million people. The reasons for this are: negative natural growth, our membership in the European Union, which provokes a large part of the country's young population to look for an opportunity to realize their professional and life path outside the borders of our country. The negative emigration from our country is a major part of the process related to the reduction of the population in Bulgaria and in particular in the rural areas of the country. It is wrongly believed that the population that migrates to Europe and other countries of the world is mainly from the cities. Often, people from rural areas look for opportunities for realization in other countries because of the higher rate of pay they can receive there compared to the pay they receive in their home country. The emigrants from the rural areas of the country are mostly young and middle-aged men who are looking for their fulfillment in the construction or agricultural sector. Very often they are of Roma or Turkish origin, but they are citizens of Bulgaria and make up a large part of the population in these areas. Moreover, these emigrants, once they have established themselves economically in other countries, figuratively speaking, "pull" the rest of their family with them, as they fully take care of his livelihood and well-being. In this way, our country is losing a large part of the minority groups in the rural areas, but we need to note that they are the younger part of the population in these areas, and the aging population above the middle age is mostly of Bulgarian ethnicity, but their children live in the big regional

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cities of Bulgaria or have also migrated abroad. All this results in a much smaller workforce in rural areas of working age and with the competencies to perform the necessary professional tasks and commitments. The following economic facts also have extremely great merit for this intensified process of emigration. Bulgaria is in one of the last places in terms of wages per person of the population of working age, compared to other EU countries. This can be seen from figure one. Bulgaria is in one of the last places in terms of wages per person of the population of working age, compared to other EU countries. This can be seen from figure one. Bulgaria is in one of the last places in terms of wages per person of the population of working age, compared to other EU countries. This can be seen from figure one.

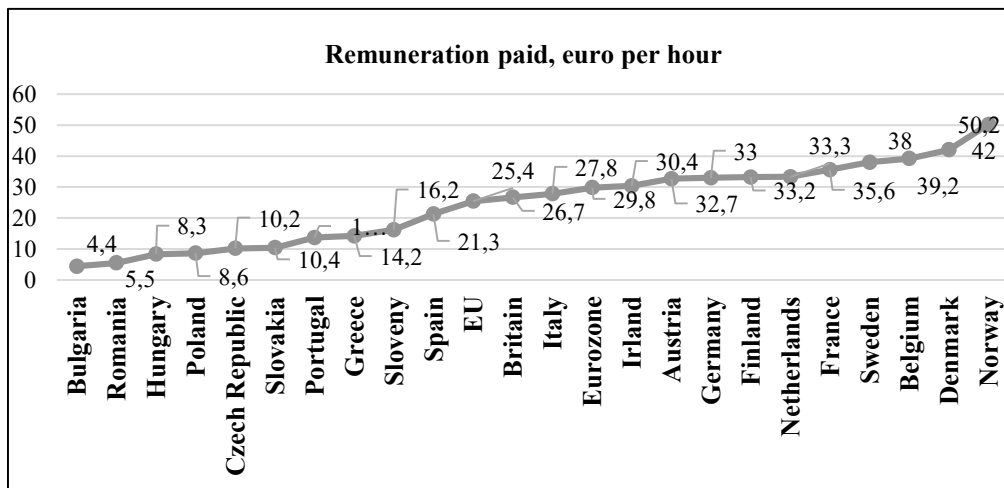


Fig.1. Labor costs in the EU - euro per hour of labor.

Regardless of the fact that labor costs have increased many times over the analyzed period 2000-2020, our country still ranks last in terms of remuneration received in the union. Bulgaria is among the countries with the largest increase in remuneration received in Europe for the period 2004 to 2017 with as much as 8.8% growth in labor costs due to its entry into the European Union and the attempt to reach other European countries, but it remains the most - the low level of labor wages at 4.4 euros per hour (fig. 1). [1] Another important economic indicator by which Bulgaria can be compared with other countries in Europe is unemployment. Unemployment in our country is below the average level in the EU at the level of 4.4% in February 2022. For comparison, unemployment in the European Union in November 2022 remains at the levels of October - 6%, according to Eurostat data, and Unemployment for the same period in 2021 it was 5.3%. In Eastern Europe, unemployment is as follows: Turkey 10%, Romania and Russia 5%, in Ukraine it is significantly higher than 15% due to the war between it and Russia, but in Macedonia it is even more than 20% for the analyzed period. Regardless of the decrease in unemployment in Bulgaria. There are still young and unemployed people in our country who need to retrain in order to find their desired profession and realize themselves professionally through it.

One million three hundred and thirty Bulgarians live beyond the Bulgarian border. They are distributed as follows:

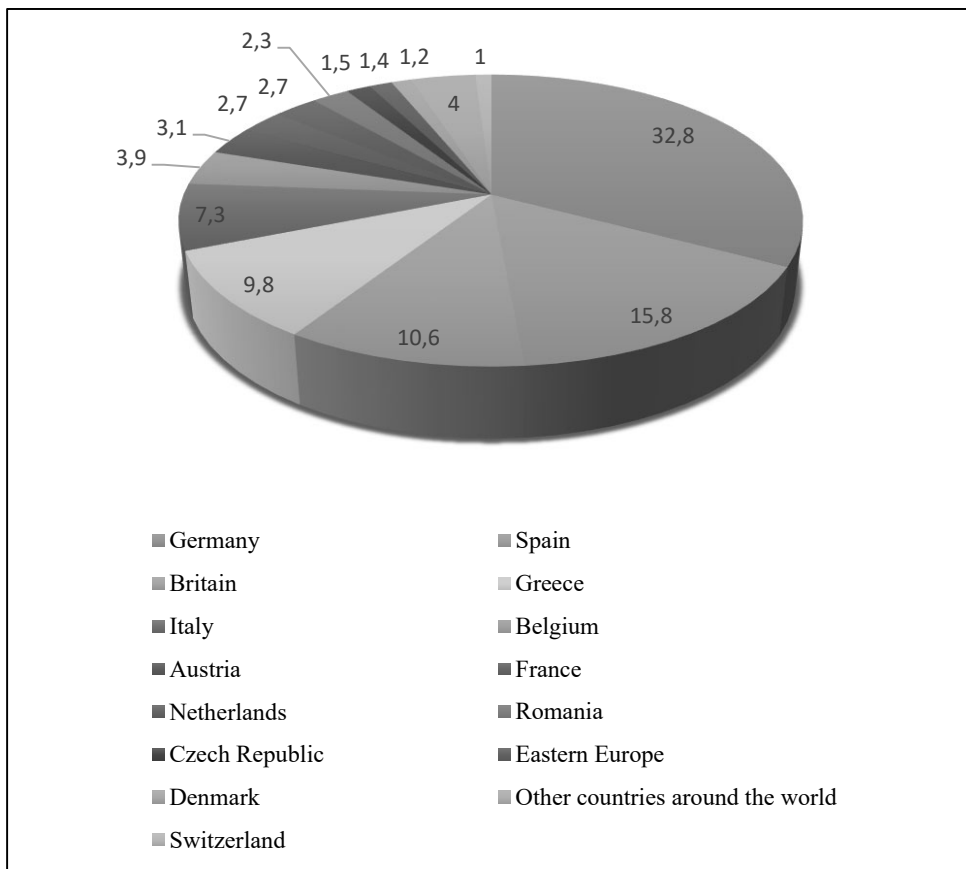


Fig. 2. Percentage share of Bulgarians living in other countries of the world and Europe as of 2018.

From figure two it is clear that the most Bulgarians live and work in Germany (32.8%), followed by Spain (15.8%) and Great Britain (10.6%). 4% live and work outside the European Union, of which a large share are in the USA and Canada, and 1% of Bulgarians abroad work and live in Switzerland. The statistics for one million three hundred and thirty thousand Bulgarians abroad include 410 thousand Bulgarian Turks registered in Turkey and just over 72 thousand people registered in the USA. (fig. 3) With very few exceptions from Canada and Japan, almost all other Bulgarians registered outside Bulgaria are in the EU. (see fig. 2) The most preferred are Germany, Spain and Great Britain and about half a million Bulgarians settled to live in Western Europe leave as soon as Bulgaria becomes part of the European Union.

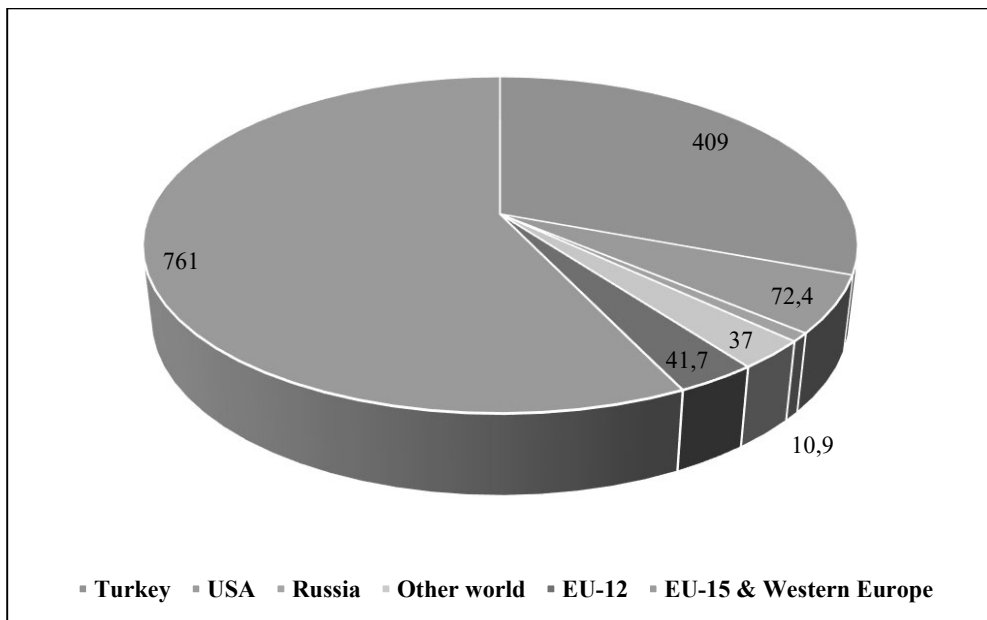


Fig. 3. Bulgarians outside Bulgaria in thousand people.

The effect of the departure of all these Bulgarians affects not only the economic indicators, but also the rural areas of the country and the urban industries. A significant part of the young, able, knowledgeable and competent population from urban and rural areas migrates from the country, which gives us reason to think about how and how we can try to be more attractive to young people so that they stay in Bulgaria and to want to work and live in it. With the introduction of new technologies that have the ability to make a person connected to the whole world regardless of where he is located, a large part of people can live in Bulgaria and work for large Western companies and receive remuneration from them. Moreover, the emergence of artificial intelligence, humanity's last great technological revolution, humanity's internet connectivity, the mobility of information, blockchain technologies, digitization in various sectors provide opportunities to people not only in urban but also in rural environments. In the agricultural sector, there are already fully digitized work processes, both in the field of crop production and in the field of animal breeding. Such are the feeding, milking and watering of the animals. In places, their cleaning and overall care is a fully automated and digitized process. In plants, we have self-functioning farms based on the principle of robotization of the entire work process. Of course, in Bulgaria, these companies are isolated cases, but it is gratifying that they exist and that even in our country this great technical and informational progress is noticeable. digitization in different sectors provide opportunities to people not only in urban but also in rural environment. In the agricultural sector, there are already fully digitized work processes, both in the field of crop production and in the field of animal breeding. Such are the feeding, milking and watering of the animals. In places, their cleaning and overall care is a fully automated and digitized process. In plants, we have self-functioning farms based on the principle of robotization of the entire work process. Of course, in Bulgaria, these companies are isolated cases, but it is gratifying that they exist and that even in our country this great technical and informational progress is noticeable. digitization in different sectors provide opportunities to people not only in urban but also in rural environment. In the agricultural sector, there are already fully digitized work processes, both in the field of crop production and in the field of animal breeding. Such are the feeding, milking and watering of the animals. In places, their cleaning

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In 2021, the agricultural territory of Bulgaria in ha, total for the whole country amounts to 6,059,877.73 ha (NSI data, 2023), and the able-bodied population in our country is 3,775,116, of which 2,850,190 are in the cities, and only 924,926 are able-bodied in the villages of Bulgaria [2]. Another very interesting and provocative fact is that according to the report on the sustainable number of workers in Bulgaria. The volume of the labor force for the analyzed period is not only stable and approximately the same, but even rises slightly due to a greater share of the female workforce participating in the work processes. For the period from 2000 to 2022, the number of women entering the labor market increased and from 46% at the beginning of the period, they increased to 60%. Another very interesting statistic is the participation of the development of the retirement age population in the labor market. For the period from 2012 to 2020 the number of workers has increased from 40 thousand to 60 thousand people, alas, this can be explained by the low and insufficient pensions for the economic standard of living, and despite the fact that they were repeatedly increased by the last governments, the high growth of inflation in recent years melts away much of people's cash at that age. The expectations of economic analysts are that after 2027-2030, labor reserves obtained from working adults will gradually melt away. At the same time, the birth rate in the country is not expected to increase significantly. Bulgaria has an average of 1.54 children per woman for the European Union, which is below what is needed to maintain the current population. In the moderate version of the scenario versions of the report reflecting the population decline in Bulgaria, it is stated, that the negative migration of the population of Bulgaria will continue with about 16 thousand people per year, and the more severe version foresees a negative migration with more than 40 thousand people and a total decrease of more than 66 thousand people working in the country. Here it is important to note that despite all the negative consequences of the war between Ukraine and Russia, a positive trend of young people emigrating from these two countries to our country, it provokes us to hope that our economy has a chance to stabilize and our gross domestic product to grow.

Therefore, since we have established that a large part of the population of working age is in the cities and much smaller in the villages of Bulgaria, one of the possible solutions for less use of human labor is the application of automation and digitization in the agriculture of our country. In fact, precision agriculture has been used in Bulgaria since the mid-sixties of the last century, but it differs quite a bit from modern automated and digitalized agriculture.

Precision agriculture improves with great precision the operations that take place in the field. This is also indicated by his name. An interesting fact is that it has existed as a name since the mid-sixties and early seventies. Then it is mainly associated with the exact dosage of the amount of applied chemical materials, such as mineral fertilizer, plant protection preparations, as well as with the seeding rate and with the quantity and quality of the applied water and pesticides for irrigated crops. "Precision farming technologies started in the late

eighties in the USA and Australia with the development of Global Positioning System (GPS), Geographic Information Systems (GIS), remote sensing and simulation modeling. Their use increases yields, the effectiveness of the application of fertilizers and plant protection products and reduces the agrochemical load on the environment and significantly improves the quality of the crop". [3] Today, precision agriculture is based on modern information systems without which it could not exist in its current form. It is also defined as a specific "technological approach aimed at agricultural management that monitors, measures and analyzes the needs of individual fields and crops" [4] through the application of the combined use of GPS and GIS.

According to the report of the European Parliament, precision agriculture is perceived as "a modern concept of agricultural management, using digital techniques to monitor and optimize agricultural production processes"[5]. Along with the concept of precision agriculture, the concepts of intelligent and digital agriculture appeared at a slightly later stage. Very often, a large part of people outside the agricultural sector, and sometimes in it, consider that these concepts are synonymous and interchangeable, but in fact this is not the case. Smart agriculture differs from precision agriculture in that it does not strive for accuracy in the very processes carried out in the agricultural sector, but rather "focuses on access to analytical and digital data and the use of this data" in the work process. Digitization is a more complex process, which covers the combination of intelligent, precision agriculture and covers the application of all digital data used and applicable by the global information system-Internet. The combination of GSM and GPS technologies gives the information a unique opportunity, transmitted in real time over long distances between different users and the time and location data to reach different users. This is a very good way for various mobile objects of the type of agricultural machinery and means of transport for goods and people, as well as mobile agricultural machinery to be continuously monitored for the course of their actions, as well as to receive continuous information about their location, movement and many other data that are necessary and can be transmitted over GSM channels and collected in one place, on one server, from which, through the relevant terminal devices, they can be visualized and used to make timely operational decisions by those who have persons in the composition of the agricultural company have the right to do so. Except for transmission of GPS positioning, the mobile device used in the agrarian business can be connected to various sensors in order to collect and transmit their data as well. Through the information received from the mobile devices, the movement and operation of the mobile object can be monitored in real time. Information about the location and condition of the agricultural and transport vehicle is obtained at the headquarters, which enables a timely response for the subsequent deployment and management of the agricultural vehicles. This further optimizes the operation of the entire agricultural and vehicle fleet, including all available agricultural self-propelled machines, such as tractors, combines, other agricultural units and possible additional attachments, to which smart devices can also be added. can be connected to various sensors in order to collect and transmit their data as well. Through the information received from the mobile devices, the movement and operation of the mobile object can be monitored in real time. Information about the location and condition of the agricultural and transport vehicle is obtained at the headquarters, which enables a timely response for the subsequent deployment and management of the agricultural vehicles. This further optimizes the operation of the entire agricultural and vehicle fleet, including all available agricultural self-propelled machines, such as tractors, combines, other agricultural units and possible additional attachments, to which smart devices can also be added. can be connected to various sensors in order to collect and transmit their data as well. Through the information received from the mobile devices, the movement and operation of the mobile object can be monitored in real time. Information about the location and condition of the agricultural and transport vehicle is obtained at the headquarters, which enables a timely response for the subsequent deployment

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However, digitization is a much more complex process than precision agriculture. It covers the combination of intelligent, precision agriculture and covers the application of all digital data used and applicable by the global information system-Internet [6]. Gradually, this third phase of precise and intelligent development precedes version 4.0 in the field of world agriculture, which was born in 2010 in America and Western Europe, as a major step towards the evolution related to the development of some of the latest technologies leading to the use of digital sensors, actuators, drones, satellite imagery, low-cost microprocessors, high-quality cellular communications, technological innovation. The main objective of digital farming is to use specialized technique and digital format of all existing systems, as they unite in their use in each of the agrarian processes. The goal is to connect all this in the global information network in order to be able to use the specialized data for the agrarian sector from all agricultural producers, the knowledge and databases reached in the field of agriculture. This is how we gradually reach the essence of digital agriculture, which, according to the German Agricultural Society, represents "the creation of value from data". Or in other words "digital or digital agriculture means to achieve value addition from the availability of specific data and to create from it reasonable intelligence and significant added value." [7], More so by applying digital agriculture in we need much less labor in the agricultural sector,

It is important to summarize that digital (digital) agriculture unites the considered two concepts of precision agriculture and smart agriculture. [8] More precisely, it uses the capabilities of precision agriculture, but also includes smart networks and data management tools, and its main goal is to use the available information and experience to make possible the automation of sustainable processes in the sector, using a significantly smaller number of

workers and employees, as a large part of the work processes are fully automated and digitized. It is highly applicable in both the plant and animal sectors. Fully digitized agricultural farms already exist in Bulgaria, not only in Europe and other highly developed countries of the world. As such a farm we can point out, that of Netko Mitev from Dobrichka region, Agricultural company for the production of essential oil plants “Pavlovi food”, “Saris Essential Oils”, “Ēli’s Herbs”, “Salla Esteit” and many others[9]. We can summarize that digital agriculture provides opportunities for a higher level of management in the sector with fewer but more highly qualified personnel, which is a favorable opportunity for the sharply reduced population in a rural environment.

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