



EFFICIENT FARMING AND TECHNOLOGICAL SOLUTIONS IN THE AGRICULTURAL SECTOR IN BULGARIA

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ABSTRACT

Nowadays, the development of technology in agriculture, as in all other spheres, is extremely dynamic, innovative and progressive, but also incredibly necessary. Modern technologies and technical solutions occupy an increasingly important place and role in agriculture in Bulgaria, which is part of the world economy, which in turn is developing in a continuous process.

The PURPOSE of the research is to analyze these technological solutions and innovations in the agrarian economy and bring them to lower costs, which in turn will increase profit and efficiency.

A research METHOD is an analysis of the introduction of technologies through various innovative solutions such as digitization, automation, robotization, software solutions and others to help farmers renew and modernize their farms. This modernization is necessary to achieve an efficient farm and make the right technological decisions as a RESULT of the study of agro-businesses.

This is necessary, as well as to deal with various problems in the agricultural sector in Bulgaria.

A CONCLUSION from the implementation of innovations in the economy is that it is a good strategy for survival in the national and especially in the international market, as well as for dealing with costs and the possibility of profit. Innovation is needed to adapt to the ever-changing external environment and reduce uncertainty at all levels: international, national and regional.

Key words: technologies, efficient economy, technical solutions, modernization of agriculture, innovations in the agricultural sector

INTRODUCTION

The economic security and progress of Bulgaria has been proven continuously during the last century. Bulgaria's membership in the EU has turned the Common Agricultural Policy (CAP) into a decisive factor for the development of Bulgarian agriculture. In recent years, the positive effect for the industry is expressed in substantial support with European funds, development programs, technical progress, machines and mechanization, automation and an increasing amount of national funds. Agricultural production in the country is characterized by increasing competitiveness and growing market orientation towards national markets. Our country has all the natural resources for effective agriculture and it is not permissible and profitable for Bulgaria to

continue losing positions on the European and world market. The development of Bulgarian agriculture cannot of course be considered independently of external factors; global processes and trends such as population growth, food and feed shortages, and increasing global price volatility; climate change; environmental pollution; the economic and environmental crisis; depletion of natural resources of water, soil, biodiversity; demographic problems; animal and human disease problems; commitments to fulfill EU goals and priorities; higher demands and expectations of consumers for the consumption of safe products and foods. (1) Nevertheless, agriculture is a sector that is flexible and adaptable to the adoption of new technologies to increase the efficiency and productivity of agricultural production. The use of new technologies and technological inputs in the agricultural sector is increasing significantly, developing tools and systems to help farmers and agribusinesses streamline their

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operations and make informed decisions based on needs and trends.

METHODS

The research methods are an analysis of the current state of the Bulgarian agricultural markets and the trends for their future development in technological progress and the technologies that enter modern agriculture. The tools used include gathering information about farms, technical innovations, modern modernized solutions and what part of farms use or wish to use the innovations and are ready for training and qualifications.

There are different types and structures of technological implementations created to help farms and their producers. One of the most significant technological developments in agriculture is the use of so-called precision agriculture. It includes the use of GPS satellites and applications, sensors and other possible technologies to collect data on soil, weather and other factors that can positively affect crop growth. The systematization and collection of this data is used to create customized plans for each field, allowing farmers to optimize irrigation, fertilization and other critical factors and circumstances. Modern technological progress and innovation in the creation of applications, as well as a wide range of modernized machines, allows modern farms to receive the best modernizations and adapted management and quality systems. Advances in technology have made it possible to replace many of the labor-intensive activities associated with agricultural production and manual labor.

Another area where technology is being used in agriculture is the development of autonomous systems. These systems, which can include drones, robots and other advanced automated machines, are able to perform tasks such as planting, watering and even harvesting without the need for human intervention. This not only increases efficiency, but also helps reduce labor costs and improve farm safety.

Another technological advance in agriculture is the use of so-called "smart greenhouses". These greenhouses are equipped with sensors, apps, automated irrigation systems and other assistive technologies that help optimize the environment for growing crops. Their use is intended to lead to higher yields and better quality production, as well as to facilitate the work process and organize it.

Across the spectrum, a number of digital tools and platforms are being developed and are

being developed to help farmers and agribusinesses manage their farming operations more efficiently. For example, there are software systems and applications that allow farmers to track their inventory, plan their supplies, analyze market needs, replace labor-intensive manual work with machines and automation, ensure better production and even sell their produce online.

Modernization in the agrarian sector was most actively noticed through the recently flared pandemic in 2020. Then the farmers' markets were forced to sell their produce online and after the closure of the physical markets, the process of online trading of agrarian goods and services began to be actively implemented. The creation of applications, sites and platforms contributes to the promotion of the product and its faster reach to the end user. Of course, this has its own risks and benefits – impossibility of delivery, confused order or courier errors, as well as consumer woes. But on a positive note, we could say that it is a step forward in technical progress and helps the farmers' union through sales and non-stagnation of goods, as well as reaching a wider range of consumers. In the following years, the hybrid way of trading - physical and online - appeared. Agricultural products, in addition to long-distance, long-distance and national networks, are sold online and in intercontinental networks.

It is expected that technologies in agriculture and agriculture will continue to develop and be implemented in practice after 2023. In many regions of the country, economic producers still work according to the old model of work (with manual labor and without modern technologies), but over time they will be forced economically to go through technological modernization, since the modernization of machines leads to more economically profitable farm management and a more cost effective system.

Spraying crops with a drone is already becoming a standard even in Bulgaria. Smart crop monitoring, smart fertilization and pest control is done with technology and advanced technology tools. Even in Bulgaria, autonomous tractors, combines and other intelligent agricultural equipment are already being used. The deployment of precision agriculture, smart livestock and smart farming technologies is expected to continue in 2023 and beyond. Technology adaptation is stronger in crop

production (especially in mass crops such as wheat and maize) and weaker in livestock production, but technology is advancing and the agricultural industry is modernizing. The process of digitization in agriculture is driven by a serious economic interest: to raise the efficiency of farmers and to replace with machines and technology the increasingly hard-to-find labor force. Therefore, in the coming decades we will witness a slow but sustainable and irreversible digital transformation in the agricultural industry.

Technology plays an increasingly important role in the agricultural industry in the 21st century and determines modern productions and the food situation on a national and global scale. From precision agriculture and autonomous systems to smart greenhouses and digital tools, these technologies are helping farmers and agribusinesses increase efficiency, productivity and profitability. As technology continues to advance, we are likely to witness even more exciting developments in the agricultural sector in the coming years.

The state of agriculture in Bulgaria can be determined through an analysis of the last 10 years of the agrarian sector, aiming to support the preparation for the development of new technical solutions. This analysis is a first step towards deriving orientation strategies to be supported by identifying the needs for their achievement. They relate to farmers' incomes, domestic and international competitiveness, the value chain, employment and young farmers, population health and food consumed. The overall goal is to achieve innovation and digitization in agriculture, efficient farming and technical progress. All analysis is developed based on a wide range of context and related metrics. The study used different methods of analysis to synthesize the main findings and conclusions. (2) The following Table 1 presents the funds that the state allocates to rural farms in Bulgaria, with the aim of increasing their competitiveness and their technical progress, so that the businesses are profitable and effectively sustainable on the national and world market:

Table 1. Authorized funds under measures from the 2014-2020 RDP in 2022.

Measure/submeasure	Authorized subsidy
1. Professional training and skills acquisition	BGN 111,901.36
2. Consulting services for small farmers	BGN 2,409,518.17
3. Investments in agricultural holdings	BGN 37,010,745.68
4. Investments in agricultural holdings under the thematic subprogramme	BGN 1,496,036.26
5. Investments in processing/marketing of agricultural products	BGN 53,533,274.04
6. Damaged agricultural production potential and introduction of appropriate preventive measures	BGN 5,097,841.04
7. Start-up aid for young farmers	BGN 8,849,993.50
8. Start-up aid for the development of small farms	BGN 20,487,005.00
9. Investment support for non-agricultural activities	BGN 13,114,022.82
10. Investments in infrastructure	BGN 122,361,814.71
11. Maintenance and restoration of the cultural and natural heritage of the villages	BGN 3,855,653.52
12. Prevention of damage to forests from forest fires, natural disasters and catastrophic events	BGN 5,710,421.87
13. Restitution of damage to forests from forest fires, natural disasters and catastrophic events	BGN 216,249.40
14. Investments in forestry technologies and in the processing, mobilization and trade of forest products	BGN 1,915,147.64
15. Establishment of producer groups and organizations	BGN 2,042,836.33
16. Cooperation	BGN 2,610,386.77
17. Assistance for preparatory activities	BGN 22,600.00
18. Implementation of operations within local development strategies	BGN 27,222,157.84
19. LAG cooperation activities	BGN 1,023,988.80
20. District revitalization costs	BGN 9,406,962.58
21. Technical assistance	BGN 23,924,453.19

Source: State Fund for Agriculture

By supporting agri-businesses, key problems in unprofitability are solved. The easiest way to understand precision farming is to think of it as anything that makes field practice more precise and controlled. A key component of this agricultural management approach is the use of information technology and a wide range of elements such as: GPS control systems, sensors, unmanned aerial vehicles, mechanical soil sampling, automated hardware and software. Opportunities are created to manage the processes in the farm with maximum precision and efficiency, reducing losses and maintaining a low cost of production (3).

The food industry has always been and will be at the forefront of adopting new technologies needed to improve efficiency, reduce waste globally and nationally, and improve the safety and quality of food products. In recent years, there has been a high jump in the development and implementation of various technologies in the food industry. One such technology that has gained widespread popularity in the food industry is automation. Automation has a significant role in streamlining the production process, reducing the need for manual labor and increasing the consistency and accuracy of food products. Robotics, for example, are increasingly being used in the food industry for tasks such as packaging, sorting and palletizing, delivery and more. Another key technology in the food industry is the Internet of Things (IoT). IoT refers to an interconnected network of devices, sensors, and systems that can collect and exchange data over the Internet. In the food industry, IoT is used to monitor and control various aspects of the production process, such as temperature, humidity and pH levels. This helps ensure that food products are consistently of high quality and safe for consumption. It is expected that even after 2023, more technologies will be developed and implemented in practice in the food industry and agriculture. The trend is towards more efficient ways of sourcing food, and it's economically sound, so it's not going to die down. Science, innovation and entrepreneurship in the food industry will continue to seek new and more effective ways to improve the quality, cost and availability of food. (4)

Further development of new and new technologies for indoor food production without the need to use the land is expected, stimulated by climate change and the scarcity of clean land

and water, as well as the threat of logistical problems.

The growth of bio-based agricultural production will drive the development and implementation of innovations in this field: new harmless pest control technologies, free of chemical pesticides, industrial pollutants and genetic engineering, indoor bio-production, production of new healthier foods and drinks, made from organic vegetables, legumes, mushrooms and fruits and more.

Due to the increasing number of pandemics, viruses and various diseases, healthy eating will continue to make its way over the next 10 years, albeit under pressure from the big interests in the food industry, fast food chains and the pharmaceutical industry. And in this direction, work will be done on the creation of organic agriculture on a larger scale and with a wider range of technological solutions. Organic products are an indispensable part of a healthy lifestyle and the quality of the product is of great importance to humanity. The European Union sets high goals in the Biodiversity Strategy in a short plan, and in Bulgaria they come with the question of whether they are achievable and are there any obstacles to their development? The logic of the creation of the organic products market is largely determined and depends on consumer demand and the extent to which the "Organic production" sector meets consumer requirements and incomes. It is understandable that the prices of organic products at home and abroad differ drastically, as the minimum wage and income of an average family differs. It is generally accepted that products are competitive when they are produced with higher quality and higher quality resource at lower production costs than competitors. The competitiveness of the products is directly related to the economic aspect and to the factors that affect its increase or decrease. Biological production can be defined as a novelty in agriculture, which is not reduced only to agricultural practice, but has its philosophical, social, institutional and environmental roots. The sustainability of the functioning of the food chain is generally perceived as the ability to respond to problems, challenges and trends of a different nature - economic, regulatory and societal. Of course, the market of biological products is not determined and coordinated by a single principle, but obeys the action of these three different aspects - public or social, regulatory (institutional) and economic (price

and profit). In addition, we also have an ecological aspect, which is related to a basic value that most consumers share – namely the protection of the environment, human and animal health. (5)

RESULTS

It can be summarized that for a more sustainable functioning of the food chain of organic production, many objective and subjective factors play a role: increasing the area of crops grown organically in our country, and hence - the amount of organic production; expanding the range of organically grown crops as a guarantee to diversify the range of organic products offered; the trend for a significant increase in the consumption of organic foods worldwide and in our country; the level of consumer awareness about the composition and quality of the products; the prices of organic products; diversifying the assortment and increasing the quality of organic products; the state policy regarding organic farming; and others. Across the spectrum, there are and are being created a number of digital tools and platforms that are being developed to help farmers and agribusinesses manage their operations more efficiently. For example, there are now software systems that allow farmers to track their inventory, schedule deliveries and even sell their produce online. The result of the research is that Bulgaria's policy follows the new CAP of the EU, which will provide financial and qualification trends for the development of Bulgarian agriculture and determine the scientific and technical progress in crop cultivation, animal husbandry and the agrarian sector in general. The goal of the entire innovation is to reach a maximum competitive market and increase the quality of production and organic agriculture.

CONCLUSION

One of the main tasks is to preserve and renew organic production with all its values and in the logic of its structure, in order to provide producers with an adequate payment for their work and increase competitiveness on a global scale. By promoting the transition to a sustainable and healthy diet, through consumer education and innovation in agriculture and the food industry; reduction of energy and water consumption in processing, rationalization of food transport and distribution, and achieving a wide variety of healthy, high-quality and safe food products for all, it is possible to achieve balance and efficiency of farms in the coming

years. To this end, it is necessary to pay attention to consumer preferences, attitudes, needs, behavior, lifestyle, education and the cultural element of food quality, but it is also necessary to improve communication between consumers, producers and the scientific research community dealing with the food chain as well as stakeholders in the field to improve the general public understanding of food production and to enable informed choices, sustainable and healthy consumption, and thereby strengthen their impact on production, inclusive growth and quality of life. Last but not least is the implementation of innovations in the economy and technical progress, the robotization of machines, applications and the facilitation of work in the agricultural sector. This is a good strategy for the survival of rural farms in the national and especially in the international market, as well as to cope with higher costs and the possibility of higher profit and efficiency of the farm. Innovations are needed to adapt to the constantly changing external environment and reduce uncertainty at all levels: international, national and regional level and increase competitiveness.(6)

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