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E-ROLNICTWO JAKO CZYNNIK EFEKTYWNOŚCI WZROSTU SEKTORA ROLNEGO UKRAINY

Streszczenie: W tej pracy przedstawiono główne wyzwania/problemy sektora rolnictwa na Ukrainie. Wzrost ekonomiczny jest krytycznym czynnikiem w pokonaniu problemu niedożywienia. Ponadto, ten proces powinien być wszechstronny oraz obejmować różne aspekty życia społecznego, aby zapewnić poprawę warunków życia najbiedniejszej części populacji danego kraju. Jednym z ważniejszych aspektów osiągnięcia tego celu jest podniesienie wydajności pracy oraz poziomu dochodów małych farm rodzinnych. W odniesieniu do tychże celów, rolnictwo odgrywa kluczową rolę tj. we wzroście dochodów segmentu ludzi ubogich i jest ono 4 razy bardziej wydajne niż inne sektory ekonomii. Światowe dane dowodzą, że rozwój rolnictwa jest kluczowym dla efektywnej redukcji niedożywienia. Technologie informacyjne oraz automatyzacja odgrywają kluczową role w pomocy przedsiębiorstwom rolniczym w podniesieniu efektywności, konkurencyjności oraz odporności na zmiany. W artykule zestawiono listę publikacji zawierających wiedzę źródłową do omówionych kwestii

Słowa kluczowe: rolnictwo, E-rolnictwo, Sektor rolniczy, Technologie informacyjno-komunikacyjne, Technologia

E-AGRICULTURE AS A FACTOR OF EFFICIENCY IN UKRAINE'S AGRICULTURAL SECTOR

Summary: This work explores key avenues for addressing challenges in Ukraine's agricultural sector. Economic growth is a critical factor in combating societal undernourishment. However, this process must be comprehensive and encompass various aspects of life to ensure the improvement of the living conditions of the impoverished segments of the population. One of the crucial components in achieving this goal is raising labor productivity and income levels in small family farms. In this regard, agriculture plays a pivotal role in increasing the income of the poorer segments of the population and is approximately four times more efficient than other sectors of the economy. Real-world evidence demonstrates that the development of agriculture is critical for sustainable reduction in undernourishment. Information technologies and automation play a key role in helping agricultural enterprises enhance the efficiency, competitiveness, and resilience to change. The paper includes references to sources that elucidate the presented material.

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1. Introduction

Many services in the field of information and communication technologies have become commonplace worldwide and will undoubtedly continue to spread faster than before, especially with the commercialization of 5G and mobility restrictions in response to the COVID-19 pandemic. Although there is concern that the use of information and communication technologies may increase energy consumption and greenhouse gas emissions, information and communication technologies also contribute to reducing greenhouse gas emissions through increased productivity and reduced mobility. The results showed that the spread of information and communication technology services, especially some artificial intelligence-based services, can increase productivity in most sectors due to labor savings and contribute to improving gross domestic product [1]. Based on this, the activation of agricultural development and rural areas by improving access to valuable information remains one of the current problems, despite the fact that computers and electronics in agriculture provide international coverage of achievements in the development and application of computer equipment, software, electronic devices and management systems to solve problems in agriculture, including agronomy, horticulture (both in food aspects and in landscaping), forestry, aquaculture, livestock, there is still a fact that there is no instant payback, despite this, over the past two decades information and communication technologies have made significant progress.

Industrial information and communication technologies and daily online information and communication technology services have become commonplace worldwide. Information and communication technologies as a sector have already had and will continue to have a major impact on economic and social activity, such as GDP growth, employment, productivity, and quality of life. Information and communication technologies also significantly contribute to productivity improvement in the industry [1].

Information and communication technologies not only contributed to economic growth and convenience of life but also reduced the impact on the environment. Information and communication technologies can be used to make our production and consumption models more sustainable.

In connection with the above, it can be determined that timely availability of information, i.e., e-agriculture systems affect the acceleration of problem-solving in the agricultural sector.

Researches and scientific works of S.V. Voitko, S.G. Diorditsa, A.G. Litvak, N.B. Kirich, N.S. Medzhibovskaya, T.V. Sakalosh, Z.M. Sokolovskaya contributed significantly to the development of modern information technologies in enterprise management. Each of them made an important contribution to the development of the use of information and communication technology in the agricultural sector.

2. Electronic agriculture

E-agriculture is a global community of practitioners promoting dialogue, information and idea exchange related to the use of information and communication technologies for sustainable agricultural and rural development.

Digital technologies are transforming agriculture and offering new opportunities for policy improvement. Digital technologies, including the Internet, mobile technologies and devices, data analysis, artificial intelligence, digital services and applications are changing agriculture and the food system [21].

Examples can be given at various stages of the agri-food value creation chain:

1. Automation of agricultural machinery allows precise adjustment of input resources and reduces demand for manual labor;
2. Remote satellite data and on-site sensors increase accuracy and reduce the cost of monitoring crop growth and soil or water quality;
3. Tracking technologies and digital logistics services offer potential for optimizing agri-food supply chains, while providing reliable information for consumers.

Digital technologies can also help governments improve the efficiency and effectiveness of existing policies and programs, as well as develop better ones. For example, available and high-quality satellite images significantly reduce the costs of monitoring many types of agricultural activities. This can allow governments to move towards more targeted policies that pay (or fine) farmers based on observed environmental outcomes. In addition to monitoring compliance with environmental policies, digital technologies allow automating administrative processes for agriculture and developing advanced government services, for example, regarding advisory or consulting services. Finally, digital technologies can support trade in agricultural and food products by connecting private sector suppliers to new markets and creating new ways for governments to control and ensure compliance with standards, as well as provide faster and more efficient border procedures necessary for perishable products [2].

E-agriculture systems provide a wide range of benefits to the agricultural sector. According to the Food and Agriculture Organization of the United Nations, digital technologies are transforming agriculture and food production by improving smallholder access to information, resources, and markets, increasing production and productivity, optimizing supply chains, and reducing operational costs [3].

Digital agriculture helps increase yields, reduce food loss and waste, as well as helps farmers get fair pay for what they produce. When farmers receive the information they need in a timely manner, they can ensure that the product is sent to the right market and sold at a fair price [4].

In addition, e-agriculture systems give producers more control over crop and livestock production, processing, distribution, and storage. This leads to greater efficiency and lower prices, safer growing conditions and safer food products, reduced environmental impact [5].

Overall, e-agriculture systems have the potential to revolutionize the agricultural sector by making it more efficient, productive, resilient, and profitable..

3. Features of Agriculture in Ukraine.

The Agriculture in Ukraine is one of the leading sectors of the country's economy, aimed at providing the population with food and raw materials for industry. Ukrainian agriculture quickly became one of the largest grain exporters.

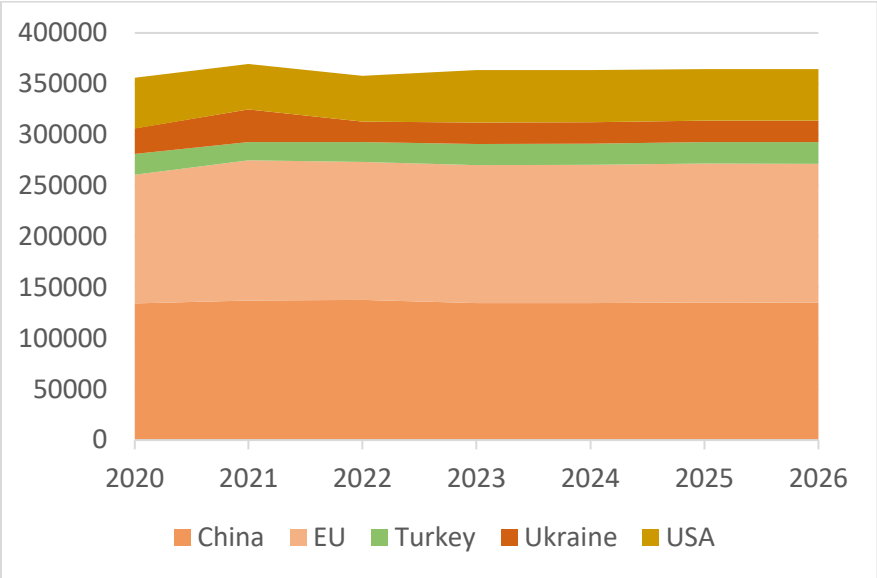

Figure 1. Wheat production with a forecast until 2026

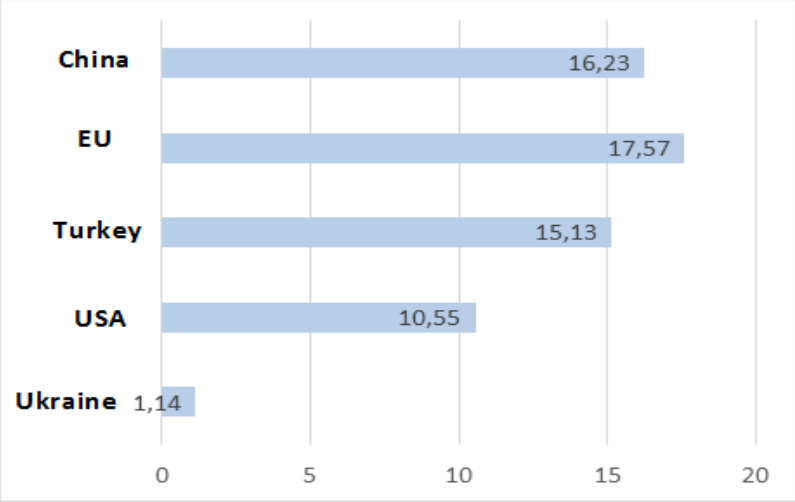

Figure 2. Support for agriculture as of 2021 as a percentage of the gross farm revenue

Ukraine's agriculture can be described as one of the least subsidized in the world. For example, in the European Union, direct subsidies to agricultural producers make up about 30-40%. In contrast, in Ukraine, subsidies are very limited and often negative, similar to the situation in New Zealand and Australia. Despite this, the Ukrainian agro-sector continues to develop [6].

Previously in Ukraine, it was impossible to buy land and, for example, pledge it to banks to attract money for investments. At the same time, the European corporate system allowed farmers to create agricultural credit cooperatives, which later became some of the largest banks in the world, transfer these lands to banks as collateral and receive good money.

Despite the absence of such mechanisms for Ukrainian companies, they invested all their investments in improving the lands. For the success story of Ukraine's agricultural sector to take place, Ukrainian companies, without relying on government support, worked as vertically integrated companies throughout the production and sales chain, raised their standards, became transparent, introduced modern technologies, attracted international capital, went public [20].

In Ukraine's agriculture, in addition to positive aspects, there are problems, among which is the predominance of old traditional technologies, which is associated with a slow pace of innovative renewal. At the same time, the development of the agricultural sector of the economy is going ahead of other sectors of the economy.

Today, Ukraine's agricultural sector faces a number of problems such as low production efficiency, insufficient mechanization and automation of processes, high production costs, poor product quality and others. However, electronic agriculture can help solve some of these problems [7].

Electronic agriculture is the use of modern technologies and information systems to improve efficiency and quality of production. It can help in collecting and analyzing data about soils, climatic conditions, plants and animals, which allows reducing the amount of production costs and improving product quality [8]. In addition, electronic agriculture can help improve mechanization and automation of the production process, reducing the amount of manual labor required [2].

However, not all farmers have access to such technologies due to their high cost. Therefore, to improve the situation in Ukraine's agricultural sector, it is necessary to create a favorable infrastructure for the development of electronic agriculture and provide access to these technologies for all farms [7].

The agricultural sector in Ukraine faces a number of problems that affect its efficiency and profitability. One of the biggest problems is insufficient mechanization and automation of processes that lead to increased production costs. In addition, the agricultural sector faces a problem of poor product quality that reduces competitiveness of Ukrainian goods on world market [7].

Other problems include high level of corruption, insufficient state support and complex economic situation in country In addition to this, Ukraine's agricultural sector faces environmental safety issues such as soil pollution and water bodies [9].

However, electronic agriculture can help solve some of these problems. It can help in collecting and analyzing data about soils, climatic conditions, plants and animals which allows reducing amount of production costs and improving product quality [8]. In addition to this electronic agriculture can help improve mechanization and automation of production process reducing amount of manual labor required [2].

4. Technologies for precision agriculture in Ukraine's agricultural sector

The agricultural sector in Ukraine can benefit from various technologies to improve efficiency and quality of production. One such technology is precision farming. It involves the use of modern technologies, such as GPS, sensors, mapping, and data analysis, to optimize production. Precision farming can help reduce production costs, improve product quality, and increase yield [10].

Precision farming has several advantages, such as:

1. Reducing production costs: The use of precision farming allows farmers to more accurately determine the needs of plants for fertilizers and other resources.
2. Improving product quality: Precision farming allows farmers to more accurately control the condition of the soil and plants, which helps improve product quality.
3. Increasing yield: The use of precision farming allows farmers to optimize production and increase yield [11].

Another technology that can be useful for Ukraine's agricultural sector is unmanned aerial vehicles (drones).

Drones can be useful for Ukraine's agricultural sector for several reasons. Firstly, they can be used for monitoring crop conditions, collecting data on soils and climatic conditions, as well as for spraying fertilizers and plant protection products. The use of drones can help reduce the amount of manual labor and improve the accuracy of fertilizer and other substance applications [12].

Drones can also be used for mapping territory and analyzing crop conditions. They can collect data on soil, humidity, plants, and other parameters, allowing farmers to more accurately control the condition of their crops and make effective decisions [13].

Figure 3. Main components of drones

Finally, drones can be used for herd monitoring. They can collect data on the number of animals, their health status, and other parameters, allowing farmers to more accurately control the condition of their animals and make effective decisions [14].

Other technologies that can be useful for Ukraine's agricultural sector include:

1. Automated irrigation control systems: These systems allow farmers to accurately control the amount of water used for irrigation, which can reduce water costs and improve irrigation efficiency [2].
2. Soil condition monitoring systems: These systems allow farmers to accurately control the condition of the soil and determine which plants grow best on certain plots of land. This helps farmers optimize production and increase yield [15].
3. Plant condition monitoring systems: These systems allow farmers to accurately control the condition of their plants and timely detect diseases and pests. This helps farmers prevent the spread of diseases and pests and preserve their crops [16].
4. Herd monitoring systems: These systems allow farmers to accurately control the condition of their animals and timely detect diseases and other problems. This helps farmers prevent the spread of diseases and preserve their animals [17].

5. Conclusion

Agriculture is an important sector of the economy, and it faces numerous challenges and problems such as climate change, resource depletion, loss of fertile soils, and food security. To solve these problems, it is important to actively use scientific research and information technologies.

Digital agriculture and digital technologies play an important role in the modern agricultural sector. They contribute to increasing productivity, resilience, and efficiency of agriculture. The application of information and communication technologies, monitoring and data analysis, process automation allows producers to obtain accurate information, optimize production, reduce losses, and promote sustainable development of agriculture.

Digital technologies also open up new opportunities for policy and governments in the agri-food sector. They allow for more efficient implementation and control of environmental standards, support consumers, and optimize supply chains. In addition, digital technologies contribute to increasing farmers' incomes and ensuring their competitiveness in the market.

Ukraine's agriculture is an important sector of the economy that has already achieved success on the world market thanks to the competitiveness and production efforts of private companies. Despite the successes achieved, there are problems in agriculture such as insufficient mechanization, high costs, low product quality, and others. An important step in solving these problems could be the introduction of digital agriculture, which will help in collecting and analyzing data, improving technologies, and increasing production efficiency. However, for successful implementation of digital agriculture, it is necessary to create an appropriate infrastructure and ensure access to these technologies for all farm enterprises.

Ukraine's agricultural sector has significant potential for improving efficiency and quality of production through the use of modern technologies such as precision farming and unmanned aerial vehicles (drones). These technologies allow reducing costs, improving product quality, and increasing yield. In addition, irrigation automation systems, soil monitoring systems, plant monitoring systems as well as animal condition monitoring systems contribute to optimizing production and conserving resources.

In response to the challenges facing the agricultural sector, farmers and agricultural enterprises should actively implement these technologies and constantly improve their practices. This will not only increase the efficiency of agriculture but also improve the competitiveness of Ukrainian agricultural products on the world market.

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