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INNOVATIONS IN AGRICULTURE: NECESSITY, PROBLEMS AND OPPORTUNITIES

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Abstract
The article deals with the issues of defining the essence and necessity of introducing innovations in the agricultural sector. The main factors that enhance and stimulate innovations in agriculture are highlighted. Public investments in agricultural R&D considered as a significant policy lever for supporting long-run productivity growth in the sector. The main approaches to the classification of innovations in the agricultural sector are considered. The examples of innovation impact on changing agriculture around the world are studied. It is justified that the priority area of innovation is introduction of the most promising agricultural technologies to increase production productivity in order reducing unit costs and strengthening its competitiveness domestically and globally markets.

Keywords: innovation; economic development; agricultural sector; R&D; innovative development of enterprise; public investments; classification of innovations.

Introduction.

Innovation is more important in modern agriculture than ever before. The industry as a whole is facing huge challenges, from rising costs of supplies, a shortage of labor, and changes in consumer preferences for transparency and sustainability. There is increasing recognition from agriculture corporations that solutions are needed for these challenges. In the last 10 years, agriculture technology has seen a huge growth in investment, with $6.7 billion invested in the last 5 years and $1.9 billion in the last year alone.

Ukraine in the context of integration into the world the economy should ensure that innovative development is stimulated by all spheres of economy, as the latest paradigm of development is emerging is based on the use of innovation. The modern paradigm of economic development puts new challenges and challenges ahead Ukrainian enterprises of the agricultural

sector. These tasks require scientifically sound solutions, so it arises the need for formation and effective implementation adequate to modern realities enterprise innovation development strategies, which is a "critical" condition for improving product competitiveness and sustainable development of enterprises.

Innovation in agriculture occurs in response to the requirements of increasing the competitiveness of the agricultural sector, given the intensification of social and political pressures on combating the climate changes effects and ensuring food safety. Through innovation in agriculture is seeking for new solutions to increase the performance of economic entities in this domain and also to ensure sustainable development of the agricultural domain. The conducted research involved, first, a theoretical approach based on reviewing the specialized literature, which allowed, later, devising an empirical study on the relationship innovation - performance in agriculture, at the European Union level.

Literature Review

The agricultural innovation approaches have become increasingly popular as a framework to analyse, and explore solutions to, complex agricultural problems. Scientists from all over the world (Alston, Bokusheva, Cechura, Henderson, Joly Lankoski, Pardey and many others [1-15] are trying to form a theoretical, methodological and practical basis for explaining the impact of innovation on the agricultural sector, and, of course, to direct this impact in the right direction.

From the literature review, we drew out the following conclusions on the impact of innovation on the performance of agriculture: innovation increases the productivity of factors, reduce the dependence of agriculture to the natural factors, less controllable, with a positive effect on economic performance, innovation processes involves reduction of production costs from agriculture, and innovation has a positive impact on the growth of the company's environmental performance by promoting resource conservation practices. Taking everything into account, it is necessary to continue further research on the main direct innovations in the agricultural sector and the possibility of their application in the domestic market.

Results and discussions

The most important task of agriculture is the production of competitive products, which is possible only using the achievements of scientific and technological progress, which are based on innovative processes that allow continuous updating of agricultural production. Thus, using and introducing innovative developments, an agricultural enterprise reduces costs, increases production volumes, profits, conquers sales markets, contributes to increased economic efficiency and the development of the national economy.

Within agro-industrial complex, innovations represent the implementation in economic practice of research and development results in the form of new varieties of plants, breeds and species of animals and poultry crosses, food products, materials, crop production technologies, animal husbandry and processing industry, fertilizers and plant protection products and animals, methods of prevention and treatment of animals and birds, forms of organization, financing and lending to production, approaches to training, retraining and advanced training of personnel, forms of organization and management of various sectors of the economy, approaches to social services to improve production efficiency.

Recently, words such as 'innovation' and 'innovative development' have become fashionable and often used in conversation. At the same time, the agro-industrial complex is currently experiencing a huge innovation crisis, which is associated with the insufficient development of the scientific and technical direction in the field of agriculture. If we compare the use of the Ukrainian innovative potential with the leading countries of the world, then it is used only 5-6%, while in the USA this indicator is about 50%. Each year, about 40-50% of agricultural scientific and technical achievements and developments remain unclaimed.

According to the review by Philippe Mauguin, President of National Institute of Agronomic Research (France) and Louise O. Fresco, President Wageningen University and Research (the Netherlands) [11], we can underline the main global reasons that stimulate agricultural innovations (table 1).

Table 1

Factors that enhance and stimulate innovations in agriculture [11]

1. Food and nutrition security and safety, asking for resource efficiency.	The world population may rise to nearly 10.5 billion by 2100. The demand for food will therefore probably increase by even more than the growth in population suggests. Improved resource efficiency is needed and Europe has to play a role in an open global trade system. Some countries have a high percentage of good agricultural soils, an exceptional level of know-how, sufficient water availability and an attractive climate.
2. Climate change influencing water availability, energy use and animal production.	Rising temperatures and changes in weather patterns may cause flooding, droughts and disease, all of which influence food production and food safety. They also lead to income risks for farmers.
3. Ecological impacts having to be reduced by increasing resource use efficiency in a circular economy.	The agricultural sector and food systems also face major challenges related to the environment and biodiversity. The chemical revolution of the 20th century has led to an agricultural system which is essentially based on high inputs of fossil energy, synthetic fertilisers, pesticides and antibiotics. These have brought and continue to bring many advantages. Intensive use of soils and monocultures without proper soil management leads to problems such as depletion of organic matter and soil biota, over-compacting caused by heavy machinery, erosion, and

	the spread of certain bacteria, fungi and weeds. More attention needs to be paid to issues related to biodiversity, landscape and nature management.
4. A lifelong healthy life-style requiring healthy diets and a green environment.	The majority of chronic diseases such as type 2 diabetes, cardiovascular diseases, certain types of cancer and obesity are linked to food intake and lifestyle. Many EU consumers eat more meat than is advisable and do not eat enough fruit and vegetables to get the intakes they require. These challenges are not a direct result of problems created by agriculture, but agriculture can be part of the solution. Agriculture in and around cities (peri-urban) can contribute to a healthy environment and lifestyle (smart cities). Digital innovations in food products (including the breeding of crops and personalised nutrition) can make healthy diets more available and affordable.
5. Rural areas facing different challenges.	Current trends in demographics, urbanization and an increase in farm size are resulting in an empty countryside. Also, within rural areas, the population clusters in cities and large towns. This leads to questions on vital infrastructure (such as broadband for precision farming and electricity for the machines of the future). It also provides opportunities to refocus regional strategies on bioeconomy, energy production and conservation of biodiversity.

Changes in the external systems of enterprises lead to the need for changes inside. This leads to apply innovative solutions in the enterprise. We can say that innovation exists at the core of organisations operating in today's fast changing business world. Though innovation is critical to organisational success, scientists and entrepreneurs agree that the innovation process is complex and not easily managed. Recent studies show that the majority of innovating firms are not primary innovators who develop innovations themselves but are instead secondry innovators who derive value from technologies developed by primary innovators.

In the agricultural sector, in contrast to other areas of the economy, the development of innovation is slower, which requires special attention and the search for additional incentives. It is extremely important during the development and implementation of innovation strategies to identify sources of innovation in the agricultural sector, their classification and tools.

According to investigation undertaken by A. Bugara [3], there are three main areas of innovation at agricultural enterprises:

1) innovation by the human factor - training of the highly skilled people in order to use new machinery, equipment and technologies;

2) innovation of biological factor - the development and mastering of innovations that affect the fertility of the land, increased productivity of animals and the yields of new and existing crops.

3) technogenic factor innovations - aiming at improving the technological and technological potential of an agricultural enterprise.

However, the peculiarities of the formation and development of the innovation process in agriculture require the expansion of the following typology. One of the most appropriate classifications, taking into account the specifics of innovation in the agricultural sector, is the classification by subject and scope in rural areas, developed by O. Donets (Figure 1).
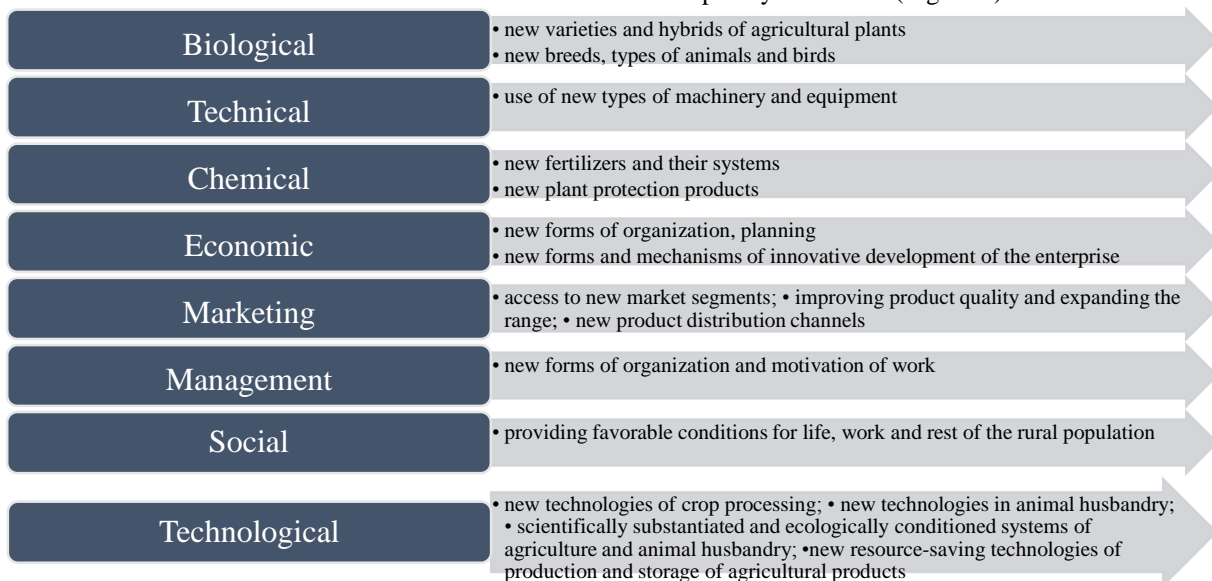
Biological	• new varieties and hybrids of agricultural plants • new breeds, types of animals and birds
Technical	• use of new types of machinery and equipment
Chemical	• new fertilizers and their systems • new plant protection products
Economic	• new forms of organization, planning • new forms and mechanisms of innovative development of the enterprise
Marketing	• access to new market segments; • improving product quality and expanding the range; • new product distribution channels
Management	• new forms of organization and motivation of work
Social	• providing favorable conditions for life, work and rest of the rural population
Technological	• new technologies of crop processing; • new technologies in animal husbandry; • scientifically substantiated and ecologically conditioned systems of agriculture and animal husbandry; •new resource-saving technologies of production and storage of agricultural products

Figure 1. Classification of innovations at agricultural enterprises [4]

Consideration the characteristics of the agricultural sector is closely related to the possibility of applying certain innovations. In agriculture, innovation processes have a number of features arising from the specifics of agricultural production:

- species diversity of agricultural products;

- interweaving of technological processes with processes occurring in the natural environment, participation in the production of living organisms (plants, animals, microorganisms);

- significant differences in agricultural production technologies, their dependence on unpredictable weather and climatic conditions;

- seasonality of production processes of certain types of agricultural products;

- territorial fragmentation of agricultural production;

- the relative isolation of the various types of agricultural producers by ownership, specialization, size, integration and cooperation; - weak relationship between agricultural producers and organizations producing scientific and technical products;

- insufficient activity of innovation in agriculture, due to the lack of solvent demand for scientific, technical and high-tech products;

- potential consumers of innovations in agriculture, as a rule, do not have enough own funds and are characterized by low creditworthiness to attract credit and investment resources, as a result of which innovative processes in agriculture are impossible without state participation and effective state support;

- low standard of living in the village;

- insufficient qualifications of agricultural workers in the field of innovation management;

- the variety of scientific and technical developments proposed for use in the agricultural sector, their various target areas;

- a long process of developing innovations, primarily in connection with the selection and breeding work;

- insufficient elaboration of the organizational and economic mechanism for transferring the achievements of scientific and technical progress to farmers;

- innovation, as a rule, is improving, not radical.

An important component of the formation of innovation processes is undoubtedly agricultural science and research. At the same time, the state policy in the field of agricultural research development plays perhaps the most important role. The need for technological development in agriculture to achieve "sustainable intensification" is on the agenda of governments and international bodies. Innovation is also at the centre of the EU2020 strategy. New technologies and their adoption by EU farmers are key drivers in maintaining European agriculture competitive in a global world. While the potential of technological development for sustainability of agriculture is acknowledged, there is a global trend towards increased regulation of new technologies in agriculture

According to the opinion of Director-General Jerzy Plewa, Directorate-General for Agriculture and Rural Development, European Commission, agricultural research and innovation have a major contribution to make in ensuring food security in the long term, addressing the environmental sustainability and resilience of competitive land-based primary production for food and non-food systems and boosting the sustainable growth of rural territories.

Besides, incorporating research and innovation activities into a long-term strategy will make it easier to identify strategic areas of short-, medium- and long-term interest, and thereby improve their overall consistency, sequencing and impact. The process for developing the European Commission's long-term strategy for EU agriculture research and innovation was launched in Milan in June 2015 and subsequently discussed at the conference Designing the path: a strategic approach to EU agricultural research and innovation, in January 2016. The outcome of a year-long process to develop this strategic approach took the form of a final paper that set out the priority areas for agricultural research and innovation along with details of how the strategy was to be implemented. The European Commission took stock of the implementation of the strategy at a conference in May 2018 AgriResearch: innovating for the future of farming and rural communities.

The strategy identifies five priority areas for research and innovation, namely:

– resource management – notably soil, water, nutrients and genetic resources, where the aim is to strike a balance between productivity and environmental goals in agriculture through efficient resource use;

– healthier plants and animals – involving research on tools to prevent and control plants and diseases and a holistic one health approach;

– integrated ecological approaches – for example, research into better use of ecosystem services instead of external inputs and developing specific farming systems such as organic and mixed farming systems;

– new openings for rural growth – involving the deployment of new business models, circular value chains and digital transformation to sustain and boost rural economies; 5 enhancing the human and social capital and rural areas through innovation networks, advisory services and demonstration sites in rural areas.

In terms of implementation issues, six key features were identified at the time namely: I. being strategic in the design and management of EU programmes, structuring the action in the long run to ensure consistency and impact; II. encouraging synergies between Member States and the EU framework programme for research and innovation (Horizon 2020 is the current one, Horizon Europe will be the next framework programme from 2021 to 2027); III. increasing international cooperation to pool existing expertise and capacities; IV. providing more space for new approaches, especially through initiatives that trigger bottom up innovation; V. developing greater synergies between the public and private sectors with a focus on the implementation of research by boosting demand-driven innovation, via the pursuit of an interactive innovation model through a process of 'genuine cocreation of knowledge' (see explanatory note in Box 2); VI. in Horizon 2020, making the interactive innovation model operational through a multi-actor approach in which all actors in the knowledge and innovation system work to co-create solutions [6; 7; 9].

Further sources of evaluative evidence on the impact of investment in agricultural research and innovation include: work undertaken by the National Institute for Agricultural Research (INRA) in France involving

its ASIRPA project, which sought to analyse the impacts of publicly funded agricultural research, published in June 2014; the findings of the IMPRESA project funded under the seventh framework programme between 2013 and 2016, which sought to measure and assess the socioeconomic impacts of agricultural research in Europe; the interim evaluation of Horizon 2020 – Societal Challenge published in 2017; and DG AGRI's external evaluation study of the implementation of the EIP for agricultural productivity and sustainability, published in November 2016 [6; 7; 9].

Public investments in agricultural R&D have been a significant policy lever for supporting long-run productivity growth in the sector. For most high-income countries, agriculture accounts for a greater percentage of public research spending than agriculture's share of the economy, at both national and aggregate levels. Research by the private sector has assumed a larger role in food and agriculture innovation, and worldwide, the dominant share of public agricultural research has shifted from high-income to developing countries. Economic studies find that investments made in agricultural R&D and the application of industrial inputs in agriculture have been major factors in the successful transition from resource-dependent to productivity-led agricultural growth during the latter half of the 20th century. National public investments in agricultural R&D, along with technology spillovers from other countries and the private sector, are significant sources of new technology driving growth in agricultural TFP. Farmer education, liberalized trade, and changes in agricultural structure also contribute to greater agricultural efficiency and productivity [13].

Historically, the U.S. Government took a prominent role in producing new innovations and technologies for agriculture because farmers themselves did not have the means to conduct formal R&D. Over time, specialized firms in the farm machinery, agricultural chemical, crop seed, and other agricultural input industries grew large enough to make considerable investments in R&D (figure 2).
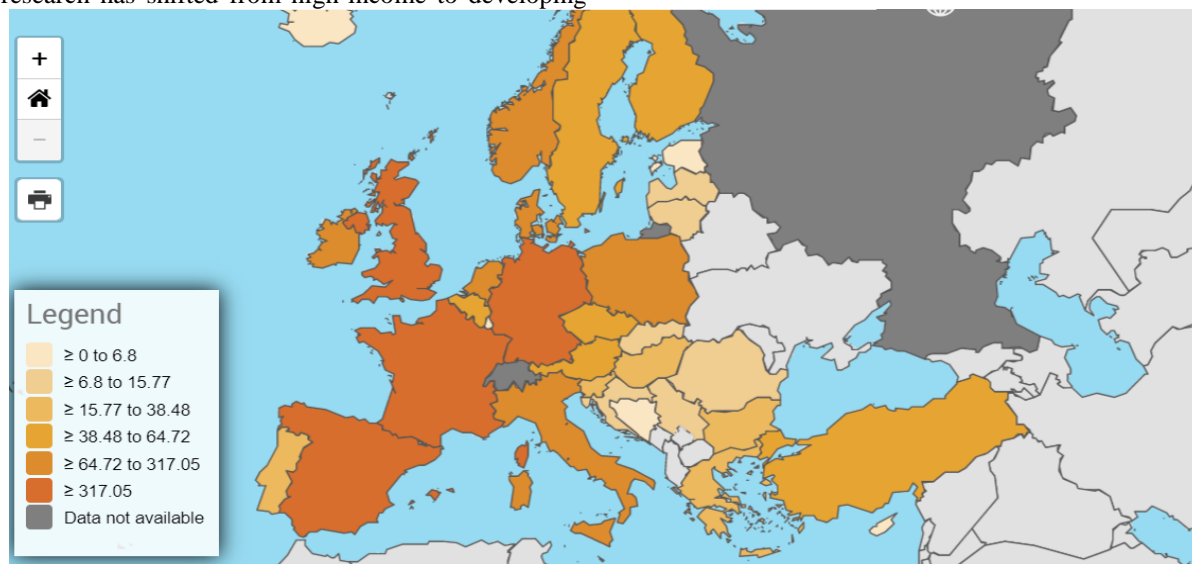

Figure 2. Government support to agricultural research and development, million euro
Source of data: Eurostat

The U.S. Government is leading the world's state support to agricultural research and development – 2 196 mln euro in 2018, the second place belongs to Japan – 1 309 mln euro. The following countries in rating are Germany – 909,5 and Spain – 434 mln euro.

Agricultural innovation is the process whereby individuals or organisations bring new or existing products, processes or ways of organisation into use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability and thereby contribute to food security and nutrition, economic development or sustainable natural resource management.

The FAO gives 5 examples of how innovation is changing agriculture around the world. Here are five examples of how innovation is changing agriculture around the world (table 2).

Table 2

Examples of the impact of innovation on changes in economic systems [6; 7; 9; 10; 15]

Biophysical insect pest control	Dominican Republic	The sterile insect technique (SIT) was applied to eradicate the Mediterranean fruit fly. In 2015, the outbreak of this pest forced the country to enact an immediate ban on its exports of fruits and vegetables, severely damaging the country's second most important source of income. SIT is an innovative technique in which male insects are sterilized in labs. When released in the wild they mate with females but do not produce any offspring. Over time, this brings the insect population down significantly. By 2017, the country's Mediterranean fruit fly population was officially eradicated. SIT is one of the most environmentally friendly control methods available, as it does not require the use of chemicals on the insect's native habitat.
Marketing	Tanzania	many rural people have difficulty earning a sustainable income, farmers are finding new uses for the indigenous Allanblackia tree, as its seed oil is rich in nutrients. Using this oil, farmers have developed new products, such as skin creams and lotions, which are lucrative in the market and have attracted international attention. The budding supply chains in the country are contributing to alleviating poverty and conserving biodiversity, giving local farmers a chance to increase their incomes through access to international markets.
Insurance	India	The government of Telanagana state implemented a new insurance scheme called Rythu Bandhu. This programme grants farmers in the state Rs. 4 000 (USD 55) per acre per season to support farm investments and purchase farm inputs. Rythu Bandhu staff oversee distribution of the funds, collect data on the uses and outcomes of the grants and develop a close relationship with the farmers to ensure successful crop planning. This scheme allows farmers to escape cycles of debt and poverty and establish sustainable and lucrative agricultural initiatives.
Artificial intelligence	Global	Amobile app called eLocust3 is being used to monitor and quickly detect one of the most dangerous migratory pest species in the world, the desert locust. The app combines the latest advances in information, communication and satellite technologies into a unified monitoring and early warning system. It has contributed significantly to a decline in the duration, severity and frequency of devastating desert locust plagues in Africa and Asia.
		Agripredict, started by a company in Zambia, which was also the winner at the 2018 #HackAgainstHunger competition in Rwanda. It uses a simple photo from a phone to detect the presence of pests or diseases. It can also forecast the probability of invasions by pests, such as the Fall Armyworm, and predict the possibility of adverse weather patterns such as drought, floods and cold fronts.

High-tech is gaining ground in the age-old world of agriculture and agricultural innovations have gradually revolutionised work in the fields and on the farm in recent years. Agricultural drones, robot weeders, connected farms, urban agriculture, new financing methods – all have developed within a new dynamic ecosystem.

Advances in technology are key to the future of agriculture as farmers strive to feed the world with limited natural resources. While much of this investment is directed at ag-tech startups and disruptive market newcomers, in many ways priorities remain the same as ever – innovation in resource use, especially in terms of land and water (also energy), to boost efficiency and yields. Major technology innovations in the space have focused around areas such as indoor vertical farming, automation and robotics, livestock technology, modern greenhouse practices, precision agriculture and artificial intelligence, and blockchain (figure 3).
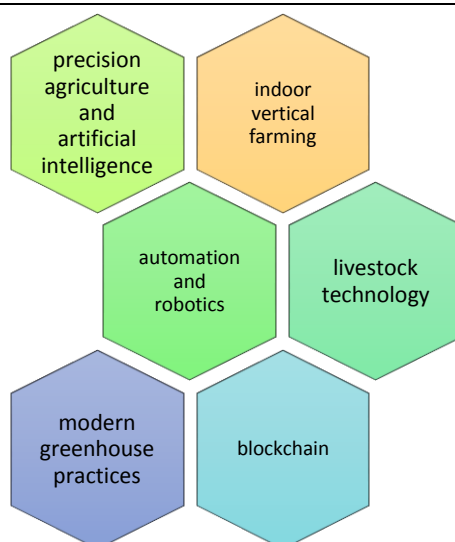
Figure 3. Emerging Innovations in Agriculture

In order to apply various innovations, it is important to get acquainted with the world experience [6; 7; 9; 10; 15] of their application.

The first one is indoor vertical farming. It can increase crop yields, overcome limited land area, and even reduce farming's impact on the environment by cutting down distance traveled in the supply chain. Indoor vertical farming can be defined as the practice of growing produce stacked one above another in a closed and controlled environment. By using growing shelves mounted vertically, it significantly reduces the amount of land space needed to grow plants compared to traditional farming methods. This type of growing is often associated with city and urban farming because of its ability to thrive in limited space. Vertical farms are unique in that some setups don't require soil for plants to grow. Most are either hydroponic, where vegetables are grown in a nutrient-dense bowl of water, or aeroponic, where the plant roots are systematically sprayed with water and nutrients. In lieu of natural sunlight, artificial grow lights are used. From sustainable urban growth to maximizing crop yield with reduced labor costs, the advantages of indoor vertical farming are apparent. Vertical farming can control variables such as light, humidity, and water to precisely measure year-round, increasing food production with reliable harvests. The reduced water and energy usage optimizes energy conservation -vertical farms use up to 70% less water than traditional farms. Labor is also greatly reduced by using robots to handle harvesting, planting, and logistics, solving the challenge farms face from the current labor shortage in the agriculture industry.

The second approach is farm automation. It often associated with "smart farming", is technology that makes farms more efficient and automates the crop or livestock production cycle. An increasing number of companies are working on robotics innovation to develop drones, autonomous tractors, robotic harvesters, automatic watering, and seeding robots. Although these technologies are fairly new, the industry has seen an increasing number of traditional agriculture companies adopt farm automation into their processes. New advancements in technologies ranging from robotics and drones to computer vision software have completely transformed modern agriculture. The primary goal of farm automation technology is to cover easier, mundane tasks. Some major technologies that are most commonly being utilized by farms include: harvest automation, autonomous tractors, seeding and weeding, and drones. Farm automation technology addresses major issues like a rising global population, farm labor shortages, and changing consumer preferences. The benefits of automating traditional farming processes are monumental by tackling issues from consumer preferences, labor shortages, and the environmental footprint of farming.

No less important and interesting direction is new livestock management. The traditional livestock industry is a sector that is widely overlooked and under-serviced, although it is arguably the most vital. Livestock provides much needed renewable, natural resources that we rely on every day. Livestock management has traditionally been known as running the business of poultry farms, dairy farms, cattle ranches, or other livestock-related agribusinesses. Livestock managers must keep accurate financial records, supervise workers, and ensure proper care and feeding of animals. However, recent trends have proven that technology is revolutionizing the world of livestock management. New developments in the past 8-10 years have made huge improvements to the industry that make tracking and managing livestock much easier and data-driven. This technology can come in the form of nutritional technologies, genetics, digital technology, and more. Livestock technology can enhance or improve the productivity capacity, welfare, or management of animals and livestock. The concept of the 'connected cow' is a result of more and more dairy herds being fitted with sensors to monitor health and increase productivity. Putting individual wearable sensors on cattle can keep track of daily activity and health-related issues while providing data-driven insights for the entire herd. All this data generated is also being turned into meaningful, actionable insights where producers can look quickly and easily to make quick management decisions.

Another new trend – mixing crop production and construction. In recent decades, the Greenhouse industry has been transforming from small scale facilities used primarily for research and aesthetic purposes (i.e., botanic gardens) to significantly more large-scale facilities that compete directly with land-based conventional food production. Combined, the entire global greenhouse market currently produces nearly US $350 billion in vegetables annually, of which U.S. production comprises less than one percent.

Nowadays, in large part due to the tremendous recent improvements in growing technology, the industry is witnessing a blossoming like no time before. Greenhouses today are increasingly emerging that are large-scale, capital-infused, and urban-centered.

Another approach – precision farming, is on everyone's lips. In one word, this is a farming management system based on the use of modern technologies at every stage of work. Usually, a field has heterogeneous zones, and technologies allow to identify such zones and manage this variability. New precision agriculture companies are developing technologies that allow farmers to maximize yields by controlling every variable of crop farming such as moisture levels, pest stress, soil conditions, and micro-climates. By providing more accurate techniques for planting and growing crops, precision agriculture enables farmers to increase efficiency and manage costs.

And finally, blockchain's capability of tracking ownership records and tamper-resistance can be used to solve urgent issues such as food fraud, safety recalls, supply chain inefficiency and food traceability in the current food system. Blockchain's unique decentralized structure ensures verified products and practices to create a market for premium products with transparency. Blockchain can be used to solve urgent issues such as food fraud, safety recalls, supply chain inefficiency and food traceability in the current food system. The structure of blockchain ensures that each player along the food value chain would generate and securely share data points to create an accountable and traceable system. Vast data points with labels that clarify ownership can be recorded promptly without any alteration. As a result, the record of a food item's journey, from farm to table, is available to monitor in real-time.

The use cases of blockchain in food go beyond ensuring food safety. It also adds value to the current market by establishing a ledger in the network and balancing market pricing. The traditional price mechanism for buying and selling relies on judgments of the involved players, rather than the information provided by the entire value chain. Giving access to data would create a holistic picture of the supply and demand. The blockchain application for trades might revolutionize traditional commodity trading and hedging as well. Blockchain enables verified transactions to be securely shared with every player in the food supply chain, creating a marketplace with immense transparency.

As the advance of technology, artificial intelligence in agriculture is no longer became a strange thing. We knew that AI is the advance of the technology that could help humans in any sector such as the industrial sector, business, and also the agriculture sector too.

It sounds a bit strange for us, isn't it? But it's real. The rise of digital agriculture and its related technologies has opened a wealth of new data opportunities. Remote sensors, satellites, and UAVs can gather information 24 hours per day over an entire field. These can monitor plant health, soil condition, temperature, humidity, etc. The amount of data these sensors can generate is overwhelming, and the significance of the numbers is hidden in the avalanche of that data. The idea is to allow farmers to gain a better understanding of the situation on the ground through advanced technology (such as remote sensing) that can tell them more about their situation than they can see with the naked eye. And not just more accurately but also more quickly than seeing it walking or driving through the fields [6; 7; 9; 10; 15].

Investment of Ukrainian companies in the introduction of innovative technologies, in particular, research and development, should be around Hr 5 billion, up to $200 million a year. According to expert estimates, companies need to invest 5-10 percent of revenue in innovative technologies. If this logic is followed, it is necessary to invest up to Hr 5 billion in the agrarian sector of Ukraine, up to $200 million per year namely in R&D, not taking into account the purchase of equipment. At present, the level of penetration of innovations into the Ukrainian agricultural sector is estimated at 10-12 percent compared to the global market. Agroholdings occupy a lion's share of the total number of companies actively using and introducing new technologies [8].

Conclusion

The current stage of development of the agricultural sector of Ukraine accompanied by an exacerbation of a number of social and economic strong problems. New challenges require timely reactions of the state, agricultural science and practice. Therefore, further prospects of the Ukrainian agricultural sector depend on its prompt and effective adaptation to the new conditions of management for the occupation of decent places among the leading producers of agri-food products in the world. The priority area of innovation is introduction of the most promising agricultural technologies to increase production productivity in order reducing unit costs and strengthening it competitiveness domestically and globally markets.

An important factor in the development of the agrosector economics is the presence of information and innovation provision and presence of agricultural producers with required the level of knowledge and appropriate qualifications. In particular, strengthening the innovative activity of agricultural producers is possible primarily for improving them by overall financial condition through a comprehensive raising funds, which should become a priority in agricultural policy.

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ОГЛЯД ЗАСОБІВ СТАТИСТИЧНОЇ ОБРОБКИ І АНАЛІЗУ ДАНИХ

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REVIEW OF STATISTICAL DATA ANALYSIS SOFTWARE

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Анотація
У статті проведено дослідження питання вибору сучасного програмного засобу статистичної обробки і аналізу даних. Визначені основні рекомендації по вибору професіональних, універсальних та спеціалізованих статистичних пакетів для фахівців та початківців.

Abstract
A study of question of choice of modern programmatic means of statistical treatment and analysis of data is undertaken in the article. Certain basic recommendations are on the choice of professional, universal and specialized statistical packages for specialists and beginners.

Ключові слова: економічна інформація, медичні дані, програмне забезпечення, статистичний пакет, технічна інформація.

Keywords: economic information, medical data, software, statistical package, technical information.

Постановка проблеми
Важливим та незамінним інструментом сучасних фахівців та дослідників є програми статистичної обробки даних, програми для наукових розрахунків. Розвиток обчислювальних методів зробив можливим розв'язання різноманітних по складності наукових завдань за допомогою обчислювальної техніки. Програмне забезпечення (ПЗ) розробля-

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