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INNOVATIVE BUSINESS MODELS IN THE AGRICULTURAL SECTOR: INTERNATIONAL EXPERIENCE AND ADAPTATION OPPORTUNITIES IN UKRAINE

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In today's globalization and acceleration of technological changes, the agricultural sector is becoming an important platform for implementing innovative business models. Innovation is a key factor in increasing production efficiency, improving product quality, and reducing the negative impact on the environment.

International experience, particularly the experience of the United States of America (hereinafter – the USA) and the European Union (hereinafter – the EU), demonstrates significant success in using innovations in the agro-industrial complex. However, the issue of adapting these models to Ukraine's conditions remains open and requires a thorough analysis.

The article is devoted to considering the international experience of innovative business models in the agricultural sector and the possibility of its adaptation in Ukraine.

It was determined that adapting innovative business models in Ukraine's agricultural sector is a critically important step toward increasing Ukrainian agriculture's competitiveness on the world stage.

Business models in the agrarian sector of successful innovative international practices of the EU and the USA were analyzed to adapt them to Ukrainian conditions.

It has been established that Ukraine has significant potential for implementing innovative business models thanks to its natural resources and agricultural traditions. However, certain factors must be considered for their successful adaptation, such as infrastructural challenges, financial support and investments, human resources, legal regulation and policy, and circular economy.

It's been demonstrated that the introduction of international experience and technologies can optimize production, reduce costs, and enhance resilience to economic challenges. However, to successfully implement these models, it's crucial to address several internal barriers, such as imperfect infrastructure, insufficient investment, and a shortage of qualified personnel. Overcoming these barriers is a key step towards the successful adoption of innovative business models in the agricultural sector.

Attention was focused on the broad prospects for introducing innovations. Ukraine has every chance to become a leader in the region by using modern business models in the agricultural sector.

Keywords: agricultural sector, business model, innovative development, competitiveness, digital agriculture.

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STATEMENT OF THE PROBLEM

Amidst the current conditions of globalization and accelerating technological changes, the agricultural sector stands out as a crucial platform for the implementation of innovative business models. This sector's role is pivotal, as innovation is a key factor in increasing production efficiency, improving product quality, and reducing the negative impact on the environment.

However, according to scientists, the domestic agricultural sector must "transition from technological degradation to a post-industrial mode of production" [12].

International experience, in particular the experience of the European Union (EU)? The United States of America (USA) demonstrates significant success in using innovations in the agro-industrial complex, but the issue of adapting these models to Ukraine's conditions remains open and requires a thorough analysis.

ANALYSIS OF THE LATEST RESEARCH AND PUBLICATIONS

The following scientists made a significant contribution to the study of issues related to the innovative development of the agricultural sector and to the substantiation of the management of socio-economic processes of territorial communities: V. Baranovskyi, T. Batrakova, I. Goncharenko, M. Dolishnyi, O. Dyachenko, T. Kalashnikova, Y. Luzan, I. Lukinov, M. Malik, G. Mostovyi, T. Shestakovska, V. Yurchyshyn, and others.

However, the issues of adaptation of the world's leading business models in the agricultural sector to the conditions of Ukraine are still insufficiently studied. This study is a response to the urgent need for more research in this area.

The article aims to review successful innovative international practices and business models in the agricultural sector and their adaptation to Ukrainian conditions.

PRESENTATION OF THE MAIN MATERIAL OF THE RESEARCH

First, it should be noted that the domestic agricultural business is in a transition period and, despite the current circumstances of martial law, has recently been successfully applying the latest innovative developments.

Today, Ukrainian farmers widely use I.T. solutions, technologies that help reduce the cost of production, increase yields, namely: the introduction of precision farming systems, logistics routes of production flow charts, quality control of crops, GPS tracking of equipment, soil research to obtain information about biochemical composition, specialized CRM and HRM production management systems, etc. [14].

According to experts, the agricultural sector accounts for up to 30% of Ukrainian exports and about 15-17% of gross domestic product. This figure is projected to increase to 25% in the future, provided that agricultural production efficiency increases, including the introduction of innovative technologies [13].

In this context, the experience of the E.U. and the United States was a positive example. These highly developed countries are leaders in implementing innovative business models in the agricultural sector. One of the leading trends is the transition to digital agriculture (AgriTech), which includes the application of technologies such as the Internet of Things (IoT), unmanned aerial vehicles, artificial intelligence, and blockchain. These technologies make it possible to optimize production processes, data collection, and analysis, significantly increasing resource management efficiency.

Another important aspect is the development of sustainable agriculture, which is focused on conserving natural resources and minimizing the negative impact on ecosystems. In this context, models that include using renewable energies, waste recycling, and introducing organic farming are popular.

Cooperative business models, which are actively used in E.U. countries, ensure the integration of smallholder farmers into larger structures, allowing for increased competitiveness and market access.

Let us take a closer look at the experience of the E.U. countries, which are among the leaders in implementing innovations in the agricultural sector. The European Strategy for Agricultural Development focuses on sustainability, technological innovation, and environmental safety. Here are some examples of successful innovative business models in agriculture in E.U. countries:

1. Holland – Vertical Farms and Sustainable Agriculture [1].

The Netherlands is one of the world leaders in applying vertical farming technologies. Dutch companies such as PlantLab and Staay Food Group are successfully developing vertical farms where cultivation occurs under controlled conditions. These farms use less water and reduce the impact on soils. Thanks to modern climate control and light systems, farmers can get high yields all year round. This allows you to optimize the use of resources and minimize product losses.

The first vertical farm has recently appeared in Ukraine [3].

Using the experience of the Netherlands, a country that is a recognized European leader in this area, domestic farmers have created an enterprise that has several advantages over greenhouses that were traditionally used before, namely:

– the ability to work all year round;

– does not require heating;

– does not require plant protection products – neither chemical nor biological;

– water saving – the possibility of reusing a significant amount of it;

– high degree of automation and, as a result, a minimum of staff;

– a vertical farm occupies a small area (acres and tens of acres compared to hectares and tens of hectares of greenhouses).

2. France – agroecology and "green" economy.

France is actively implementing an agroecology model to increase agricultural productivity while maintaining ecological balance [2]. For example, Ferme du Bec Hellouin uses permaculture principles to grow products without chemical fertilizers and pesticides, focusing on organic farming. The French government also offers subsidies and incentives to farmers to switch to renewable energy sources and reduce carbon emissions.

It should be noted that the European Commission has implemented the European Green Deal since 2019, namely measures aimed at reducing greenhouse gas emissions and minimizing resource use while achieving economic growth [8]. The point is that agricultural products presented on the E.U. market must meet the highest standards of environmental friendliness.

3. Germany—digital farming and farm management platforms. Germany is actively developing the concept of digital farming. In agriculture, precision technologies are aimed primarily at soil protection

and economic efficiency, reducing crop losses and increasing yields per hectare of land, and, in general, increasing the efficiency of the country's land bank [4].

Bayer Crop Science offers the FieldView platform, which allows farmers to use data from satellites and sensors to analyze soil health, predict yields, and manage production processes. This allows farmers to optimize resources such as fertilizers and water and significantly reduce costs. Digital tools are also used to monitor pests and diseases, allowing for timely responses to crop threats.

4. Denmark – ecological livestock farming and renewable energy.

Denmark is a leader in sustainable animal husbandry. Many farmers in the country are adopting waste management technologies and biogas plants to produce energy from animal waste. Nature Energy works with farms to collect agricultural waste and turn it into biogas. This reduces the ecological footprint and contributes to developing sustainable business models.

Denmark's agribusiness is one of the most intensive and productive in Western Europe and the world. As a net exporter of agricultural products, it is among the top seven countries in the world. In terms of exports of meat and hard cheeses, the country is second only to the Netherlands.

Considerable attention is paid to environmental issues. Danish law strictly regulates the use of chemicals. In addition, the procedure and volume of use of organic fertilizers are dictated by law, making it impossible to dump agricultural waste into the environment.

Environmentally friendly technologies are being successfully introduced in Danish agribusiness under administrative pressure and because they have become economically profitable for the farmers themselves. The latest scientific developments are funded at the state level and by cooperative associations. This, in turn, not only eliminates environmental pollution but also leads to an increase in the output of environmentally friendly products and the competitiveness of Danish agribusiness [10].

Moreover, Denmark has developed the concept of the "Scandinavian niche," which involves the search for unique areas of activity that are not interesting or inaccessible to the world's largest monopolists and not fighting them. For example, the German market supplies high-quality fresh beef; the U.K. market has established the production of a particular type of bacon; and Japan has an exclusive pork variety. Thus, the small country of Denmark satisfies the needs of consumers in many countries around the world by helping domestic food companies such as Mayeriselskabet Danmark, Thulin, etc. to become the leading producers of meat products in Western Europe [10].

5. Italy – farmers' cooperatives and sustainable agriculture.

Italy has a well-developed system of cooperative business models, which allows small farmers to pool their resources to increase their market competitiveness. For example, the Granarolo Cooperative, one of the largest in Italy, brings together more than 600 farmers to produce dairy products using sustainable farming and processing methods. This allows you to reduce production costs, improve market access, and ensure high-quality products [7].

As for the United States, it is one of the leading countries in the world regarding agricultural innovation. The American agricultural sector is actively introducing modern technologies to increase the productivity and efficiency of agricultural production [5, 6, 9, 11]. Examples of successful innovative business models that operate in the United States are:

1. Internet of Things (IoT) and precision agriculture.

Precision farming technologies are widely used in the U.S., using data from sensors, satellites, and drones to accurately monitor soil health, moisture, temperature, and plant growth. This allows farmers to optimize their use of fertilizers, water, and pesticides. One example is John Deere, which offers farmers tractors and equipment with built-in IoT sensors for precise field management. With these technologies, farmers can reduce costs and increase yields.

2. Autonomous machines and drones are actively used in the United States to monitor fields and deliver the necessary materials. Raven Industries has developed autonomous tractors that can work independently in the fields, reducing the need for labor and increasing efficiency. This allows farmers to control their resources with minimal time and money.

3. Agribusiness platforms for farmers. U.S. companies are creating agribusiness platforms such as FarmLogs and Granular, which offer farmers a comprehensive solution for managing their farms. These platforms provide the ability to analyze big data, predict yields and costs, and monitor the profitability of the farm. They also help farmers find the best markets for their products, which allows them to optimize processes from production to sale.

4. Biotechnology and genetic innovations. In the United States, considerable attention is paid to developing agricultural biotechnology. Monsanto (now part of Bayer) develops genetically modified crops that are resistant to pests and diseases. This can significantly increase yields and reduce the cost of

pesticides and other protective equipment. Innovations in biotechnology are also contributing to increasing the agricultural sector's resilience to climate change.

5. Renewable energy and environmental sustainability. Agriculture in the U.S. is actively integrating renewables into its business models. For example, many farms use solar panels or biogas plants to produce energy. This reduces energy costs and helps farms meet environmental standards. Brightmark specializes in converting agricultural waste into biogas, which allows waste to be recycled into useful resources and reduces carbon dioxide emissions.

Thanks to its natural resources and agricultural traditions, Ukraine has significant potential to implement innovative business models. However, for their successful adaptation, it is necessary to consider certain factors, such as:

– infrastructural challenges. For the effective implementation of innovative models, it is necessary to modernize infrastructure, especially in rural areas. This includes the development of digital networks, logistics systems, and energy efficiency;

– financial support and investments. An important factor is the attraction of investments for the development of the latest technologies in the agricultural sector. This may include support from the state, as well as the creation of favorable conditions for foreign investors;

– human resources. It is necessary to invest in the training and development of human resources, in particular, young professionals with competencies in technology and innovation management;

– legal regulation and policy. Legislation should support innovation and create conditions for its implementation. This includes tax incentives for businesses investing in innovation, as well as programs to stimulate green production;

– circular economy. The gradual transition of agri-business to the principles of circular economy (organic fertilizers, combining the efforts of livestock and crop production, etc.).

CONCLUSIONS

Adapting innovative business models in Ukraine's agricultural sector is a critical step towards increasing the competitiveness of Ukrainian agriculture on the world stage. The introduction of international experience and technologies will optimize production, reduce costs and increase resilience to economic challenges. However, for the successful implementation of these models, it is necessary to overcome several internal barriers, such as imperfect infrastructure, insufficient investment and lack of qualified personnel.

The prospects for introducing innovations are broad, and Ukraine has every chance to become a leader in the region by using modern business models in the agricultural sector.

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ІННОВАЦІЙНІ БІЗНЕС-МОДЕЛІ В АГРАРНОМУ СЕКТОРІ: МІЖНАРОДНИЙ ДОСВІД І МОЖЛИВОСТІ АДАПТАЦІЇ В УКРАЇНІ

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У сучасних умовах глобалізації та прискорення технологічних змін аграрний сектор стає важливою платформою для впровадження інноваційних бізнес-моделей. Інновації є ключовим фактором підвищення ефективності виробництва, покращення якості продукції та зниження негативного впливу на довкілля.

Міжнародний досвід, зокрема досвід країн Сполучених Штатів Америки (далі – США) та Європейського Союзу (далі – ЄС), демонструє значний успіх у використанні інновацій у агропромисловому комплексі, проте питання адаптації цих моделей до умов України залишається відкритим і вимагає ґрунтовного аналізу.

Стаття присвячена розгляду міжнародного досвіду інноваційних бізнес-моделей в аграрному секторі та можливості його адаптації в Україні.

Визначено, що адаптація інноваційних бізнес-моделей в аграрному секторі України є критично важливим кроком на шляху до підвищення конкурентоспроможності українського сільського господарства на світовій арені.

Проаналізовано бізнес-моделі в аграрному секторі успішних інноваційних міжнародних практик країн ЄС та США з метою їх адаптації до українських умов.

Встановлено, що Україна має значний потенціал для впровадження інноваційних бізнес-моделей, завдяки своїм природним ресурсам і сільськогосподарським традиціям. Проте для їх успішної адаптації необхідно враховувати певні чинники, такі як: інфраструктурні виклики, фінансову підтримку та інвестиції, кадровий потенціал, правове регулювання та політику, циркулярну економіка.

Доведено, що впровадження міжнародного досвіду та технологій дозволить оптимізувати виробництво, знизити витрати та збільшити стійкість до економічних викликів. Проте для успішної реалізації цих моделей необхідно подолати низку внутрішніх бар'єрів, таких як недосконала інфраструктура, недостатня кількість інвестицій і брак кваліфікованих кадрів.

Акцентовано увагу на тому, що перспективи впровадження інновацій є досить широкими, і Україна має всі шанси стати лідером у регіоні з використання сучасних бізнес-моделей в аграрному секторі.

Ключові слова: аграрний сектор, бізнес-модель, інноваційний розвиток, конкурентоспроможність, цифрове землеробство.