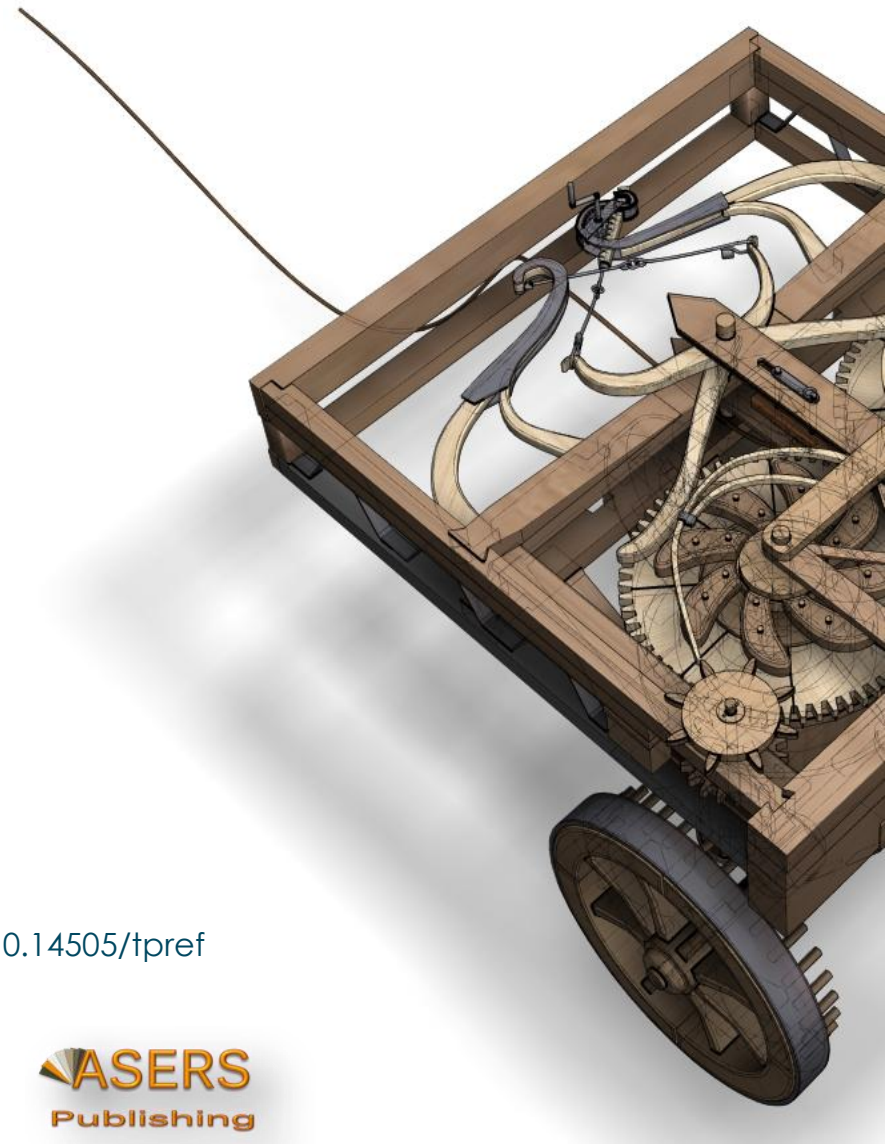
Theoretical and Practical Research in Economic Fields



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Theoretical and Practical Research in Economic Fields

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Optimization of Management of Agricultural Business Stuctures for Increasing Economic Efficiency

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Abstract: Agriculture is one of the main sectors of the economy of Ukraine, which provides food security, creates jobs, and promotes the development of rural areas. Changes in the world economy, new technologies, and changes in consumer preferences require agricultural businesses to adapt and improve management approaches. The aim of the article was to create effective approaches to optimizing the management of agricultural businesses to increase their economic efficiency. The research employed financial, statistical, comparative analysis, and SWOT analysis. The results showed that the agricultural sector of Ukraine has great potential for growth but faces a number of challenges. The area of agricultural land in Ukraine (41.5 million hectares) exceeds the area of Germany and France, but the productivity and skill level of workers remain lower. In 2023, the export of agricultural products of Ukraine amounted to € 24 billion, which is significantly inferior to Germany and France. The profitability of agricultural companies of Ukraine was 9.0%, while in Germany it was 12.0%, and in France - 15.5%. This emphasizes the need for more effective management strategies. The need for transition to sustainable agriculture through the implementation of ecological practices that conserve natural resources and ensure food security is determined. The academic novelty of this study is a systematic approach to the analysis and optimization of the management of agricultural businesses in Ukraine. Prospects for future research are the development of management models for agricultural companies that consider the specifics of small and medium-sized enterprises (SMEs), with the aim of increasing their competitiveness.

Keywords: sustainable development; resource management; innovation; agricultural policy; economic factors; optimization.

JEL Classification: M21; O13; O40; Q10.

Introduction

In the conditions of globalization and rapid technological changes, agriculture is becoming an increasingly important element of the economic system of each country. Agricultural businesses are not only a source of food security, but also important participants in economic relations that ensure employment, investment, and regional development. However, despite their strategic importance, many agricultural enterprises face numerous challenges. These challenges are associated with low economic efficiency, outdated management methods and lack of adaptability to rapidly changing market conditions.

The modern agricultural sector is going through a period of transformation caused not only by economic factors, but also by changes in the social and ecological environment. The growing demand for high-quality and

environmentally friendly products, as well as requirements for sustainable development, require agricultural enterprises to quickly adapt and implement new technologies. These technologies not only optimize production processes, but also improve management decisions, which entails increased productivity and product quality (Grober and Grober, 2020).

Optimization of the management of agricultural businesses becomes especially relevant in view of the need to increase their competitiveness. Modern approaches to management include the integration of the latest technologies, improvement of business processes, implementation of a quality management system and efficient use of resources. Optimizing financial flows, analysing market trends and consumer needs are also important components of this process, which allows businesses to quickly respond to changes in the market environment (Yan *et al.* 2024).

In addition, the importance of cooperation between agricultural enterprises and scientific institutions for the implementation of innovative developments that can increase production efficiency is increasing (Guo *et al.* 2024). For example, the use of the latest agronomic methods, such as precision farming, can significantly reduce the costs of fertilizers and plant protection products, as well as increase yields. So, in turn, results in an increase in the profitability of enterprises.

However, optimization of management in the agricultural sector is not reduced to technological innovations. Human resources (HR) are equally important, which require training and development for effective work in the modern market. Implementation of training programmes, development of leadership skills and a team capable of working under the conditions of uncertainty are the key to successful adaptation of agrarian businesses to new challenges (Ilchuk *et al.* 2023).

So, optimizing the management of agricultural businesses not only contributes to increasing their economic efficiency, but also ensures sustainable development of the agricultural sector as a whole, forming the basis for future growth and stability. In view of constant changes and challenges, it is important to look for new solutions and improve existing management practices, focusing on innovation and integration of modern technologies.

In addition, important aspects of optimization are the analysis of the external environment, the study of consumer needs, and adaptation to changes in the demand for agricultural products (Markovych *et al.* 2023). Agricultural companies that are able to quickly respond to changes have competitive advantages that allow them to function successfully even under uncertain conditions. Therefore, research and development of effective management strategies are key tasks for increasing the economic efficiency of agricultural businesses.

Therefore, the research is focused on the study of management optimization practices in the agricultural sector, the analysis of existing management models, and their adaptation to the specifics of Ukrainian agriculture. The aim of the study is to formulate and substantiate effective approaches to optimizing the management of agricultural businesses in order to increase their economic efficiency. The aim involved the fulfilment of the following research objectives:

- Analyse the structures of agricultural enterprises in Ukraine;
- Determine trends in the development of the agricultural sector;
- Explore opportunities to increase the resilience of agricultural businesses structures to economic, environmental, and social challenges.

The importance of the study is stipulated by the need to increase the efficiency of Ukraine's agricultural sector in the context of global competition, economic instability and climate change. Given the significant role of the agro-industrial complex in shaping the country's GDP, ensuring food security and export development, the study allows us to identify the key factors that affect the productivity and profitability of agricultural enterprises. The strategic approaches to managing the agricultural sector proposed in this paper can serve as a basis for developing effective government support programmes aimed at stimulating innovation, attracting investment and expanding international cooperation, which will contribute not only to the economic growth of the sector but also to increasing its resilience to external challenges.

1. Literature Review

The existing studies show that agriculture needs to adapt to new conditions associated with globalization, changes in consumer demand and environmental requirements. In particular, according to Abdullayev *et al.* (2024), agriculture is a critically important sector of the economy that directly affects food security. At the same time, according to Zelisko *et al.* (2024), many agricultural enterprises face problems of low productivity because of outdated technologies and management methods. In such conditions, optimization of management becomes necessary to increase economic efficiency.

An important aspect of modern management in agriculture is the introduction of innovative technologies. The study by Guo *et al.* (2024) demonstrates how precision farming and process automation can significantly reduce production costs and increase yields. In addition, Farace and Tarabella (2024) note that the use of the latest agronomic methods, such as biotechnology, allows to increase the resistance of plants to diseases and stresses.

The study of Gadanakis (2024) is an important contribution to the development of the theory and practice of optimizing the management of agricultural businesses. The author emphasizes the importance of digitization in agribusiness, pointing out that the integration of information technologies into management processes allows optimizing resource costs and increasing the accuracy of forecasting. Digitization of agribusiness can be achieved by implementing such technologies as precision agriculture, big data (BD), artificial intelligence (AI), and the Internet of Things (IoT). These technologies enable agricultural companies to collect and analyse large amounts of data, which helps them to make more informed decisions about production, marketing, and logistics (Hryvkivska *et al.* 2024).

The research of Yang (2024) is significant in the development of the theory and practice of optimizing the management of agricultural businesses. The author of the study shows that creating a favourable social climate in teams can significantly increase labour productivity and employee involvement in the management process. A favourable social climate in teams can be achieved with the help of various measures aimed at improving working conditions, interaction between employees and enhancing their motivation (Kik *et al.* 2024). In addition, the reseachers emphasize the importance of developing social skills among employees of agricultural enterprises, as this enables them to interact more effectively with each other and with management, which, in turn, can lead to improved results (Jensen *et al.* 2024). HR also play a key role in optimizing management. According to Noja *et al.* (2023), the insufficient qualification of workers is one of the main reasons for the low efficiency of agricultural enterprises.

Regarding economic aspects, Qiu *et al.* (2024) note that the efficiency of agricultural business structures can be evaluated through financial indicators, such as profitability and capital turnover. At the same time, Rossokha and Nechyporenko (2023) emphasizes that agricultural enterprises must adapt their strategies to the changing economic environment, which requires regular monitoring of market trends and consumer demand. The study by Zhu *et al.* (2024) reveals the development of the theory and practice of optimizing the management of agricultural business structures. The author emphasizes the importance of investments in agricultural infrastructure, as it creates conditions for reducing costs and increasing the overall efficiency of business structures. According to Yan *et al.* (2024), investment in the agricultural infrastructure can be directed to the development of such areas as transport infrastructure, storage and processing of products, as well as information systems. This enables agricultural enterprises to reduce logistics costs, increase production speed and efficiency, and improve product quality.

According to a study by Akintuyi (2024), investment in agricultural infrastructure can have a significant positive impact on the development of agricultural enterprises. A key element in the process of management optimization is strategic management. The study by Fei *et al.* (2025) points to the importance of developing long-term strategies that take into account not only current needs but also prospects for the development of the agricultural sector. The literature review shows that optimization of the management of agricultural business structures is a complex and multifaceted process. This process requires further research and the integration of innovative technologies to increase production efficiency and improve product quality. The introduction of modern technologies plays a key role in increasing the competitiveness of agricultural enterprises on the global market.

2. Method

Research Design

The research was conducted in several stages, which provided a systematic approach to the analysis of management practices of agricultural business structures. The main stages of the research:

1. Preparation and planning. The research objectives were determined at this stage, the hypotheses were advanced, and research questions were formulated. We conducted an analysis of academic literature related to the management of agricultural structures, in particular, innovative methods of optimization.
2. Data collection. We selected statistics for 2018–2023. Information was collected from open sources and studies to compare the Ukrainian experience with other countries.

3. Data analysis: Data processing and financial analysis were carried out. Statistical methods were used to study the dynamics of the development of agricultural enterprises.
4. Interpretation of the results. The results of the analysis gave grounds to identify key trends, problems, and opportunities for management optimization. The strengths and weaknesses of agricultural businesses were identified with the help of SWOT analysis.

Sampling

A total of 100 agricultural enterprises from different regions of Ukraine were selected to ensure the representativeness of the study. The sample included enterprises of different sizes - small, medium and large, specializing in different types of agricultural activity, operating in different climatic conditions, and using different management models. The sample covers a variety of enterprises to investigate the effect of factors such as size, specialization, and regional location on their performance. The subjects were selected using a randomized method to avoid bias. France and Germany were also included in the sample because of their important role in the European agricultural industry. France is one of the largest producers of agricultural products in the European Union (EU), and Germany is a major exporter of agricultural products. The inclusion of these countries in the sample made it possible to compare the efficiency of Ukrainian and European agricultural enterprises. This made it possible to identify best practices and management strategies used in France and Germany, and to analyse the influence of different regulatory environments, market conditions, and cultural factors on the efficiency of enterprises in different countries.

Methods

Several practical methods were used for the research:

1. Financial analysis. Financial reports and indicators of enterprises were analysed to assess their efficiency and profitability. Special attention was paid to the dynamics of profitability and efficiency of resource management.
2. Statistical analysis. Statistical methods (correlation analysis) were used to identify the relationship between the indicators of financial performance of enterprises and their management practices.
3. Comparative analysis. Comparison of performance indicators of enterprises for different years and between different countries, including Ukraine, France, and Germany.
4. SWOT analysis. It was used to determine the strengths and weaknesses of enterprises, as well as to assess opportunities and threats in the market.

Instruments

The following tools were used to conduct the research:

- Microsoft Excel for processing and analysis of financial indicators, construction of tables and graphs.
- SPSS for statistical data analysis and correlation analysis.

3. Results

In modern conditions of agricultural production, the integration of modern management approaches is especially important. In particular, according to the State Statistics Service of Ukraine, there were 21,256 agricultural enterprises in Ukraine as of 2021. Enterprises cultivating more than 1,000 hectares occupy 48.8% of the total area of agricultural land. In Ukraine, there is a tendency to decrease the number of small agricultural enterprises cultivating areas of less than 100 hectares. Their number decreased from 16,900 in 2018 to 14,500 in 2023. Instead, there is an increase in medium-sized enterprises that cultivate between 100 and 1,000 hectares. Their number increased from 3,800 in 2018 to 5,000 in 2023 (State Statistics Service of Ukraine, 2024).

Analysis of the structure of agricultural enterprises in Ukraine shows a tendency towards the concentration of land and resources in larger agricultural companies. This can lead to increased productivity but also threatens the livelihood of small farmers. It is necessary to develop policies that support small and medium-sized entrepreneurs in the agricultural sector to ensure their competitiveness and sustainability.

The dynamics of the profitability of agricultural enterprises in Ukraine from 2018 to 2023 shows certain fluctuations in profitability indicators (ROE) and their change (Table 1).

The profitability of agricultural enterprises in Ukraine gradually declined from 15.3% in 2018 to 9% in 2023, indicating increasing pressure on the sector because of economic and political challenges, including the COVID-19 pandemic and full-scale war. At the same time, the agricultural sector's share of exports fluctuated, reaching

49.5% in 2021, but declining to 45% in 2022 because of geopolitical concerns. In 2023, the share of the agricultural sector increased again to 47.8%, which confirms its key role in the economic stability of the country.

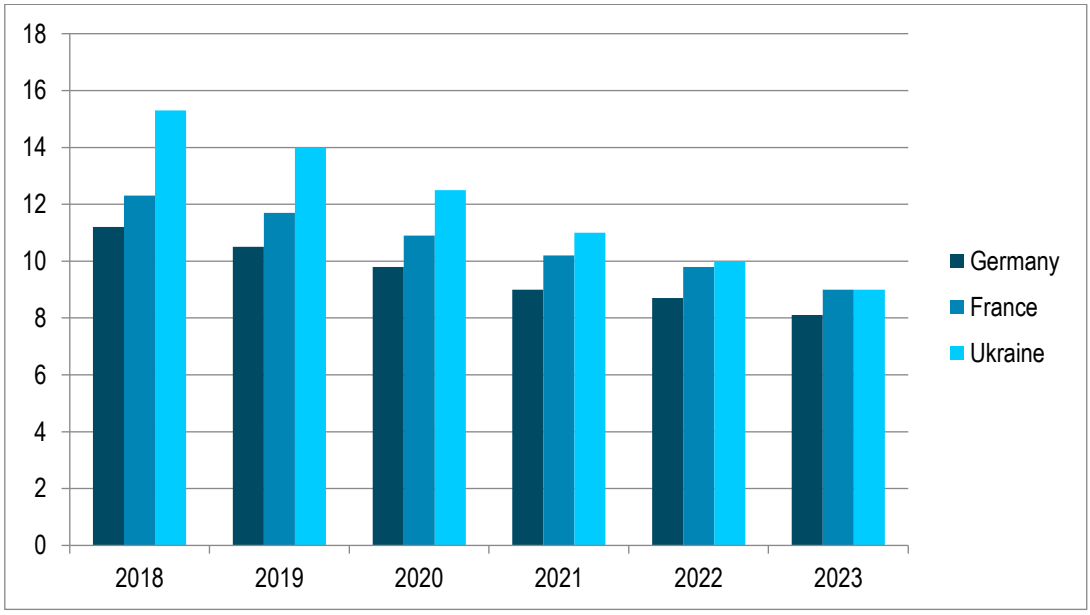
Table 1. Dynamics of profitability of agricultural enterprises in Ukraine (2018–2023)

Year	Return on Equity (ROE) (%)	Change (%)
2018	15.3	-5.56
2019	14.0	-8.49
2020	12.5	-10.71
2021	11.0	-12.00
2022	10.0	-9.09
2023	9.0	-10.00

Source: developed by the authors.

Analysis of the dynamics of the profitability of agricultural enterprises in Germany, France, and Ukraine for 2018–2023 shows a general tendency to decrease efficiency. The highest profitability was observed in Ukraine, but it decreased from 15.3% in 2018 to 9% in 2023. Similar processes are observed in Germany and France, where the indicators also decreased: from 11.2% to 8.1% in Germany and from 12.3% to 9% in France. These changes may be the result of macroeconomic challenges, market fluctuations, and changes in the agricultural sector (Figure 1).

Figure 1. Comparison of the profitability of agricultural enterprises in Germany, France, and Ukraine for 2018–2023



Source: graphed by the authors.

A comparison of the agricultural sectors of Ukraine, Germany, and France indicates significant differences in economic indicators. Ukraine, with an area of agricultural land of 41.5 million hectares, produces only €12.5 milliard of agricultural products. This is significantly lower than in Germany, where the indicator is €45.6 milliard, and in France - €71.4 milliard. The qualification level of workers in Ukraine is 60%, while in Germany it is 80%, and in France - 85%. Exports also show a contrast: Ukraine exports are €24 milliard, while Germany exports are €50 milliard, and France - €70 milliard. These figures emphasize the need to improve management and invest in modern technologies to improve the efficiency of the agricultural sector in Ukraine (Table 2).

Despite the challenges faced by the agricultural sector, its importance in the economy of Ukraine is undeniable, which makes it necessary to identify the key strengths and weaknesses of the sector using a SWOT analysis. It was established that the agricultural sector of Ukraine has strong points, such as high-quality products, qualified specialists and natural resources. However, it also has weaknesses such as dependence on weather conditions, financing problems, and low investment activity. The agricultural sector of Ukraine has opportunities for development, such as the expansion of exports and the introduction of modern technologies, but it is also exposed to threats, such as economic fluctuations and competition from importers (Figure 2).

Table 2. Comparison of the agricultural sector of Ukraine with Germany and France

Countries	Areas of agricultural land (million ha)	Production of agricultural products (€ milliard)	Skill level of workers in the agricultural sector (%)	Profitability (ROE) (%) in 2018	Profitability (ROE) (%) in 2023	Exports of agricultural products (€ milliard) in 2018	Exports of agricultural products (€ milliard) in 2023
Ukraine	41.5	12.5	60	15.3	9.0	19.6	24.0
Germany	16.7	45.6	80	18.5	12.0	45.6	50.0
France	29.4	71.4	85	20.0	15.5	63.1	70.0

Source: tabled by the authors.

Figure 2. SWOT analysis of the agricultural sector of Ukraine

Source: developed by the authors.

SWOT analysis of agricultural enterprises of Ukraine showed that the sector faces a number of internal and external challenges despite the significant potential for growth. To achieve stability in the conditions of global competition, enterprises need to adapt to changing market conditions. Recommendations arising from this analysis may include the introduction of modern technologies to increase productivity and production efficiency, as well as the expansion of sales markets through active participation in international exhibitions and fairs. It is also important to ensure access to financing that will enable agricultural enterprises to invest in modernization and development.

It should be noted that the improvement of personnel qualifications and the involvement of specialists in agronomy and management can significantly increase the efficiency of company management. It is also necessary to develop strategies for minimizing the risks associated with climate change and economic fluctuations. Therefore, the focus on adaptation to new conditions is required to optimize the management of

agricultural business structures in Ukraine. Investment in technology and human capital development are also important, which will contribute to increasing the competitiveness of the agricultural sector at the international level (Table 3).

Table 3. Stages of optimizing the management of agricultural business structures

Stage	Activity description	Result
1. Analysis of the current situation	- Financial analysis - Assessment of resources - SWOT analysis	Determining strengths and weaknesses, opportunities and threats
2. Definition of goals	- Short-term goals - Long-term goals	Clearly defined goals for improving efficiency
3. Strategy development	- Optimization of production processes - Supply management - Investment in innovation	Strategic recommendations for improving activities
4. Implementation of changes	- Staff training - Involvement of consultants	Training of employees and support in optimization
5. Monitoring and evaluation	- Definition of KPIs - Regular analysis	Tracking the progress and effectiveness of implemented changes
6. Feedback	- Assessment of results - Collection of reviews	Improving strategy based on practical experience
7. Continuous improvement	- Adaptation to changes - Innovative approach	Sustainability and adaptability of business in the market

Source: developed by the authors.

The practice of managing the productivity of agricultural enterprises in Ukraine shows the need to develop and implement specialized management methods, functions, and organizational structures. This contributes to increasing the competitiveness of farms. The concept of strategic management of agricultural enterprises should be developed based on the analysis and the possibilities of adaptation to market conditions. It should be oriented to the demand and needs of the market. It is important to develop effective relationships between labour, financial and information resources, to stimulate productivity and minimize costs.

Effective management requires flexibility, adaptability and regular review of objectives in line with market changes. Optimization of management in the agricultural sector includes the use of modern innovations in programming, modelling, and forecasting. The efficiency improvement strategy should be an integrated system of organizational and informational principles, tools and mechanisms that increase the competitiveness of farms.

Strategy development begins with market analysis, resource assessment, determining clear goals, creating a business plan, and implementing new technologies. A risk management system should minimize threats such as climate change and price fluctuations. It is also important to invest in staff training and develop partnerships in the agro-industrial complex.

Figure 3. Principles of strategic management

Source: developed by the author

Farmers must adhere to a strategic plan, ensuring a sequence of actions and a systematic approach to development. Efficiency is achieved through resource optimization, which not only increases productivity, but also reduces costs. Flexibility enables quick adaptation to changes, and balance takes into account economic, social, and environmental aspects. Minimizing risks through identifying threats and developing strategies is a key aspect of productivity management in the agricultural sector (Figure 3).

Therefore, the management of agricultural business structures in Ukraine requires constant improvement and adaptation to changing market conditions. Stable development of the agricultural sector can be achieved through the support of small and medium-sized entrepreneurs, facilitate their access to resources and markets, and encourage cooperation between all participants in the agricultural chain.

4. Discussion

A comparison of the results obtained with studies of strategic management in the agricultural sector reveals common trends and different approaches that have been applied in recent studies. Thus, the research of Svitovyi (2022) and Trusova *et al.* (2023) emphasizes the importance of adaptability in the strategic management of agricultural enterprises. Their conclusions emphasize that the ability to adapt to market changes is critical for the survival and successful functioning of agricultural companies. The study of Slobodianyk *et al.* (2021) focuses on technological changes, which indicates the growing role of digitalization, which, according to the authors, is a key factor for increasing the adaptability and competitiveness of agricultural companies.

The studies of Svitovyi (2022) and Trusova *et al.* (2023) emphasize the importance of adaptability in the strategic management of agricultural enterprises. Their conclusions emphasize that the ability to adapt to market changes is critical for the survival and successful functioning of agricultural companies. The research conducted by Slobodianyk *et al.* (2021) focuses on technological changes, which indicates the growing role of digitalization. According to the authors, the latter is a key factor for increasing the adaptability and competitiveness of agricultural companies.

Environmental aspects and sustainable development are becoming increasingly important in the agricultural sector, which is reflected in the study of Tykhenko (2022). The author emphasizes the need to integrate sustainable practices into the strategy of agricultural companies, which not only corresponds to global trends, but also ensures long-term competitiveness in the market. Our own results confirm this opinion, because agricultural companies that implement environmental initiatives are able to ensure not only sustainable functioning but also improve their image in society.

The importance of institutional support is also a relevant issue in the studies of Tykhenko (2022) and Shandova (2023). They claim that effective interaction between agricultural enterprises and state institutions can significantly increase the efficiency of agricultural companies. This shows that proper government policy and support can become a driving force for the development of the agricultural sector, in particular, under economic instability, which is also indicated in the conducted research.

The results of Williams and Triest (2023) demonstrate that innovative technologies have significant potential to increase productivity in the agricultural sector. These results are consistent with the data obtained, which indicate the positive impact of innovations on the efficiency of agricultural companies. However, the study of Pruntseva (2020) indicates the barriers to the introduction of innovations that require additional measures to overcome them. This emphasizes the importance of creating a favourable innovation environment for agricultural companies.

The research conducted by Maksym *et al.* (2022) on the circular economy and Kaminskyi *et al.* (2020) on sustainable production models point to new paradigms in strategic management that can become the basis for future strategies of agricultural companies. These new models are aimed at reducing waste, rational use of resources and supporting sustainable development. This is especially important in the context of global climate change and growing demand for ecological products. A comparison of the obtained results with current studies emphasizes that strategic management in the agricultural sector of Ukraine requires a comprehensive approach. This approach should include adaptability, technological development, environmental friendliness, innovation, and state support. It will enable agricultural enterprises not only to cope with modern challenges, but also to succeed in view of constant changes, ensuring sustainable development, and increasing competitiveness. So, the research results not only confirm the relevance of existing theoretical approaches but also introduce new aspects into the understanding of effective strategic management in the agricultural sector of Ukraine. The aim of the research corresponds to the obtained results, as it implied the identification of effective approaches to the optimization of the management of agricultural business structures. The obtained results confirm the need for a comprehensive approach to strategic management in the agricultural sector. The practical use of research results

can be aimed at the development of strategic plans for the development of agricultural enterprises, the introduction of innovative technologies and environmental practices, the creation of a favourable innovation environment, and the development of new production and consumption models.

Limitations

The study covers the period from 2018 to 2023, which may not be sufficient to identify long-term trends. Technological changes, government policies and programmes, the impact of climate change, and other factors may require a longer period for analysis.

Recommendations

Recommendations for increasing the efficiency of the agricultural sector of Ukraine: investment in modern technologies and innovations, product diversification, as well as strengthening cooperation and clustering.

Conclusions

The agricultural sector of Ukraine has significant potential for growth but faces a number of internal and external challenges. Ukraine has a larger area of agricultural land than Germany and France, but lower agricultural productivity. In 2021, the area of agricultural land in Ukraine was 41.5 million hectares, while in Germany — 16.7 million hectares, and in France — 29.4 million hectares. The employee qualification in the agricultural sector of Ukraine is 20%, 25% lower than in Germany and France. The same situation with exports. In 2023, the exports of agricultural products of Ukraine amounted to €24 milliard, while in Germany - €50 milliard, and in France - €70 milliard. In 2023, the profitability of agricultural enterprises in Ukraine was 9.0%, while in Germany - 12.0%, and in France - 15.5%. This indicates the need to implement more effective management strategies and innovations to improve the economic situation in the sector.

The agricultural sector of Ukraine has such strengths as high-quality products, qualified specialists, and natural resources. However, there are also weaknesses, such as dependence on weather conditions, financing problems, and low investment activity. Enterprises need to adapt to changing market conditions in order to achieve stability in the conditions of global competition. Recommendations arising from the study may include the introduction of modern technologies to increase productivity and production efficiency. Furthermore, it is important to expand sales markets through active participation in international exhibitions and fairs. The scientific novelty of the study lies in the development of new theoretical approaches and practical recommendations for the strategic management of the agricultural sector of Ukraine in the context of global challenges. In particular, the relationship between the level of employees' qualifications, investment activity and export potential of agricultural enterprises is determined. A set of measures to increase productivity through the introduction of digital technologies, innovative management methods and diversification of sales markets is proposed. The results obtained can serve as a basis for the formation of effective state policies to support agricultural business, stimulate investment and increase the competitiveness of the industry.

In addition, the obtained data can help in the elaboration of policies that support the development of the agricultural sector. Information about the structure of agricultural enterprises and their profitability can become the basis for the creation of support programmes for small and medium-sized agricultural businesses. It can also help to stimulate investment in technology and innovation. The practical value of the research conducted is the development of recommendations and strategies that can be used by agricultural enterprises to increase their economic efficiency and competitiveness in the market.

Credit Authorship Contribution Statement

Sofia Scutari: Conceptualization, Investigation, Writing – original draft, Methodology;
Petru Catan: Project administration, Data curation, Supervision;
Oleg Scutari: Software, Visualization, Funding acquisition Software, Validation, Formal analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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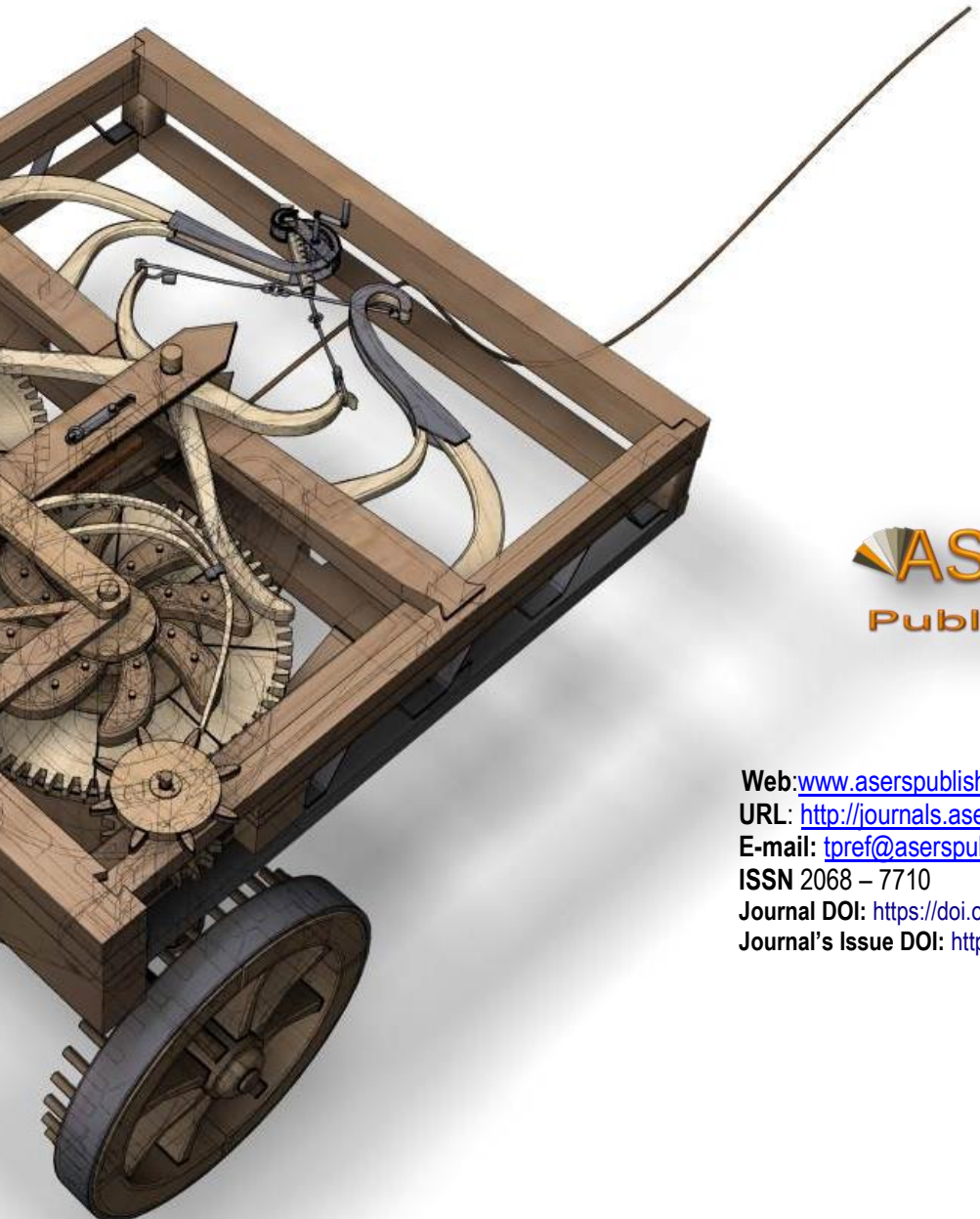

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