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Controlling as a Tool for Strategic Development in Agro-Industrial Management

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This article examines the strategic importance of controlling in the agroindustrial sector, exploring how controlling mechanisms can affect the effectiveness of management decisions and ensure the sustainable development of agricultural enterprises. It analyzes key aspects of implementing controlling to optimize management processes and increase operational efficiency. The article provides an in-depth analysis of the basic controlling methods and tools that are used to analyze internal processes and assess the external environment. The need to integrate the controlling function with agroindustrial enterprises' strategic management is justified to increase their adaptability and competitiveness. A model of strategic controlling is proposed that considers the agroindustrial sector's specificity, which can serve as a basis for achieving long-term strategic goals.

Keywords: controlling, resource optimization, strategic development, agro-industrial management, cost management, economic efficiency, planning, investments, production productivity, financial analysis.

1. Introduction

The agro-industrial sector, a linchpin of the Ukrainian economy, is crucial for the country's food security and export potential. However, in the face of rapid changes in the external environment, such as market instability, legislative changes, climate challenges, and intensified international competition, agro-industrial enterprises are compelled to adapt their strategies.

To ensure sustainable development and enhance the competitiveness of these enterprises, there is an urgent need for effective management tools. These tools enable swift responses to challenges and facilitate strategic decisions based on objective data.

A critical tool within business management is controlling, which integrates planning, control, and analysis functionalities (Senyk et al., 2024). This tool equips the company's leadership with the essential information to make strategic decisions. Despite the significant potential of controlling, its use in the agro-industrial sector remains limited due to insufficient awareness of its capabilities and methodological aspects of implementation (Markina et al., 2021). This gives rise to the need to investigate the role of controlling as a strategic development tool in managing the agro-industrial complex and determine its effective inclusion in the management processes of agro-industrial enterprises.

2. Literature Review

Recent studies and scientific publications testify to this tool's importance for increasing enterprise management efficiency. In particular, Reta et al. (2018) and Mishchenko et al. (2020) emphasize the need for accurate measurement and assessment of the company's financial strategy in the strategic controlling system and provide a comprehensive classification of controlling tools that can be used to manage the company. Their investigations offer a wide range of tools that can be adapted to achieve the strategic goals of agribusiness enterprises.

Butenko (2018) views control as a pivotal management tool, particularly in the face of contemporary challenges. His study demonstrates how control can aid enterprises in adapting to new management approaches, thereby enhancing their efficiency and ensuring their continued relevance in a rapidly changing business landscape.

Sysoiev (2020) presents a methodology for evaluating the effectiveness of operational activities through the lens of controlling. This study is particularly pertinent for agro-industrial enterprises, where operational efficiency is a critical factor in maintaining competitiveness. In the research conducted by Diachenko (2010), controlling is considered an essential element of increasing management efficiency. It is also emphasized that through controlling, enterprises can optimize management decisions and improve resource use efficiency (Markina et al., 2022).

The field of agro-industrial management has developed rapidly during recent decades due to the concern about the market situation and the need for ecological management (Stepanenko et al., 2023; Hutsaliuk et al., 2024a,b). Control (controlling) as the managerial function is essential for strategic development owing to the most critical part of organizations—creating the ability to monitor, control, evaluate, and improve the performance of the managerial system (Malyarets et al., 2017).

Control as a management function is often depicted as a structured process comprising measuring performance, comparing it to predefined goals, and initiating corrective actions when identified gaps exist (Robert et al., 2022; Ojiako et al., 2023; Nosach et al., 2023). With widespread knowledge of the advancement of technology, this foundational model of controlling function has grown to include contemporary methods to harness technology for

better decision-making and operational efficiency (Kharazishvili et al., 2023). The ultimate goal of control is to assist in achieving organizational objectives, thereby creating an opportunity for the organization to respond nimbly and effectively to its internal and external environments.

Regarding practical implications for the agro-industrial realm, controlling is essential for enterprises due to its reliance on specific, measurable planning indicators (Kryukova et al., 2023). According to Zhai et al. (2023), the agro-industrial sector is challenged by market volatility and fluctuating commodity prices, making it a complex economic activity for management. Implementing efficient controlling practices allows for mitigating risks caused by market volatility and facilitates the coordination of marketing, production, finance, and others (Guo et al., 2024).

The sustainably-planned agro-industrial management provides continuity and competitiveness for enterprises in the long term. According to the latest studies, a more integrated approach combining old and new management approaches will be beneficial (Chmutova et al., 2017; Markina et al., 2017; Hutsaliuk et al., 2020). The Agri-Tech Innovation Framework proposes to improve the production and use of food, energy, and materials by integrating newly available technologies and methods to control the agro-industrial output (Arthur et al., 2024). Besides, research suggests that managerial decisions are based on data-independent methods. Abate (2021) indicates that big-data analytics and real-time monitoring systems in agro-industry enable decision-makers to make 'correct' decisions, bringing about 'improvements in both operation and strategy.' Similar results are found by Gupta et al. (2020), who discovered that organizations using intelligent controlling methods have 'significantly higher market share and financial performance' than those that rely upon traditional systems.

New hi-tech control methods have been developed, which are also at the service of the agro-industrial sector, based on automation, digital tools, and performance indicators implemented by the agro-food industry. As Kharazishvili et al. (2023), precision agriculture tools such as satellite monitoring or IoT [Internet of Things] devices can be used to decrease the manager's subjective view in decision-making and provide them with more data for their decisions. Integrated control allows for more effective use of factors and, thus, lower waste and better output. In addition, kinder control is supplemented by new practices of co-responsibility and co-sustainability. Literature shows that ESG (environmental, social, and governance) criteria are being increasingly introduced into traditional systems of control so that companies in the agro-industry can adopt them and get closer to a higher level of worldwide sustainability objectives.

In general, all these studies emphasize the importance of controlling the strategic development of agro-industrial enterprises and their role in increasing efficiency, optimizing costs, and implementing financial strategies. However, implementing proper controlling practices in the agro-industrial sector could be complicated by factors such as the absence of specialists in agriculture and modern management practices, the low level of investments in technology and staffing, and the low capacities of smaller agricultural enterprises.

3. Methodology

The methods of statistical analysis, logical conclusion and balance method were used in this study, a collaborative effort with the agro-industrial complex. Statistical analysis was applied to process and interpret the collected data. The balance method was used to determine indicators of domestic demand, real consumption of products, as well as to analyze dependence on imports. This method is based on the requirements of an integrated approach to determining indicators, which include production, import and export. Thanks to the method of logical conclusion, the research data were summarized, which made it possible to formulate well-founded proposals and recommendations.

The purpose of the work is to analyze the influence of controlling as a strategic development tool in managing the agro-industrial complex and to develop recommendations for its optimization. The study was structured around the following tasks:

I. To study the theoretical foundations and practical application of controlling in the agro-industrial complex.

II. To evaluate the influence of controlling on the strategic management of agro-industrial enterprises.

III. To analyze statistical data on the effectiveness of control activities in agro-industrial production.

IV. To identify the main problems and obstacles to the inclusion of controlling in strategic planning.

V. To develop proposals for improving the controlling system to increase the competitiveness and efficiency of agro-industrial enterprises.

4. Results and Discussion

Controlling in the agro-industrial sector is a critical tool that allows enterprises to adapt to rapid changes in the market environment, effectively manage resources, and ensure the implementation of strategic goals (Pylypenko et al., 2023). In the conditions of globalization and growing competition, the controlling system at agro-industrial enterprises is not only a control mechanism but also an element of strategic management aimed at increasing efficiency and competitiveness. Effective management in the agro-industrial sector is ensured by the use of control tools that allow enterprises to optimize their processes and increase competitiveness, making professionals in the sector feel efficient and effective in their operations. Controlling in the agricultural sector contributes not only to the improvement of internal activities, but also to the preparation of strategic foundations for sustainable development (Polyakova et al., 2023).

According to the State Statistics Service, during 2020-2022, the agro-industrial sector's production volume increased by 15%, reflecting an increase in management efficiency and cost optimization thanks to the implementation of control systems. Domestic cereal production increased by 20%, and resource efficiency improved by 25%.

The company "Agro-Ukraine," which implemented a controlling system in 2019, reduced total

production costs by 18% due to the optimization of logistics and loss reduction. Furthermore, using budgeting and financial planning made it possible to increase profitability by 30% due to more accurate forecasting of yields and pricing (State Statistics Service of Ukraine, 2024).

Strategic control allows not only monitoring current indicators but also analyzing trends and identifying potential opportunities for development. The use of SWOT and PEST analysis in the control framework helps to identify external and internal risks and form strategic initiatives.

Controlling covers a wide range of activities, from planning and budgeting to analyzing plan execution and operational management. In the agro-industrial sector, controlling helps determine production costs, optimize purchasing activities, and adjust the development strategy in accordance with changes in the external and internal environment.

Controlling is not just a tool, but the most important strategic tool that empowers agro-industrial enterprises to align their operational activities with strategic goals. It plays a pivotal role in facilitating more informed decision-making and improving responsiveness to market changes, giving professionals in the sector a sense of confidence in their strategic choices.

Strategic controlling is the linchpin that ensures the seamless integration of strategic planning and management into one process. It includes the analysis of market trends, identification of potential risks and business opportunities. In the agricultural sector, where changes in the prices of inputs and products can significantly affect profitability, strategic controlling plays the role of a critical success factor, reassuring professionals in the sector about the alignment of their strategies (Reta et al., 2018).

Among the main controlling tools, budgeting, forecasting, benchmarking, cost and profitability analysis, and management by objectives (MBO) can be distinguished. The use of these tools allows agro-industrial enterprises to allocate resources effectively, determine development priorities, and evaluate the effectiveness of decisions (Mischenko et al., 2020).

The following table (Table 1) presents the main controlling tools used to analyze internal processes and assess the external environment.

Table 1. Main Controlling Tools

Tool	Description
Budgeting	Budgeting is a crucial controlling tool that allows an enterprise to plan its financial flows and monitor their implementation. It includes drawing up operational, investment, and financial budgets, which align the company's strategy with its financial capabilities and goals. This tool also allows you to evaluate the efficiency of resource use and quickly react to deviations from the planned indicators.
Analysis of Deviations	This method allows for comparing actual performance results with planned indicators and identifying deviations and their causes. Analyzing deviations enables the enterprise to quickly adjust its actions to achieve the planned goals and evaluate the effectiveness of management decisions.
ABC Analysis	ABC Analysis is a method for classifying a company's resources, products, or customers according to their importance and profitability. This method helps determine which elements are critical to the business and focfocusessources on optimizing them. It is especially useful for inventory management, identifying the most profitable products or customers.

System of Key Performance Indicator(-s) (KPI)	The KPI System is a tool for assessing the company's achievement of its strategic goals. KPIs can include financial, operational, customer, and other indicators that reflect the state of the business. Controlling based on KPI allows the enterprise to focus on the most important aspects of its activity and evaluate progress in achieving strategic goals.
SWOT Analysis	SWOT Analysis is used to assess the enterprise's external environment and internal potential. This method allows for identifying the strengths and weaknesses of the enterprise, as well as the threats and opportunities of the external environment. The results of the SWOT analysis help form strategies that consider the enterprise's internal capabilities and the risks of the external environment.
Balanced Scorecard (BSC)	This tool combines financial and non-financial indicators to comprehensively assess the company's performance. BSC includes four main perspectives: economic, customer, internal business processes, and training and development. It allows the enterprise to focus on long-term goals and integrate strategic planning with operational management.
Factor Analysis	This method identifies the main factors affecting the research results. The analysis provides a deeper understanding of the reasons for changes in performance indicators and identifies key aspects that should be addressed to improve results.
Portfolio Analysis	This method evaluates and manages the enterprise's business portfolio, including analyzing products or divisions according to profitability, risks, and growth prospects. Portfolio analysis helps make decisions about investments, diversification, or asset reduction, ensuring the optimal use of the company's resources.
Centers of Responsibility	This approach involves dividing the enterprise into separate divisions, each responsible for its financial results. Each responsibility center has its own performance indicators and budgets, which allows you to increase control over costs and improve the financial results of the entire enterprise.

These controlling methods and tools allow agricultural enterprises to analyze internal processes more effectively, assess the impact of external factors, and make more informed management decisions to achieve strategic goals and ensure sustainable development.

Market volatility, climate change, and political uncertainty are among the challenges facing the agribusiness sector. In this context, one of the key areas of development is the development of flexible strategic plans and control systems that can quickly adapt to changing conditions. This adaptability provides a sense of reassurance and preparedness for any situation (Butenko, 2018).

Controlling is essential in increasing the efficiency of management decisions and ensuring the sustainable development of agro-industrial enterprises (Sysoiev, 2020). In the modern agro-industrial market, where enterprises struggle with high costs, significant volumes of production, and constant changes in the external environment, controlling becomes an indispensable tool for optimizing business processes and making informed management decisions (Figure 1).

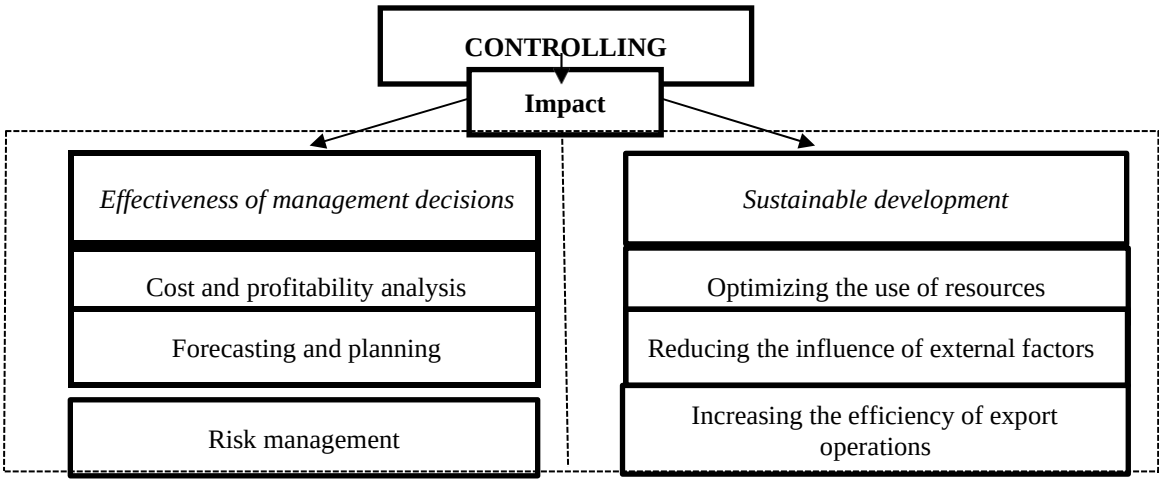

Figure 1. The Impact of Controlling on the Effectiveness of Management Decisions and Sustainable Development

Thanks to the controlling system, agro-industrial enterprises, such as Myronivsky Hliboproduct PJSC (MHP), can meticulously analyze the cost of production. This not only allows for the identification of the most expensive processes but also enables the implementation of measures to optimize them. In the case of MHP, where the total expenses are 370 million USD and the loss is 153 million USD, controlling emerges as a crucial tool for detailing expenses and identifying areas of cost reduction. This, in turn, will bolster the financial stability of the company by increasing the margin and improving its financial results.

Forecasting and planning are other essential aspects in which control plays a key role. For example, Kernel PJSC produces 2.0 million tons of grain and has expenses of 600 million USD; the accuracy of forecasting financial indicators is paramount. Thanks to controlling, the company can plan its activities more accurately, minimizing risks and maximizing profits, which in turn contributes to sustainable development.

Controlling also plays a pivotal role in helping enterprises implement robust risk monitoring systems. This is particularly crucial in conditions of unstable markets and legislative changes. Thanks to controlling, companies can better prepare for unexpected events, thereby limiting their negative impact on financial results. For instance, Astarta-Kyiv PJSC, which suffered a loss of 239.5 million USD, can use controlling to fortify its risk management and reduce the negative impact of external factors on its activities, instilling a sense of security in stakeholders.

Controlling also plays a significant role in ensuring the sustainable development of agro-industrial enterprises, providing them with tools for effective resource management and increasing profitability. For example, Agroinvest Ukraine LLC, with available resources of 150,000 hectares and investments worth 50 million USD, can optimize the use of these resources thanks to controlling. This optimization will not only reduce costs but also significantly increase the company's profitability, painting a promising picture of the future

for stakeholders.

Reducing the impact of externalities such as war-related costs is also an important challenge for agribusiness. In the case of Kernel PJSC, which spent 40 million USD on war-related costs, an audit can help minimize them and find ways to offset them by managing other costs more effectively.

In addition, controlling contributes to increasing the efficiency of export operations, which is an essential aspect for enterprises such as Myronivsky Hliboproduct PJSC. The increase in export revenue by 13% is an indicator of successful strategic planning, which can be further strengthened by implementing control to monitor the effectiveness of logistics and other export processes.

The creation of a strategic controlling model for the agro-industrial sector requires the integration of various parameters that affect the production, distribution, and sale of agro-industrial products. This model includes special mechanisms for strategic planning, performance measurement, and environmental scanning tailored to the sector's unique challenges.

Input data for model creation:

- Xt – production output (production volume) in period t.
- Ct – total production costs in period t, including variable and fixed costs.
- Pt – selling price of a product unit in period t.
- Dt – demand for products in period t.
- Rt – available resources (for example, land, water, seeds) in period t.
- It – investments in technology, equipment, and innovations in period t.

The goal of the model is to maximize the company's profit, taking into account resource constraints and risks. Profit for period t is calculated as: $Profit=(Pt \cdot Xt)-Ct$, where Ct includes variable costs proportional to production volume and fixed costs that do not depend on production volume but may change over time depending on inflation and other factors. The constraints for the model will look like this:

a. Resource limitations: $Xt \leq f(Rt)$, is a function of the production possibility, which depends on the available resources.

b. Budget constraints: $It+Ct \leq$ Available Budget.

c. Demand constraints: $Xt \leq Dt$.

Optimization of the enterprise life cycle is a comprehensive process that takes into account the forecasting of future market trends, changes in production technologies (Zaitsev et al., 2020; Taran et al., 2020), and environmental restrictions, ensuring a thorough approach.

To achieve optimal solutions, a linear or dynamic programming model is used, where the primary objective function is the maximization of the total profit for the entire planning period: $\max \sum_{t=1}^{T} \text{profit}$, where T is the planning horizon.

This model allows for integrating strategic and tactical management aspects into a single system, providing a comprehensive approach to controlling the agro-industrial sector (Table 2).

Table 2. Output Data for the Calculation of the Strategic Controlling Model

Indicators	Myronivsky Hliboproduct PJSC (MHP)	Agroinvest Ukraine LLC	Astarta-Kyiv PJSC	Kernel PJSC
Production volume (Xt)	1.4 million tons of grain	1.2 million tons of grain	1.3 million tons of grain	2.0 million tons of grain
Total costs (Ct)	370 million USD	320 million USD	450 million USD	600 million USD
Selling Price (Pt)	180 USD per ton	180 USD per ton	185 USD per ton	190 USD per ton
Demand (Dt)	Not specified	High	High	High
Available Resources (Rt)	200 thousand hectares	150 thousand hectares	250 thousand hectares	500 thousand hectares
Investment (It)	100 million USD	50 million USD	80 million USD	120 million USD
Revenue	3.021 million USD	500 million USD	650 million USD	1,000 million USD
Net debt	1.101 million USD	200 million USD	300 million USD	450 million USD
Costs related to the war	35 million USD	20 million USD	30 million USD	40 million USD
Export revenue	Increased by 13%	Increased by 10%	Increased by 12%	Increased by 15%
Theoretical revenue	252 million USD	216 million USD	240.5 million USD	380 million USD
Profit (loss)	-153 million USD	-124 million USD	-239.5 million USD	-260 million USD

Next, we will calculate the indicators using the proposed model (Table 3).

Table 3. Intermediate Calculations According to the Model

Enterprise	Production volume (Xt), million tons	Selling price (Pt), USD per ton	Total costs (Ct), million USD	Revenue (Pt * Xt), million USD	Estimated profit, million USD
Myronivsky Hliboproduct PJSC (MHP)	1.4	180	370	252,000	251,63
Agroinvest Ukraine LLC	1.2	180	320	216,000	215,68
Astarta-Kyiv PJSC	1.3	185	450	240,500	240,05
Kernel PJSC	2.0	190	600	380,000	379,4

MHP PJSC has one of the highest profits among companies, although its production volume is smaller than that of Kernel PJSC. It indicates effective cost management and high profitability. Agroinvest Ukraine LLC has the lowest production volume among companies, but at lower costs, it was possible to achieve a significant profit, which indicates potential for further growth as production increases. Astarta-Kyiv PJSC shows an average rate of profitability. Despite the higher selling price, total costs are relatively high, which lowers total profit. The company can focus on cost optimization to increase profitability. Kernel PJSC has the largest production volume and the highest selling price among all companies. This made it possible to obtain the highest profit, despite the high total costs. A high volume of production and optimization of the price of products are the main factors of the company's success.

Several approaches can be used to forecast cost optimization, depending on which factors we want to take into account. The primary goal is to reduce total costs (Ct) while maintaining or

increasing profit. This is a crucial task for the company's financial health. For this, several scenarios can be considered:

a. Reduction of fixed costs. Fixed costs can be reduced by optimizing administrative expenses, reducing real estate maintenance costs, reducing staff, or automating certain processes.

b. Reduction of variable costs. Variable costs can be reduced by optimizing the use of resources, implementing more efficient technologies, and improving logistics and supply.

c. Optimizing the use of resources. You can examine the relationship between resources (Rt) and output (Xt) and find the optimal combination that allows you to reduce costs while maintaining or increasing productivity.

d. Investments in technologies. Investing (It) in new technologies can reduce long-term costs, even if they initially require significant capital investment. This includes automation, energy saving, and new methods of processing or storing products.

Let us simulate the forecast under the condition of reducing costs by 10% and maintaining current production volumes (Table 4) using the following formula: Profit (Optimized)=(Pt×Xt×1000)−(Ct×(1−10%)).

Table 4. Cost Optimization Forecast Based on the Strategic Controlling Model

Enterprise	Total costa (Ct), million USD	Optimized costs (Ct), million USD	Estimated profit, million USD	Optimized profit, million USD
Myronivsky Hliboproduct PJSC (MHP)	370	333	251,63	251,67
Agroinvest Ukraine LLC	320	288	215,68	215,71
Astarta-Kyiv PJSC	450	405	240,05	240,10
Kernel PJSC	600	540	379,4	379,46

The conducted analysis shows that a 10% reduction in costs positively affects the financial results of agro-industrial enterprises. Although the profit increase is slight, it demonstrates the importance of cost optimization to improve profitability. For such large enterprises as Myronivsky Hliboproduct PJSC (MHP) and Kernel PJSC, the effect of optimization is most noticeable, emphasizing the importance of effective cost management. Other companies, such as Agroinvest Ukraine LLC and Astarta-Kyiv PJSC, also show a positive impact of optimization, which indicates the possibility of further improvement of their operations. Thus, even a slight reduction in costs can significantly improve financial performance, increasing the competitiveness and sustainability of agro-industrial enterprises in the long term.

5. Conclusion

The introduction of controlling as a strategic development tool in agro-industrial management is a pivotal factor in enhancing the efficiency of management decisions, optimizing costs, and ensuring the sustainable development of enterprises. The case studies of MHP PJSC, Agroinvest Ukraine LLC, Astarta-Kyiv PJSC, and Kernel PJSC demonstrate that controlling enables a detailed analysis of costs, forecasting of financial results, and better risk

management. This, in turn, fosters increased profitability, improved market competitiveness, and more effective responses to changes in the external environment. The role of controlling these achievements instills confidence in the decision-making processes of agro-industrial enterprises.

Further research can improve strategic controlling models, taking into account the specifics of the agro-industrial sector, and develop new tools for a more in-depth analysis of risks and opportunities. Research into integrating control with modern information technologies is especially relevant, as it will increase the accuracy of forecasting and the speed of management decision-making. In addition, it is necessary to investigate the impact of global challenges, such as climate change and political instability, on the effectiveness of control systems in agro-industrial enterprises.

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