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QUALIFICATION THESIS

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Student: 2nd-year student, group EC-24dmi
Specialty: 051 Economics
Educational Program: Economics

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Supervisor: Prof., D.Sc. Olshanskyi O.V.
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Kyiv – 2026

VOLODYMYR DAHL EAST UKRAINIAN NATIONAL UNIVERSITY
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Institute, Faculty, Department: Faculty of Economics and Management
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TASK
FOR MASTER'S QUALIFICATION THESIS

Student Name: _______Wang Lu__________
1. Thesis Topic: "Strategy for the Innovative Development of an Agro-Industrial Holding Based on the Principles of the Circular Economy"
Supervisor: Olshanskyi Oleksandr Viktorovych, Prof., D.Sc.
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3. Initial Data for the Thesis: scientific works of domestic and foreign scholars on economics, innovative development of enterprises, strategic management, circular economy, resource efficiency, and sustainable development of agro-industrial holdings; statistical and analytical data on the performance of the enterprise under study; materials from the pre-graduation internship report; the company’s financial statements and non-financial reporting.

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4. Content of the Explanatory Note: 1. Theoretical and methodological foundations of the innovative development strategy of an agro-industrial holding based on the principles of the circular economy. 2. Assessment of the current state of economic activity and resource use efficiency of the agro-industrial holding. 3. Analysis of the production, financial, environmental, and organizational prerequisites for the implementation of circular economy principles in the company’s activities. 4. Development of a strategy for the innovative development of the agro-industrial holding based on circular economy principles. 5. Substantiation of the proposed

measures and assessment of their impact on the efficiency, competitiveness, and long-term development of the enterprise.

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5. List of Graphic Materials:
Tables, figures and other demonstration material

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6. Consultants for Thesis Chapters:

Chapter	|Consultant Name, Title	Signature|, Date	
		The Task is given	The task is received

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CALENDAR PLAN

No.	Task Stage	Deadline	Remarks
1	Approval and assignment of thesis topic	January 2026	
2	Justification of the topic's relevance	January 2026	
3	Bibliographic research and material preparation for Chapter 1	January 2026	
4	Submission of Chapter 1 materials	January 2026	
5	Data collection for Chapter 2	January 2026	
6	Submission of Chapter 2 materials	February 2026	
7	Preparation and drafting of Chapter 3	March 2026	
8	Submission of Chapter 3 materials	March 2026	
9	Drafting conclusions and finalizing the thesis	March 2026	
10	Defense presentation preparation	March 2026	

Student: ___________________________________Wang Lu

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ABSTRACT

Master's thesis:95 p., 36 tables, 2 figures, 28 sources.

The object of the research is the process of innovative development of an agro-industrial holding in the context of the transition to a circular economy.

The subject of the research is a set of theoretical, methodological, and practical aspects of managing the innovative development of an agro-industrial holding based on the principles of the circular economy, including mechanisms of strategic planning, economic substantiation, and assessment of the effectiveness of the proposed measures.

The purpose of the qualification thesis is the theoretical substantiation and development of practical recommendations for forming a strategy of innovative development of an agro-industrial holding based on the principles of the circular economy, taking into account technological, digital, organizational, and economic factors.

The theoretical and methodological principles of innovative development of enterprises under the conditions of the circular economy have been studied, and the conceptual foundations of integrating circular practices into the corporate strategy of an agro-industrial holding have been generalized. Based on the analysis of the activities of PJSC “MHP”, an assessment of financial and economic performance, resource potential, innovation activity, and the level of implementation of circular practices has been carried out. The strategic priorities of innovative development of the holding have been substantiated, a set of innovative and circular measures has been developed, and the economic feasibility of the proposed strategy has been proved, taking into account its production, energy, environmental, and social effects.

INNOVATIVE DEVELOPMENT, AGRO-INDUSTRIAL HOLDING, CIRCULAR ECONOMY, STRATEGY, RESOURCE EFFICIENCY, BIOENERGY, DIGITALIZATION, COMPETITIVENESS.

CONTENTS

INTRODUCTION

The current stage of development of the agro-industrial sector is characterized by a combination of global competition, increasing resource constraints, increased environmental requirements and the need to ensure food security. In the context of Ukraine's integration into the global economic space and adaptation to the standards of the European Union, the formation of an effective model of innovative development of enterprises is of particular importance. The traditional linear business model, based on the intensive use of natural resources, is gradually losing its effectiveness, giving way to a circular economy focused on closed production cycles, waste minimization and increased resource productivity.

For large agro-industrial holdings, the transition to an innovative and circular model is not only an environmental requirement, but also a strategic condition for maintaining competitiveness. The integration of bioenergy solutions, digital resource management technologies and ESG principles into corporate strategy creates the prerequisites for long-term economic growth and increased financial sustainability.

The relevance of the study is due to the need to develop a scientifically sound mechanism for managing the innovative development of an enterprise in the context of the circular transformation of the agro-industrial sector, which will ensure a combination of economic efficiency, environmental responsibility, and social stability.

The object of research is the process of innovative development of an agro-industrial holding in the context of the transition to a circular economy.

The subject of the study is a set of theoretical, methodological and practical aspects of managing the innovative development of an agro-industrial holding based on the principles of a circular economy, including mechanisms for strategic planning, economic justification and assessment of the effectiveness of the implemented measures.

The purpose of the study is to develop and economically substantiate a strategy for managing the innovative development of an agro-industrial holding in a circular economy, taking into account technological, digital, and organizational and economic factors.

To achieve the set goal, the work provides for the solution of the following tasks:

to explore the theoretical foundations of innovative enterprise development and the concept of a circular economy;

analyze the current state and results of the agro-industrial holding;

assess innovative activity and the level of implementation of circular practices;

determine strategic priorities for innovative development;

develop a set of innovative and circular measures;

to carry out an economic justification of the proposed strategy and assess its effectiveness;

conduct a risk assessment and forecast the socio-economic and environmental results of the strategy implementation.

A set of general scientific and special methods was used in the research process. Theoretical generalization and system analysis were used to study the essence of innovative development and circular economy. The comparative analysis method was used to assess the enterprise's activities and determine strategic development reserves. Economic and mathematical methods, in particular the calculation of efficiency indicators (NPV, payback period, profitability), were used to substantiate the proposed measures. The scenario analysis method was used to assess risks and determine the development options. Graphical and tabular methods were used to visually present the research results.

CHAPTER 1 THEORETICAL AND METHODOLOGICAL PRINCIPLES OF INNOVATIVE DEVELOPMENT IN THE CONDITIONS OF CIRCULAR ECONOMY

1.1. Theoretical foundations of innovative development of an enterprise

Innovative development of an enterprise is one of the key categories of modern economic theory and management practice, reflecting the ability of a business entity to systematically update, create and implement new knowledge, technologies, products and management solutions in order to ensure long-term competitiveness and increase business value. In modern conditions of globalization, technological turbulence and the growing role of intellectual capital, innovative development takes on the character of a strategic imperative that determines the trajectory of the enterprise's functioning in a dynamic environment.

The economic essence of innovative development is revealed through the combination of two interrelated categories - "innovation" and "development". Innovation is interpreted as the result of creative activity aimed at creating new or improved products, processes, organizational forms or market solutions that have economic value and are commercialized in practical activities. Development, in turn, means irreversible, directed and qualitative changes in the structure and functioning of the economic system. Therefore, the innovative development of an enterprise should be understood as a process of qualitative transformation of its production, technological, organizational and management systems based on the creation and implementation of innovations.

The evolution of the concept of innovative development is associated with a change in dominant economic paradigms. In the early stages of industrial development, innovations were viewed primarily as technical improvements in production. Classical economic theories focused on the factors of labor, capital, and land, while scientific and technological progress was perceived as an exogenous factor.[7, 21, 24]The turning point was the formation of the theory of innovation as an internal driver of economic dynamics, when innovation was recognized as the main source of economic growth and structural changes.

Within the neoclassical and neo-Schumpeterian[24]traditions of innovation began to be considered as the result of entrepreneurial initiative and investment in research and development. Further development of the concept is associated with the formation of the theory of endogenous growth, in which knowledge, human capital and intellectual resources are the key determinants of long-term development. In modern economic science, innovative development is interpreted as a complex multi-level process that encompasses the creation, diffusion and use of knowledge within the enterprise and beyond.

The change in approaches to understanding innovative development has led to the expansion of its content. If at the initial stages innovations were associated mainly with product and technological changes, now they include organizational, managerial, marketing and social innovations. In this context, the innovative development of an enterprise acquires a complex character and involves the integration of various types of innovations into a single system of strategic management.

The systematization of the evolutionary stages of the concept of innovative development can be presented in the form of a generalized table.

Table 1.1

Evolution of approaches to understanding innovative development

Period	Dominant approach	Characteristics of innovations	The role of the enterprise
Industrial stage	Technical and technological	Innovation as an improvement of production processes	Technical change implementer
Entrepreneurship theory	Entrepreneurial	Innovation as a result of entrepreneurial initiative	Active change agent
Endogenous growth theory	Knowledgeable	Innovation as a result of knowledge accumulation and R&D	Knowledge generator
Modern systems paradigm	Integrated	Innovation as a comprehensive business model transformation	Strategic resource integrator

In modern conditions, the innovative development of an enterprise is considered as a continuous process of adaptation to changes in the external environment and the formation of internal competitive advantages. Its economic content is the creation of added value through increasing resource productivity, optimizing costs, developing new markets and forming stable positions in the industry structure.

Of particular importance is the relationship between innovative development and the concept of strategic management. Innovations cease to be random or episodic decisions and are integrated into the long-term strategy of the enterprise. Thus, innovative development becomes not only a functional area of activity, but also a system-forming element of corporate policy.

The economic essence of innovative development is also manifested through its impact on the structure of the enterprise's resource potential. The importance of intangible assets, intellectual capital, digital technologies and organizational competencies is growing. A new configuration of production factors is being formed, in which knowledge and information act as key resources for value creation.

Summarizing various approaches, it is advisable to define the innovative development of an enterprise as a purposeful, systematic and continuous process of qualitative changes in its activities, based on the creation and implementation of innovations aimed at ensuring long-term competitiveness, economic sustainability and growth of market value. Such an approach allows integrating technological, organizational and strategic aspects of innovations into a single conceptual model of development.

Thus, the evolution of the concept of innovative development indicates a gradual transition from a narrow technical and technological interpretation to a comprehensive systemic vision, in which innovations serve as the basis for the transformation of the enterprise's business model. This creates a methodological basis for further research into the mechanisms of management of innovative development of agro-industrial enterprises on the principles of a circular economy.

In the modern economic system, the competitiveness of an enterprise is formed under the influence of a complex of internal and external factors, among which innovative development occupies a leading place. For agro-industrial enterprises operating in an environment of high resource dependence, price volatility and global competition, innovations become not only a tool for growth, but also a condition for maintaining market positions. In this context, innovative development acts as a strategic factor in the formation of sustainable competitive advantages[21,25,27].

The competitiveness of an agro-industrial enterprise should be considered as its ability to function effectively in domestic and foreign markets, providing higher product value for consumers compared to competitors while achieving economic efficiency. In the context of globalization of agricultural markets and increasing requirements for quality, safety and environmental friendliness of products, traditional factors of competitiveness, such as access to natural resources or low production costs, no longer guarantee long-term stability. The advantage is gradually shifting to the plane of technological, organizational and managerial innovations.

Innovative development ensures the formation of competitive advantages through several interrelated mechanisms.[24]. First, technological innovations contribute to increasing labor productivity and resource efficiency. The introduction of modern agricultural technologies, automated production management systems, and digital process monitoring allows for reducing costs, minimizing raw material and energy losses, and increasing the stability of production results. Second, product innovations create opportunities for product differentiation and entering new market segments, in particular markets with higher quality standards and environmental responsibility. Third, organizational innovations increase management flexibility, which is especially important in conditions of instability in the external environment.

In the agro-industrial sector, competitiveness has specific features related to the biological nature of production, seasonality, dependence on climatic conditions and long production cycles. That is why innovative development in this area covers not only technological solutions, but also a set of measures for risk management, diversification of activities and integration of production chains. Vertical integration, creation of closed production cycles, use of by-products and introduction of energy-saving technologies form a new level of competitive advantages based on the efficiency of resource flows.

An essential aspect is the relationship between innovation activity and long-term financial performance. Studies of the economic dynamics of enterprises indicate that the systematic implementation of innovations is positively correlated with the growth of profitability, market share and business capitalization. In agro-industrial holdings, innovative development contributes to the optimization of logistics processes, reduction of transaction costs and increase of investment attractiveness.

A summary of the main areas of influence of innovative development on the competitiveness of agro-industrial enterprises can be presented in Table 1.2.

Table 1.2

The impact of innovative development on the competitive advantages of an agro-industrial enterprise

Direction of innovation	Economic effect	Competitive result
Technological innovations	Cost reduction, productivity increase	Price advantage
Product innovations	Expanding the range, improving quality	Product differentiation
Organizational innovations	Improving management efficiency	Flexibility and adaptability
Digital solutions	Transparency and process optimization	Increasing partner trust
Environmental innovations	Rational use of resources	Positive reputation and access to new markets

A special role in ensuring competitiveness is played by the integration of innovations into the strategic model of enterprise development. Innovations must be coordinated with long-term goals, corporate culture and risk management system. Only with strategic coordination can innovation activities create sustainable competitive advantages, rather than short-term tactical benefits.

An important characteristic of a modern agro-industrial enterprise is its ability to form an innovation ecosystem, which includes cooperation with scientific institutions, technology companies, financial institutions and government agencies.

Such interaction helps to accelerate the implementation of new solutions, reduce innovation risks and increase the overall efficiency of the innovation process.

Thus, innovative development is a key factor in shaping the competitiveness of agro-industrial enterprises, as it ensures a systematic increase in production efficiency, expansion of market opportunities, and strengthening of strategic positions in the industry structure.

In modern conditions of complexity of economic relations, growth of technological dynamics and increase of requirements for efficiency of use of resources management of innovation processes requires application of system approach. Innovative activity of the enterprise cannot be considered as a set of isolated measures or separate projects as it covers all functional subsystems – production, financial, marketing, personnel and organizational. That is why system approach allows to integrate innovative solutions into the unified logic of strategic development[19, 26, 27].

The system approach is based on the understanding of the enterprise as an open socio-economic system that functions in interaction with the external environment and consists of interconnected elements. The innovation process in this context acts as a subsystem that has its own goals, resources, mechanisms and results, but at the same time affects the overall effectiveness of the enterprise. Innovation management should ensure consistency between the strategic goals of the company and specific innovation initiatives.

From the standpoint of a systems approach, the innovation process has a certain structure, which includes the stages of generating ideas, assessing their feasibility, developing and implementing solutions, commercializing results and monitoring effectiveness. Each of these stages is associated with the corresponding resource flows and management functions. Violation of the integrity of the system or lack of coordination between its elements reduces the effectiveness of innovation activities and increases the risks of losses.

One of the key characteristics of systemic innovation management is a focus on long-term results. Innovations require significant investment and time to achieve economic effect, so their implementation should be subordinated to the strategic priorities of the enterprise's development. Within the framework of a systemic approach, innovation activities are integrated into the overall strategic management system through the definition of goals, the formation of a portfolio of innovation projects and the establishment of criteria for assessing performance.

An important element of the system approach is resource balance. Innovative development involves the involvement of financial, material, labor and information resources, which should be optimally distributed between current activities and promising areas. Excessive concentration of resources on individual innovation projects can create an imbalance in the functioning of the enterprise, while insufficient funding reduces the development potential. Therefore, innovation management requires constant coordination of resource constraints with strategic objectives.

The system approach also involves taking into account the external relations of the enterprise. Innovation processes largely depend on interaction with suppliers, consumers, scientific institutions, investment structures and government agencies. The formation of an innovation ecosystem allows the enterprise to gain access to new knowledge, technologies and financial resources, which helps to reduce innovation risks and increase the speed of innovation implementation. Thus, the innovation system of the enterprise is open and interacts with elements of the national and international innovation infrastructure.

In the structure of system management of innovation processes, it is possible to distinguish the main functional blocks that ensure the integrity and effectiveness of innovation activities (Table 1.3).

The system approach emphasizes the need for feedback and adaptability. Innovative projects are implemented in conditions of uncertainty, so it is important to provide mechanisms for controlling and adjusting strategic decisions. Monitoring key performance indicators allows for timely detection of deviations and minimizing the risks of failure. Thus, the innovation management system must be flexible and capable of self-renewal.

Table 1.3

Main elements of the innovation process management system

System element	Content	Functional purpose
Strategic block	Defining goals and directions of innovative development	Forming a long-term orientation
Organizational block	Innovation management structure, division of powers	Coordination of actions of units
Resource block	Financial, material, human and information resources	Ensuring project implementation
Process block	Planning, implementation and control of innovation activities	Operational management
Evaluation unit	Monitoring performance and adjusting decisions	Providing feedback

Of particular importance is the integration of innovation management with other management subsystems of the enterprise. Innovations affect production processes, logistics, marketing, finance and personnel policy. The system approach assumes the coherence of these subsystems in order to avoid contradictions and duplication of functions. For example, the introduction of new technologies should be accompanied by appropriate changes in the management structure, personnel training and financial planning.

In the context of modern economic development trends, systemic management of innovation processes is increasingly combined with the concepts of sustainable development and circular economy. Innovative solutions are aimed not only at increasing economic efficiency, but also at ensuring environmental balance and social responsibility. This expands the functional role of the enterprise's innovation system and requires taking into account environmental and social indicators when assessing results.

Therefore, a systematic approach to managing innovation processes ensures the integrity, coherence, and strategic direction of an enterprise's innovation activities. It allows integrating innovations into the overall development model, optimizing resource use, increasing adaptability to changes in the external environment, and creating sustainable competitive advantages.

1.2. The concept of a circular economy in the agro-industrial sector

The concept of a circular economy was formed as a response to the limited natural resources, the growing environmental burden and the inefficiency of the linear business model based on the principle of “extraction – production – consumption – waste”. The traditional economic system involves a one-way movement of material and energy flows, which leads to the depletion of the resource base and the accumulation of waste.[6,13]In contrast, the circular economy offers a model of closed cycles, within which resources retain their value for as long as possible, and waste is minimized or transformed into secondary resources.

The economic essence of the circular economy lies in the formation of a system of production and consumption in which increased economic efficiency is combined with a decrease in resource intensity and environmental burden.[25]. At the heart of this concept is the idea of resource reproducibility, extending the life cycle of products and optimizing material and energy flows. The circular model is not limited to waste recycling issues, but covers the entire value chain - from product design to reuse and recovery of materials.

The formation of the theoretical foundations of the circular economy is based on a combination of ecological economics, industrial ecology theory, the concept of sustainable development and approaches to resource flow management. Within this paradigm, the enterprise is considered as an element of a broader socio-economic system responsible for the rational use of natural capital and the formation of long-term economic value.

The key principles of the circular economy are preserving natural capital, optimizing resource use and increasing system efficiency. Preserving natural capital involves reducing dependence on non-renewable resources and switching to renewable energy sources. Optimizing resource use means extending the life cycle of products through repair, modernization, reuse and recycling. Increasing system efficiency aims to minimize negative externalities, including environmental and social ones.

In scientific literature[6,13]The approach describing the circular economy through the so-called "R-principles" that reflect different ways of preserving resource value has become widespread. Despite the variability of interpretations, most researchers identify resource reduction, product reuse, material recovery, and waste recycling as basic elements of the circular model. In modern interpretations, the list of principles is expanding to include product redesign, functionality recovery, resource sharing, and a service consumption model.

In order to systematize the basic principles of the circular economy, it is advisable to summarize their content in Table 1.4.

Table 1.4

Basic principles of the circular economy

Principle	Content	Economic effect
Resource conservation	Reducing the use of primary raw materials	Reducing production costs
Life cycle extension	Repair, modernization, reuse	Increasing the cost of products
Recycling and recovery	Using waste as secondary resources	Formation of additional sources of income
Use of renewable energy	Fossil fuel substitution	Energy independence
System integration	Coordination of material and energy flows	Improving overall efficiency

The implementation of these principles involves the use of various circular economy models. One of the basic ones is the closed material cycle model, within which production or consumption waste is returned to the production process as secondary raw materials. Another model is the service or functional model, in which the enterprise focuses not on selling a product, but on providing a service, while maintaining control over material resources and ensuring their reuse. Also common is the industrial symbiosis model, which involves cooperation between enterprises with the aim of using the by-products of one producer as a resource for another.

Of particular importance is the bioeconomic model, which is based on the use of renewable biological resources and their full cyclical reproduction. In this model, organic waste is transformed into fertilizers, bioenergy or other value-added products.

This approach is especially relevant for the agro-industrial sector, where material flows are of a biological nature.

A comparison of the main circular economy models is presented in Table 1.5.

Table 1.5

Circular economy models and their characteristics

Model	Characteristic	Scope of application
Closed material cycle	Return of waste to production	Industry, agricultural sector
Service model	Transition from selling a product to providing services	Mechanical engineering, logistics
Industrial symbiosis	Enterprise cooperation for resource exchange	Industrial clusters
Bioeconomic model	Use and reproduction of biological resources	Agricultural sector

An important feature of the circular economy is the integration of economic, environmental and social aspects of development. In contrast to the traditional approach, where priority is given to profit maximization, the circular model focuses on creating long-term value, taking into account the limitations of natural capital. This approach contributes to the formation of sustainable business models that can function in conditions of resource constraints and increased environmental regulation.

Therefore, the principles and models of the circular economy form the conceptual basis for the transformation of modern enterprises in the direction of increasing resource efficiency and reducing environmental burden. The circular business model changes the logic of value creation, orienting enterprises towards long-term economic performance, innovation and integration of material and energy flows.

The agro-industrial sector is one of the most resource-intensive sectors of the economy, combining the use of land, water, energy and biological resources within complex production chains. At the same time, this sector has objective prerequisites for the implementation of a circular business model, since a significant part of material flows is of an organic nature and has the potential for reuse or biological reproduction. The implementation of the principles of a circular economy in agribusiness is characterized by specific features due to biological production cycles, seasonality, spatial dispersion of assets and dependence on natural and climatic conditions.

One of the key characteristics of agricultural production is the cyclical nature of natural processes. Unlike industry, where material flows are predominantly technogenic in nature, in agribusiness they are formed on the basis of the biological cycle of substances. This creates the prerequisites for closing material cycles within one enterprise or a group of interconnected entities. For example, organic waste from crop and livestock farming can be used as raw materials for the production of bioenergy or organic fertilizers, which are returned to the fields and restore soil fertility.

A feature of the circular model in agribusiness is also the close relationship between food production and the ecological stability of territories. Rational land management, the introduction of precision agriculture technologies, reducing nutrient losses and reducing greenhouse gas emissions are components of the circular transformation of the industry. In this context, innovations are aimed not only at increasing yields or livestock productivity, but also at ensuring the long-term reproduction of natural capital.

An important component of the implementation of the circular model is the integration of different areas of agro-industrial activity. Vertical integration, which combines the production of raw materials, their processing and sale of final products, creates opportunities for optimizing material flows and minimizing waste. Within such a structure, by-products of one division can act as a resource for another, forming an intra-corporate cycle of resource use.

Energy innovations play a significant role in the circular transformation of agribusiness[2.19]. The use of biogas plants, biomethane production, and renewable energy sources can reduce dependence on fossil fuels and reduce energy costs. At the same time, the processing of organic waste into bioenergy helps solve the problem of by-product disposal and reduce the environmental burden.

It is advisable to systematize the features of implementing the circular model in agribusiness in Table 1.6.

Table 1.6

Specific characteristics of the circular model in agribusiness

Characteristic	Manifestation in the activities of the enterprise	Economic result
Biological cyclicity	Use of organic waste in production	Reducing fertilizer costs
Vertical integration	Closed production chains	Logistics optimization
Energy autonomy	Biogas and renewable energy sources	Reducing energy consumption
Digitalization	Resource flow monitoring	Improving control accuracy
Environmental responsibility	Reducing emissions and waste	Improving reputation and access to markets

A significant factor in the successful implementation of the circular model is the use of digital technologies. Systems for monitoring yield, managing livestock complexes, analyzing soils and controlling resource consumption ensure increased transparency of production processes and allow optimizing the use of material and energy flows. Digitalization contributes to the formation of an integrated information management system, which is a necessary condition for the functioning of closed cycles.

The problem of scaling circular practices within agro-industrial holdings deserves special attention. Large enterprises have the opportunity to invest in high-tech solutions and create complex infrastructure facilities that provide waste processing and alternative energy production. At the same time, for small and medium-sized agricultural producers, the implementation of the circular model often requires cooperation and the formation of cluster associations.

The implementation of the circular model in agribusiness also comes with certain limitations. These include high initial investment costs, the need to modernize technological equipment, insufficiently developed processing infrastructure, and regulatory barriers. In addition, circular transformation requires a change in management culture and the formation of a long-term strategic vision.

At the same time, the economic benefits of the circular model in the agricultural sector are complex. They are manifested in reducing raw material and energy costs, diversifying income sources, increasing investment attractiveness and strengthening positions in international markets, where environmental production standards are becoming increasingly important. In this aspect, the circular model becomes not only a tool for environmental modernization, but also an important factor in strategic competitiveness.

Thus, the implementation of the circular model in agribusiness is characterized by a combination of the biological nature of production, the integration of material flows and the innovative nature of resource management. The specifics of the industry create both additional opportunities for closing cycles and certain limitations that require a comprehensive strategic approach. This necessitates the integration of circular practices into the corporate strategy of the enterprise.

The integration of circular practices into the corporate strategy of the enterprise is a logical stage of transforming the business model in accordance with modern requirements of resource efficiency, environmental responsibility and long-term economic sustainability. If at the initial stages of implementation the circular economy can be considered as a separate direction of environmental or innovative activity, then in a strategic perspective it acquires a system-forming character and affects all levels of management.

Corporate strategy defines the long-term development goals of the enterprise, directions of resource allocation and principles of interaction with the external environment. In the conditions of strengthening environmental standards, changing consumer preferences and increasing role of non-financial criteria for business evaluation, integration of circular approaches becomes a component of strategic competitiveness. An enterprise that focuses on closed production cycles, rational use of resources and waste minimization forms a more sustainable model of value creation.

The integration of circular practices involves revising strategic objectives taking into account resource constraints and long-term environmental risks. The traditional growth strategy aimed at increasing production volumes is gradually complemented by a focus on increasing resource productivity and optimizing material flows. In this context, the strategic focus is shifting from extensive development to intensive development based on innovation and efficiency.

An important prerequisite for integrating circular practices is the adaptation of the enterprise's business model. A circular business model is characterized by maintaining control over material resources throughout the product life cycle, expanding service components, diversifying revenue sources, and forming partnerships within production chains. This approach allows the enterprise to reduce its dependence on primary raw materials and create additional value streams.

The integration of the circular component into the corporate strategy is carried out through a combination of strategic, organizational and operational levels of management. At the strategic level, priorities for resource efficiency, environmental modernization and innovative development are determined. At the organizational level, appropriate management structures and coordination mechanisms are formed. At the operational level, specific measures to optimize material and energy flows are implemented.

A summary of the key areas for integrating circular practices into corporate strategy is presented in Table 1.7.

Table 1.7

Directions for strategic integration of circular practices

Integration level	Content of strategic changes	Expected result
Strategic	Defining resource efficiency and environmental responsibility goals	Long-term sustainability
Organizational	Formation of units or persons responsible for circular projects	Management consistency
Investment	Reallocation of capital in favor of energy-efficient and innovative solutions	Improving resource productivity
Operating	Optimization of production processes and logistics	Reducing costs and waste
Informative	Implementation of monitoring and reporting systems	Increasing transparency

A significant role in the strategic integration of circular practices is played by the corporate governance system. The presence of clearly defined performance indicators, control and reporting mechanisms allows assessing the achievement of strategic goals and adjusting management decisions. In modern conditions, non-financial indicators, in particular indicators of environmental and social responsibility, which reflect the impact of the enterprise on the environment and society, are becoming increasingly important.

Integrating the circular economy into corporate strategy also involves active engagement with external stakeholders. Collaboration with suppliers, consumers, financial institutions, and government agencies creates the conditions for the formation of extended value chains, within which material flows are coordinated at the inter-organizational level. This approach contributes to the development of industrial symbiosis and cluster forms of cooperation.

In the agro-industrial sector, the integration of circular practices into corporate strategy is of particular importance, since the activities of enterprises are directly related to the use of natural capital. Rational land management, reduction of nutrient losses, implementation of bioenergy technologies and reduction of greenhouse gas emissions are becoming components of strategic development policy. Thus, the circular economy is becoming a tool not only for environmental modernization, but also for increasing the competitiveness of agricultural holdings.

At the same time, the strategic integration of circular practices requires a change in management culture and the formation of a long-term vision of development. The transition from a linear to a circular model is not limited to the implementation of individual technologies, but requires a transformation of approaches to planning, investing and evaluating results. The success of such a transformation depends on the coherence of actions of all divisions of the enterprise and the readiness of management to make strategic decisions taking into account environmental and social factors.

Therefore, the integration of circular practices into corporate strategy is a complex, multi-level process that involves reorienting the management system towards the principles of resource efficiency, closed material flows and long-term sustainability. In the agro-industrial sector, such integration creates the prerequisites for the formation of innovative business models that can ensure economic growth while preserving natural capital.

1.3. Methodological approaches to the formation of an innovative development strategy

The formation of a strategy for the innovative development of an enterprise on the basis of a circular economy requires the use of adequate analytical tools that provide a comprehensive assessment of the internal potential and the external environment of operation. In modern practice of strategic management, integrated methods of analysis are of particular importance, which allow combining economic, technological, environmental and social aspects of development. Such tools include SWOT analysis, PEST analysis and ESG approach, which complement each other and form a holistic analytical basis for strategic decisions[11,12,22].

SWOT analysis is one of the most common methods of strategic diagnostics, which involves systematizing the strengths and weaknesses of the enterprise, as well as the opportunities and threats of the external environment. In the context of innovative and circular development, this tool allows you to assess the available resource potential, technological competencies, the level of organizational flexibility and readiness to implement closed production cycles. Strengths may include the availability of innovative infrastructure, access to financial resources, vertical integration or developed logistics. Weaknesses are often associated with high energy intensity of production, insufficient level of digitalization or limited experience in implementing environmental projects.

Opportunities of the external environment in the context of the transition to a circular economy are associated with the expansion of markets for environmentally certified products, access to "green" financing, participation in international sustainable development programs. Threats can manifest themselves in the form of increased regulatory requirements, volatility of raw material markets, technological risks or increased competition. Thus, SWOT analysis creates a basis for determining strategic priorities and allows you to align internal resources with the capabilities of the external environment.

PEST analysis is focused on studying the macro environment and takes into account political, economic, social and technological factors that influence the activities of the enterprise. For agro-industrial holdings operating in an international environment, this tool is of particular importance, as it allows you to take into account changes in agricultural policy, tax regulations, trade regimes, environmental standards and innovation trends.

Political factors include government support for innovation, environmental legislation, and international agreements in the field of climate policy. Economic factors are related to the investment climate, inflation rate, currency fluctuations, and availability of credit resources. Social aspects include changing consumer preferences, increasing demands for product quality and safety, and increasing attention to the social responsibility of business. Technological factors determine the pace of development of digital solutions, bioenergy, automation, and other innovative areas.

A summary of the content of the PEST analysis for an agro-industrial sector enterprise is presented in Table 1.8.

Table 1.8

Macrofactors of the enterprise's strategic environment

Group of factors	Content of influence	Strategic importance
Political	Agricultural market regulation, environmental standards	Formation of operating conditions
Economical	Price situation, investment attractiveness	Determining financial capabilities
Social	Demand for ecological products, demographic changes	Market orientation
Technological	Development of digital and energy-efficient technologies	Opportunities for innovative growth

The ESG approach, which covers environmental, social and governance aspects of a company's activities, is of particular importance in modern strategic analysis. Unlike traditional financial indicators, ESG indicators allow us to assess the long-term sustainability of a business, its level of responsibility to society and its ability to adapt to global challenges.

The environmental component of ESG involves assessing the impact of the enterprise on the environment, the level of greenhouse gas emissions, the efficiency of water and land use, the volume of waste recycling. The social component covers issues of labor protection, interaction with communities, and human capital development. The management component includes the transparency of corporate governance, the internal control system, and compliance with ethical standards.

Integrating ESG into strategic analysis allows combining economic efficiency with circular economy principles. In particular, environmental performance indicators become important criteria for making investment decisions, and the level of social responsibility affects reputation and access to international capital markets.

The combination of SWOT, PEST and ESG analysis forms a multi-level system of strategic diagnostics. SWOT allows you to assess internal potential and external opportunities, PEST - to identify macroeconomic trends, and ESG - to integrate the principles of sustainable development into the strategic planning process. This combination of tools provides a comprehensive understanding of the operating conditions of the enterprise and creates an analytical basis for forming an innovative development strategy based on the principles of a circular economy.

Therefore, the use of modern strategic analysis tools allows an enterprise not only to identify key influencing factors, but also to form a holistic vision of its own position in the economic environment. This ensures the validity of management decisions and increases the effectiveness of the implementation of an innovative and circular development strategy.

The formation of an effective strategy for innovative development based on the principles of a circular economy requires an objective assessment of the innovative and resource potential of the enterprise.[1, 20, 25]. It is the potential that determines the capabilities of a business entity to implement new technologies, transform production processes, optimize material and energy flows, and achieve long-term competitiveness. In modern conditions, potential is considered not as a static set of resources, but as a dynamic system of interconnected elements capable of reproduction and development.

The innovative potential of an enterprise should be interpreted as a set of scientific and technical, organizational, personnel, financial and information capabilities that ensure the creation and implementation of innovations. Its assessment involves the analysis of not only quantitative indicators, but also qualitative characteristics, such as the level of management culture, staff readiness for change, and the presence of partnerships with scientific institutions and technology companies.

Resource potential, in turn, covers the material, financial, labor, land, energy and information resources of the enterprise, which can be used to ensure innovative transformation. In the agro-industrial sector, land and biological resources are of particular importance, the efficiency of which determines not only economic results, but also the environmental sustainability of production.

Methodological approaches to assessing innovation and resource potential are based on a combination of quantitative analysis of indicators and expert assessment of qualitative parameters.[11,12]. Quantitative indicators of innovation potential include the volume of investment in research and development, the share of innovative products in the total volume of sales, the level of technological renewal of fixed assets, and the costs of digitalization of processes. Qualitative characteristics may include the degree of integration of innovations into strategic planning, the level of motivation of personnel to implement innovations, and the effectiveness of the internal communications system.

A summary of the main indicators for assessing the potential of an enterprise is presented in Table 1.9.

An important component of the evaluation is the analysis of the efficiency of resource use.[14]. In the context of a circular economy, indicators of resource productivity, energy efficiency and the rate of material reuse are of particular importance. Determining the share of secondary resources in total consumption allows us to assess the degree of closure of production cycles and the level of integration of circular practices.

Table 1.9

Indicators for assessing innovation and resource potential

Indicator group	Quantitative indicators	Qualitative characteristics
Innovation potential	Investments in R&D, share of innovative products, level of equipment renewal	Readiness for change, innovative culture
Financial potential	Profitability, liquidity, investment resources	Access to external financing
Material and technical potential	The degree of depreciation of fixed assets, energy intensity of production	Technological flexibility
Human resources potential	Staff qualifications, labor productivity	Competence and adaptability
Resource efficiency	Raw material and energy costs per unit of production	Level of environmental responsibility

Potential assessment should be carried out taking into account the strategic perspective. It is necessary to determine not only the current state of the resource base, but also the possibilities of its development, modernization and diversification. In this context, methods of comparative analysis, benchmarking and scenario forecasting are used. Comparison with leading companies in the industry allows you to identify lags or competitive advantages, and the scenario approach makes it possible to assess the potential consequences of investment decisions.

Integrated assessment of innovation and resource potential involves the formation of a general indicator that reflects the level of readiness of the enterprise to implement an innovation-circular strategy. This approach ensures the complexity of the analysis and creates a basis for making informed management decisions.[3,4].

A special role is played by the relationship between innovative and resource potential. Innovations are aimed at increasing the efficiency of resource use, while the availability of sufficient resource provision is a prerequisite for the implementation of innovative projects. Thus, the potential of an enterprise is an integrated category that combines material, financial and intellectual capabilities into a single system.

Therefore, assessing the innovative and resource potential of an enterprise is a necessary stage in the formation of an innovative development strategy based on the principles of a circular economy. A comprehensive analysis allows you to determine the level of readiness of the enterprise for transformation, identify internal growth reserves and justify the directions of further modernization.

Developing a strategy for innovative development of an enterprise based on the principles of a circular economy requires the formation of a clear methodological sequence of actions that combines the results of strategic analysis, potential assessment and definition of long-term goals. The methodology should provide a logical transition from diagnosing the current state to forming a system of strategic decisions aimed at transforming the business model in the direction of resource efficiency, innovation and environmental sustainability.

The strategy of innovative development based on circularity is considered as a comprehensive program of actions that defines the directions of updating the technological base, optimizing material and energy flows, improving the organizational structure and integrating the principles of sustainable development into corporate policy. Its formation involves a combination of economic, technological and environmental management tools.

The strategy development methodology can be structured as sequential stages, each of which performs a separate function in the overall strategic planning system. The first stage involves a comprehensive strategic diagnosis, including SWOT analysis, PEST analysis, ESG assessment, and analysis of innovation and resource potential. The purpose of this stage is to identify the strengths and weaknesses of the enterprise, identify external opportunities and threats, and assess the level of readiness for circular transformation.

The second stage involves the formation of strategic goals for innovative development, taking into account the principles of the circular economy. The goals should be consistent with the corporate mission and focused on the long-term. They may concern increasing resource productivity, reducing waste, reducing the energy intensity of production, developing bioenergy areas, or implementing digital resource management systems.

At the third stage, strategic priorities and directions for business model transformation are determined. Within the framework of the circular approach, such directions may include the creation of closed production cycles, the development of intra-corporate industrial symbiosis, the modernization of technological equipment, and the implementation of resource flow monitoring systems. An important condition is the coordination of innovative initiatives with the financial capabilities of the enterprise and its organizational structure.

The next stage involves the formation of a portfolio of innovative circular projects. Each project is assessed from the standpoint of economic feasibility, environmental effect and social impact. Investment analysis methods are used, calculation of net present value, internal rate of return, payback period and sensitivity analysis. In the context of the circular economy, indicators of reduction in consumption of primary resources and waste volumes are additionally taken into account.

A summary of the stages of strategy development is given in Table 1.10.

Table 1.10

Stages of developing an innovative development strategy based on circularity

Stage	Contents of the works	Expected result
Strategic diagnostics	Analysis of internal and external environment	Determining starting conditions
Goal setting	Defining strategic guidelines	A coherent system of goals
Determining priorities	Choosing key areas of transformation	Clear strategy structure
Formation of a project portfolio	Assessment of economic and environmental efficiency	A sound plan of action
Monitoring and adjustment	Implementation monitoring and evaluation of results	Adaptation to environmental changes

An important component of the methodology is the formation of a system of indicators for assessing the implementation of the strategy. Such indicators may include the level of resource productivity, the coefficient of material reuse, the share of renewable energy in the overall balance, the volume of investments in circular technologies, the level of emission reduction. The presence of clear indicators allows ensuring the transparency of the strategic process and its regular adjustment.

The methodology also involves integrating the innovation-circular strategy into the corporate governance system. This means establishing responsibility for project implementation, forming internal regulations, adapting the personnel motivation system, and ensuring information support for management decisions. An important condition is the creation of a feedback mechanism that allows for prompt response to deviations from planned indicators.

In the context of agro-industrial holdings, the strategy development methodology should take into account the scale of operations, vertical integration, and territorial dispersion of assets. This requires coordination between production units, logistics centers, and processing enterprises in order to form a single closed cycle of resource use.

Therefore, the methodology for developing an innovative development strategy based on circularity is a multi-level system of management decisions that combines strategic analysis, goal setting, project portfolio formation, and a results monitoring system. Its application ensures the structured nature of the enterprise transformation process, increases the efficiency of resource use, and creates the prerequisites for long-term economic growth in the context of the transition to a circular business model.

Conclusions to Chapter 1

The first section examines the theoretical and methodological principles of managing the innovative development of an enterprise in a circular economy. The generalization of scientific approaches allowed us to clarify the economic essence of innovative development as a systemic process of technological, organizational and managerial renewal aimed at the formation of long-term competitive advantages. It is proved that in modern conditions, innovative development should be considered through the prism of resource efficiency, environmental responsibility and the integration of ESG principles into corporate strategy.

The concept of a circular economy is analyzed and its key principles are identified: closed material cycles, waste minimization, resource reuse, and the development of renewable energy. It is substantiated that for agro-industrial enterprises, the circular model is economically feasible, since it allows combining efficiency improvements with environmental modernization of production.

Methodological approaches to the formation of an innovative development strategy are identified, which provide for a systematic analysis of internal potential, assessment of the external environment, and integration of innovative and environmental components into strategic management.

Thus, the theoretical basis of the study creates a basis for further applied analysis and development of an innovative and circular enterprise development strategy.

CHAPTER 2 DIAGNOSTICS OF INNOVATIVE AND CIRCULAR DEVELOPMENT OF AN AGRO-INDUSTRIAL HOLDING

2.1. Organizational and economic characteristics of the MHP activities

MHP is a vertically integrated agro-industrial holding, whose activities cover the full production cycle - from growing grain crops and producing feed to processing poultry products and selling them on domestic and foreign markets. The company's organizational structure is formed taking into account the principles of centralized strategic management and decentralized operational control, which ensures flexibility of management decisions while maintaining a single corporate policy.

The holding's structure is characterized by the presence of a parent company, which determines strategic development priorities, forms investment policy and coordinates the activities of subsidiaries. The group includes production units in crop and livestock sectors, feed mills, meat processing plants, logistics centers, export and trade structures and auxiliary service companies. Such an integrated management model allows for control over key links in the creation of added value and minimizes transaction costs.

The basis of the holding's production activities is the poultry sector, which includes poultry farming, incubation, slaughter, processing and packaging of products. The company has modern production complexes with a high level of automation of technological processes. Vertical integration allows you to control quality at all stages of production - from feedstock to finished products. This approach contributes to increasing competitiveness and forming a stable position in international markets.

The crop segment plays a strategic role in ensuring the holding's feed independence. The group's enterprises cultivate significant areas of agricultural land on which grain and oilseed crops are grown. Part of the products is used for internal needs in the production of compound feed, which ensures the stability of the pricing policy and reduces dependence on external suppliers. The other part is sold on the market, generating additional income.

A separate area of activity is the production of compound feed, which ensures a closed production cycle. The presence of our own compound feed plants allows us to optimize feed formulations in accordance with technological requirements and reduce production costs. This also contributes to improving biosafety and product quality control.

In the structure of the holding, an important place is occupied by processing enterprises that carry out deep processing of meat raw materials. The development of this segment allows to form products with high added value and expand the range for different consumer segments. The company actively develops branded products, which are focused on the domestic market, and also exports to the countries of the European Union, the Middle East and other regions.

A significant role in the holding's activities is played by the logistics infrastructure, which includes warehouse complexes, transport units and export terminals. A developed logistics system ensures the continuity of production processes, reduction of transportation costs and efficiency of contract execution. In conditions of instability of international markets, effective logistics is one of the key factors in maintaining competitive positions.

The structural model of the holding is presented as an integrated system of interconnected divisions that form a single production and economic complex (Table 2.1).

Table 2.1

Structural elements of the holding and their functional purpose

Business segment	Main functions	Strategic importance
Crop production	Growing of cereals and oilseeds	Providing feed base
Feed production	Processing of raw materials into compound feed	Reducing dependence on suppliers
Poultry breeding	Poultry farming and processing	Formation of basic income
Processing	Production of value-added products	Diversification
Logistics and Export	Transportation and sales of products	Access to international markets

A separate area of activity is the development of bioenergy capacities, which allows using livestock by-products to produce biogas and electricity. Such diversification contributes to increasing energy autonomy and integrating the principles of the circular economy into the production model.

The organizational structure of management is built on the principle of functional division of powers with centralization of strategic decisions at the corporate center level. Operational units have a certain autonomy within the limits of approved budgets and production plans. This provides a balance between control and flexibility, which is important for managing a large diversified holding.

Thus, the holding's structure is characterized by a high level of vertical integration, diversification of activities and the presence of a developed infrastructure. This model allows for the formation of closed production cycles, optimization of costs and ensuring stability of functioning in a changing market environment. At the same time, the complexity of the organizational structure requires an effective system of coordination and strategic management, which is a prerequisite for the implementation of the holding's innovative and circular development strategy.

The financial and economic results of an agro-industrial holding are a key indicator of the effectiveness of its business model, level of competitiveness and ability to innovative transformation. For a vertically integrated company that carries out a full production cycle - from the agricultural segment to the processing and export of finished products, financial indicators reflect not only the effectiveness of individual areas, but also the effectiveness of internal coordination of resource flows (Table 2.2).

Table 2.2

Main financial and economic indicators of the MHP company

Indicator	2019	2020	2021	2022	2023
Net sales revenue, UAH billion	65.3	70.8	89.1	96.7	105.4
Operating profit, UAH billion	8.4	9.1	12.6	10.9	13.2
Net profit, UAH billion	5.0	5.3	8.1	6.4	7.8
Assets, UAH billion	92.6	98.4	112.3	118.9	124.7
Equity, UAH billion	54.8	56.2	61.5	63.1	66.4

To visualize changes in revenue and profit, Fig. 2.1 presents a graphical representation of the obtained analysis results.

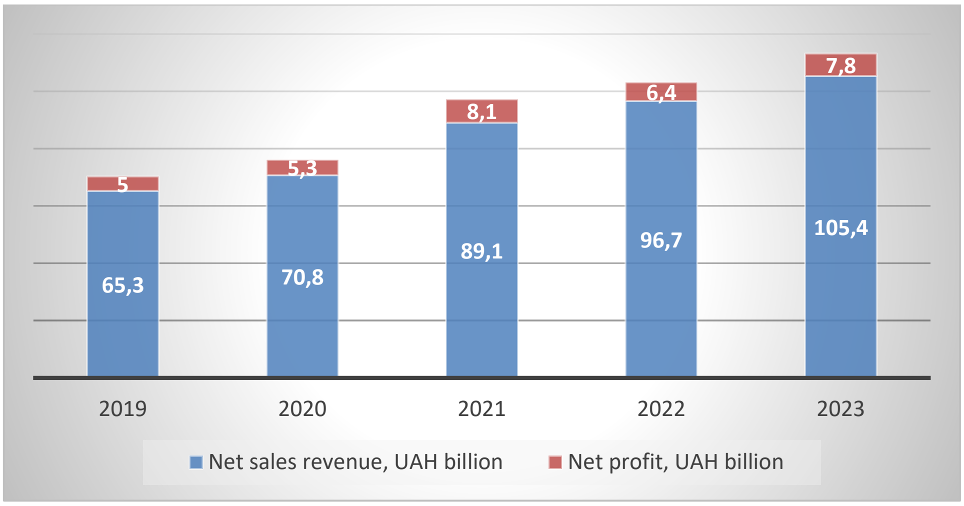

Fig. 2.1. Dynamics of net income and net profit of MHP in 2019-2023.

Analysis of graphical data shows that the dynamics of MHP's profitability is characterized by wave-like changes, but overall it maintains a positive development direction. Despite the presence of individual fluctuations in financial results, the general trend indicates a gradual strengthening of the company's profitable positions. The reduction in profit in 2022 was due to the cumulative impact of increased production and operating costs, the complication of logistics processes, as well as an increase in the level of instability of the external environment. At the same time, already in 2023, the enterprise managed to adapt to new operating conditions, which ensured the restoration of positive dynamics and growth in financial results.

The dynamics of the holding's income is formed under the influence of several groups of factors: production and sales volumes, product portfolio structure, domestic and foreign market conditions, currency fluctuations, and logistics conditions. A significant share of export revenue determines the dependence of financial results on world prices for agricultural products and the stability of international trade channels. At the same time, vertical integration allows for partial neutralization of price risks due to internal redistribution of resources between segments.

The income structure is characterized by the dominance of the poultry sector as the main generator of revenue. The crop segment performs a dual function: on the one hand, it provides a feed base for livestock, and on the other, it forms a separate stream of income from the sale of grain and oilseed crops. The processing sector contributes to an increase in the share of products with high added value, which has a positive effect on the business margin.

The dynamics of MHP production volumes is presented in Table 2.3.

Table 2.3

Sales volumes of products of PrJSC "MHP"

$ million	4Q 2023	4Q 2022	2023	2022
Sales of chicken*, thousand tons	157	184	692	658
Average price of poultry meat, $/kg	1.98	1.90	1.95	1.95
Oil sales, thousand tons	106	109	518	314

In 2023, MHP's poultry production activities were characterized by heterogeneous dynamics. In particular, in the last quarter, a certain decrease in production volumes was recorded, which amounted to 172.3 thousand tons, which is 8% less compared to the previous quarter and 5% lower than the indicator of the same period in 2022. At the same time, despite such a quarterly reduction, at the end of the year, the total volume of MHP chicken production in Ukraine demonstrated positive dynamics. Compared to the previous year, it increased by 3% and reached 718.6 thousand tons, which indicates the preservation of the general trend towards increasing the company's production results (Fig. 2.2).

The dynamics of product sales in the chicken production segment generally corresponded to the main trends observed in the production sector. In the fourth quarter, a decrease in sales volumes was recorded, which was largely due to a decrease in export deliveries. Compared to the same period in 2022, sales volumes decreased by 15%, which reflects the impact of external market and logistics factors on the company's sales activities. At the same time, according to the results of 2023, sales as a whole showed positive dynamics and increased by 5%, reaching 692 thousand tons.

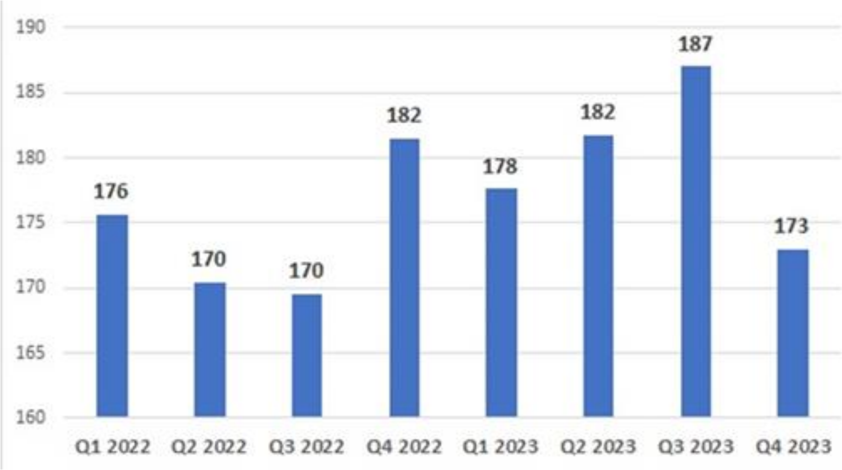

Fig. 2.2. Chicken production of PrJSC "MHP", thousand tons

It is especially important that the export direction retained the leading role in the sales structure: export volumes increased by 8% and amounted to 397 thousand tons, or 57% of the total sales volume. This indicates a fairly stable position of the company in foreign markets and the significant importance of international sales in shaping its performance results.

The financial result of the holding is determined by the ratio of operating income and expenses. In the cost structure, a significant share is accounted for by expenses for feed, energy, labor, logistics and depreciation of fixed assets. The introduction of innovative technologies and energy-efficient solutions allows reducing production costs and increasing operating profitability. Energy cost management is of particular importance, since agro-industrial production is characterized by high energy intensity.

Analysis of profitability indicators indicates the importance of maintaining a balance between the scale of production and the level of costs. The profitability of operating activities depends on the efficiency of technological process management, optimization of logistics and financing structure. Investments in the modernization of production facilities and the development of bioenergy facilities contribute to increasing long-term financial sustainability. The dynamics of profitability indicators of the MHP company are presented in Table. 2.4.

Table 2.4

MHP company profitability indicators, %

Indicator	2019	2020	2021	2022	2023
Sales profitability	7.7	7.5	9.1	6.6	7.4
Return on assets	5.4	5.4	7.2	5.4	6.3
Return on equity	9.1	9.4	13.2	10.1	11.7

The results of the analysis of profitability indicators give grounds to assert that MHP generally maintains a sufficiently high level of efficiency in the use of available resources. The maximum profitability values were recorded in 2021, which was largely consistent with the favorable market situation and more stable business conditions. In 2022, there was a certain decrease in the relevant indicators, which reflected the impact of unfavorable external and internal factors on the company's performance. At the same time, already in 2023, the company demonstrated a restoration of the profitability level, which indicates its ability to adapt to difficult operating conditions. Such dynamics are positive in terms of ensuring financial stability, maintaining competitive positions and maintaining the efficiency of the company's operating activities in the medium term.

For a comprehensive characterization of financial and economic results, it is advisable to use a system of key indicators that reflect various aspects of the enterprise's activities (Table 2.5).

Table 2.5

Main financial and economic indicators of the holding company's activities

Indicator group	Economic content	Analytical value
Income (revenue)	Volume of products sold	Scale of activity
Operating profit	Result of the main activity	Production efficiency
Net profit	Financial result after tax	Overall performance
Sales profitability	Profit share in revenue	Business Marginality
Financial stability ratio	Equity to debt ratio	Level of financial risks
Investments in fixed assets	Volume of capital investments	Modernization potential

The financial stability of the holding is determined by the capital structure and the level of debt burden. The use of long-term financing allows the implementation of large-scale investment projects, but requires effective liquidity and risk management.

In an unstable market environment, maintaining the optimal ratio of equity and debt capital becomes especially important.

The dynamics of the capital structure and liquidity of the studied enterprise are presented in Table 2.6.

Table 2.6

Financial stability and liquidity indicators of MHP

Indicator	2019	2020	2021	2022	2023
Autonomy coefficient	0.59	0.57	0.55	0.53	0.53
Current liquidity ratio	1.42	1.38	1.51	1.29	1.34
Financial leverage ratio	0.69	0.75	0.82	0.89	0.88

The results of the analysis provide grounds to assert that MHP generally maintained a sufficient level of financial stability during the period under study, although some indicators reflect an increase in dependence on attracted sources of financing. In particular, the autonomy coefficient demonstrates a gradual decrease from 0.59 in 2019 to 0.53 in 2022–2023, which indicates a certain reduction in the share of equity in the structure of the company's financial resources. At the same time, the values of this indicator remain at an acceptable level, which allows us to state that the company maintains a relatively stable position in terms of financial independence.

A similar trend is confirmed by the dynamics of the financial leverage ratio, which increased from 0.69 to 0.88 during 2019–2023. This indicates a gradual increase in the role of borrowed capital in financing MHP's activities, which, on the one hand, can expand opportunities for development, and on the other hand, is accompanied by an increase in financial risks. At the same time, current liquidity indicators throughout the analyzed period were within the regulatory limits: after fluctuations from 1.42 in 2019 to 1.29 in 2022, in 2023 there was a certain improvement to 1.34. This indicates the company's ability to ensure timely fulfillment of current obligations and maintain an adequate level of solvency even in an unstable external environment. In general, the set of above indicators confirms that MHP maintains an acceptable level of financial stability and liquidity, although it requires further control over the ratio of equity and borrowed capital.

Investment activity is one of the indicators of the company's innovation orientation. Capital investments are directed towards the modernization of production complexes, automation of technological processes, development of bioenergy and improvement of logistics infrastructure. Such investments form the basis for increasing productivity and implementing a circular business model.

The assessment of resource efficiency complements the financial analysis. Reducing energy consumption, optimizing feed consumption, reducing raw material losses and minimizing waste have a positive impact on the cost of production and competitiveness. Thus, economic performance is directly related to the level of technological modernization and the implementation of innovations.

In modern conditions, non-financial indicators characterizing environmental and social performance are increasingly added to financial analysis. Reducing emissions, increasing energy efficiency, developing social programs for employees and communities are becoming factors in increasing investment attractiveness and strengthening corporate reputation.

The resource potential of an agro-industrial holding determines its ability to ensure the stability of production, maintain competitiveness in domestic and foreign markets and implement an innovative and circular development strategy. The structure of the resource potential combines land, material and technical, energy, labor, financial and information resources, which function as an interconnected system. For a vertically integrated company, the efficiency of using each of these components directly affects the overall economic result.

Land resources are a basic element of the holding's production system. Significant areas of agricultural land provide the opportunity to form a stable fodder base, diversify the crop structure and optimize crop rotation. Rational use of land resources involves the introduction of modern agricultural technologies, precision farming, monitoring soil fertility and controlling the use of mineral fertilizers. Preservation of the natural potential of lands is not only an economic, but also a strategic condition for long-term development.

Statistical and analytical data on the activities of MHP show that land resources are a defining element of the holding's production system and form the basis of its agricultural potential. In 2023, the company's land bank amounted to about 361.5 thousand hectares, while the area of harvested crops reached 346.8 thousand hectares. This indicates a high level of land involvement in economic turnover, which amounted to almost 96% of the available land area. At the end of the year, the company received 2.56 million tons of agricultural crops, which exceeded the similar indicator of the previous year by 32%. In the structure of the gross harvest, the leading place was occupied by corn, the production volume of which exceeded 1.34 million tons. At the same time, wheat, soybeans, sunflower and rapeseed were also of significant importance. This production structure gives reason to assert that the land resource of MHP ensures not only the cultivation of commercial crop products, but also the creation of a stable feed base for the functioning of a vertically integrated model of an agro-industrial holding.

The efficiency of land potential use is also confirmed by the yield indicators of the main crops, which in 2023 exceeded the average values for Ukraine. In particular, the yield of corn in the MHP was 9.9 t/ha versus 7.8 t/ha on average for the country, wheat – 6.6 t/ha versus 4.8 t/ha, sunflower – 3.1 t/ha versus 2.4 t/ha, rapeseed – 3.7 t/ha versus 2.9 t/ha, and soybean – 3.2 t/ha versus 2.7 t/ha. The above indicators indicate a more effective use of land, which is achieved through the introduction of modern agricultural technologies, increasing the level of technological efficiency of production processes and the use of digital solutions in managing the agricultural segment. An important aspect is also the use of elements of rational land use, in particular, compliance with crop rotation, leaving part of the areas fallow and monitoring the condition of the soil. Taken together, this allows us to consider the land resource of MHP not only as a material basis for production, but also as a strategic factor for ensuring economic efficiency, increasing competitiveness, and implementing the principles of the circular economy in the long term.

The material and technical base of MHP is distinguished by a high level of complexity, scale and deep vertical integration, which ensures the technological completeness of the production cycle within the agro-industrial holding. In 2023, the company operated in Ukraine on the basis of three vertically integrated full-cycle poultry complexes, which covered all key stages of production - from incubation and raising poultry to its slaughter, processing and preparation of finished products for sale. Additionally, the holding operated two breeding complexes, which produced 551 million hatching eggs during the year. An important place in the material and technical support system was also occupied by three compound feed sites, the total production volume of which amounted to about 1.9 million tons of feed, which created a proper basis for stable provision of the poultry sector with its own feed resources. The formed infrastructure was supplemented by two meat processing plants, which in 2023 produced 40.8 thousand tons of products, as well as nine distribution centers and 432 transport units, which ensured the effective organization of internal logistics and sales. Therefore, the material and technical base of MHP is not a set of isolated production facilities, but an integrated industrial system capable of supporting a continuous process of creating added value within the holding.

The high level of technical equipment and automation of production processes is confirmed not only by the structure of available capacities, but also by the results of their practical use. In 2023, MHP production sites in Ukraine operated at 100% capacity, with the exception of individual facilities whose activities were temporarily limited under the influence of military risks. This indicates the effective organization of the production process, the ability of the enterprise to adapt to an unstable external environment and maintain the proper level of functioning of the main production units. At the same time, the material and technical development of the holding is combined with the implementation of modern standards of quality, safety and energy efficiency. The company's production facilities are certified in accordance with international standards, which confirms the proper level of control of technological processes and the compliance of products with modern market requirements. An important area of modernization is the development of energy infrastructure: biogas complexes with a total capacity of 17 MW and solar installations with a capacity of 3.9 MW operate within the structure of MHP, and the volume of biogas production in Ukraine in 2023 reached 311.97 million kWh. Such parameters give reason to assert that the renewal of fixed assets and technical re-equipment at MHP are systemic in nature and are aimed not only at increasing productivity, but also at reducing energy costs, increasing resource efficiency and strengthening the holding's competitive positions in the long term.

MHP's production base is characterized by a high level of internal integration and closed key technological cycles, which ensures the integrity of the holding's functioning and consistent control over all stages of added value creation. In 2023, the company operated in Ukraine on the basis of three vertically integrated full-cycle poultry complexes, two breeding complexes, which produced 551 million hatching eggs, as well as three feed production sites, the total output of which was about 1.9 million tons. The production of feed was fully provided by its own facilities, which created appropriate conditions for the stable functioning of the poultry sector and significantly reduced dependence on external suppliers. The organizational completeness of this system was strengthened by nine distribution centers and 432 transport units, which ensured the continuity of internal logistics, product movement and its timely delivery to sales channels.

The effectiveness of this model is confirmed by the results of the company's production activities. According to the results of 2023, MHP produced 718.6 thousand tons of poultry meat and 40.8 thousand tons of meat products, while the total volume of poultry products sales reached 692 thousand tons. It is significant that 397 thousand tons, or 57% of the total sales, were directed to foreign markets, which indicates the significant role of exports in the formation of the holding's income. At the same time, the revenue of the poultry segment and related operations amounted to 1,643 million USD, and the adjusted EBITDA reached 319 million USD. The totality of the above data gives grounds to assert that the closed nature of production cycles ensures not only technological continuity and an appropriate level of control over production processes, but also increases the efficiency of resource use, helps reduce operational risks, and strengthens the competitive position of MHP in domestic and foreign markets.

Energy resources in the activities of MHP are one of the determining factors in ensuring the continuity of the production process, since the functioning of the agro-industrial holding is associated with significant energy intensity of poultry farming, feed, grain drying, processing and logistics. In 2023, the total energy consumption of the Ukrainian segment of the company amounted to 9,827 TJ, of which 7,746 TJ were from non-renewable sources, and 2,081 TJ from renewable sources. The structure of renewable energy supply was dominated by energy obtained from biogas, the volume of which was 1,394 TJ, while another 687 TJ was provided through the use of energy solutions based on sunflower husks. Thus, the share of energy from renewable sources in the total consumption reached 21%, which indicates a gradual strengthening of the role of alternative energy in the resource supply system of the holding.

An important direction for increasing MHP's energy efficiency is the development of its own generation, primarily in the bioenergy segment. In 2023, the company operated two biogas complexes in Ukraine with a total capacity of 17 MW, which provided electricity, heat and industrial steam for production needs. At the end of the year, the volume of biogas produced amounted to 311.97 million kWh, electricity production reached 115.35 million kWh, and thermal energy - 123.86 million kWh. Along with this, the company developed solar generation, the capacity of which reached 3.9 MW, which further strengthened the diversification of energy supply sources. The systematic nature of energy management is also confirmed by the implementation of international energy efficiency management standards, in particular, certification of production facilities according to the ISO 50001 standard.

The use of by-products of agro-industrial production for biogas generation, increasing the volume of own energy generation and implementing energy-saving technologies create the prerequisites for strengthening the energy autonomy of MHP. This approach contributes to reducing energy costs, increasing the resilience of the production system to external energy risks, and also ensures the practical implementation of the principles of the circular economy through the re-involvement of by-products in economic turnover and the formation of additional economic effects.

The labor potential of MHP is an important component of the holding's resource base and is formed due to the significant personnel involved in production, engineering, management and service departments. As of the end of 2023, the number of employees in the Ukrainian segment of the company was 28,788 people, while 4,667 people were employed in the European segment. Such a scale of staffing indicates a significant level of labor potential of the holding and its ability to maintain the continuity of the functioning of a complex vertically integrated production system. At the same time, the personnel structure reflects a fairly broad social and labor base of the company: in Ukraine, 60% of employees were men and 40% were women, while in the European segment the ratio was 44% and 56%, respectively. Under such conditions, it is advisable to consider MHP's labor resources not only as a factor in ensuring the production process, but also as a strategic element of the holding's long-term development.

The efficiency of the use of labor resources is largely determined by the level of professional training of personnel, the system of continuous learning and the opportunities for developing competencies. In 2023, 3,154 employees underwent professional training at MHP, and the total volume of such training exceeded 75 thousand hours, which significantly exceeded the indicator of the previous year. The average duration of training per participant was 24 hours. Along with this, about 5,500 employees were covered by soft skills development programs, 190 managers underwent specialized management development programs, and 400 people studied English language programs. The use of digital learning management platforms was also an important tool for improving skills: more than 2,900 employees used the SAP SuccessFactors Learning Management System, within which more than 7,200 e-courses were completed. This gives grounds to assert that MHP has formed a multi-level system of professional development of personnel, focused on adapting employees to technological, organizational and managerial changes.

For a large agro-industrial holding, not only the number of employees and the level of their training are important, but also the formation of a corporate culture focused on safety, innovation and continuous improvement of internal processes. In

2023, in the Ukrainian segment of the company, the number of production incidents decreased from 22 to 15 cases, and the loss of working time due to accidents decreased from 9891 to 6866 hours. At the same time, expenses for occupational safety measures exceeded UAH 102 million, and financing for the purchase of modern certified personal protective equipment amounted to more than UAH 69 million. Social support for personnel in conditions of military challenges deserves special attention: the company continued to make payments to 2380 mobilized employees. The combination of the above indicators shows that human resources management at MHP is comprehensive and involves a combination of personnel stability, investments in human capital, development of professional competencies, and ensuring a safe production environment, which overall increases the sustainability and innovative capacity of the holding.

MHP's information potential is an important component of the holding's resource support, since it is digital systems that create the basis for coordinating production, logistics, financial and control processes within a vertically integrated business model. In 2023, the company continued the consistent development of digital infrastructure, in particular by forming a modern data warehouse based on Microsoft's cloud architecture and strengthening network security at large production sites. Such solutions are aimed at increasing the reliability of information processing, ensuring continuous access to data and creating technical prerequisites for the operational management of complex resource flows. Under these conditions, it is advisable to consider the information potential of the enterprise not only as a set of hardware and software, but as a strategic factor in increasing the manageability of the entire production system.

A significant direction in the development of MHP's digital environment has been the implementation of information solutions focused on supporting operational management and analytics in the agricultural and manufacturing segments. The company uses precision farming tools and specialized analytical panels, which makes it possible to carry out more detailed monitoring of production parameters, assess the efficiency of resource use and make informed decisions based on data sets. It is also important to implement digital support for production processes, which ensures the recording of key parameters of product manufacturing, quality control and tracking of operations at different stages of the technological cycle. In 2023, pilot digital solutions in the field of working time planning and internal logistics were implemented at individual production facilities of the company, and the first stage of the transport flow management project covered four logistics and distribution centers. This indicates a gradual transition from fragmented automation to comprehensive digitalization of management and operational functions.

The holding's information potential also covers the sphere of internal communications, personnel training and maintaining an appropriate level of information security. In 2023, more than 2.9 thousand employees used the SAP SuccessFactors Learning Management System digital learning management system, within which more than 7.2 thousand e-courses were completed. This indicates the active use of digital platforms not only for production management, but also for the development of human capital, the dissemination of corporate standards and the strengthening of a compliance culture. At the same time, the absence of significant complaints about data confidentiality violations confirms the appropriate level of information security organization. Taken together, the above characteristics give reason to assert that digitalization at MHP performs a system-forming function, as it ensures transparency of operations, increases the accuracy of control over the use of resources, contributes to the reduction of losses and creates the necessary conditions for the integration of the principles of the circular economy into the holding's management practice.

A summary of the main components of the resource potential is presented in Table 2.7.

The holding's production base is significantly dispersed, which necessitates coordination between individual divisions and optimization of logistics flows. The presence of its own elevators and warehouses ensures flexibility in storing raw materials and finished products, and a developed transport infrastructure contributes to the effective implementation of export contracts.

Table 2.7

Structure of the holding's resource potential

Potential component	Characteristic	Strategic importance
Land resources	Significant areas of agricultural land	Formation of the feed base
Material and technical base	Modern production complexes	Production stability
Energy resources	Bioenergy facilities and traditional sources	Energy autonomy
Labor potential	Qualified personnel	Innovative capacity
Information resources	Digital control systems	Process optimization

The resource potential of the enterprise serves as the foundation for the implementation of the innovation strategy. It is the availability of a modern production base, financial resources and qualified personnel that creates the conditions for the introduction of new technologies, process automation and the development of circular initiatives. At the same time, the efficiency of resource use determines the competitiveness of the enterprise in the conditions of growing global competition.

2.2. Analysis of innovation activities and circular practices

Assessment of the innovative activity of an agro-industrial holding is a necessary prerequisite for determining the level of its readiness to implement an innovative development strategy based on the principles of a circular economy. Innovative activity reflects the intensity of the creation and implementation of new technological, organizational, digital and energy solutions, as well as the volume of investments aimed at modernizing the production base. For a vertically integrated company, innovations cover all segments of activity - from agricultural production to processing and logistics.

The holding's innovative activities are comprehensive and are related to the modernization of production facilities, automation of technological processes, implementation of quality control systems, digital management platforms and development of bioenergy facilities. The high level of capital intensity of the industry necessitates significant investments in the renewal of fixed assets, which directly affects the competitiveness of products.

To assess the innovative activity of an agro-industrial holding, it is advisable to use a system of interrelated financial and production indicators that allow for a comprehensive description of the scale, intensity and effectiveness of technological renewal. Such indicators include the volume of capital investments, their share in the income structure, the rate of renewal of fixed assets, costs for digitalization and automation of production and management processes, as well as the share of products with a higher level of added value in the total sales volume. Using a set of these indicators allows not only to determine the level of investment activity of the enterprise, but also to establish how consistently its course for technological modernization and structural improvement of production is being implemented. Analysis of the dynamics of these indicators is of particular importance, since it makes it possible to identify the main trends in the company's development, assess the direction of investment decisions and clarify their impact on increasing labor productivity, resource efficiency and strengthening competitive advantages. In this context, the study of investments in fixed assets and their structure by individual segments of activity is an important component of the analytical assessment of the holding's innovative development.

Investments in fixed assets are one of the key indicators of innovative development. In the agro-industrial sector, a significant part of capital investments is directed to the construction and reconstruction of production complexes, modernization of equipment, implementation of automated management systems and development of infrastructure for storage and transportation of products. Such investments form the material basis for increasing labor productivity and reducing the cost of production. According to the official consolidated reporting of MHP, the volume of additions to fixed assets increased from 66.1 million USD in 2020 to 307.0 million USD in 2024, and the net book value of fixed assets from 1,678.9 million to 2,301.2 million USD. This makes it possible to show not only the fact of capital investments, but also the increase in the material base and investment reserve in unfinished projects.

Table 2.8

Dynamics of MHP investments in fixed assets and indicators of updating the material and technical base in 2020–2024, million USD

Year	Additions to fixed assets	Net book value of fixed assets at the end of the year	Uncompleted capital investments at the end of the year	Advances as part of capital investments in progress
2020	66.1	1,678.9	71.3	8.1
2021	144.8	1,939.6	112.8	24.3
2022	156.1	1,855.8	108.4	28.2
2023	208.0	1,885.3	140.1	23.0
2024	307.0	2,301.2	247.6	53.0

Source: compiled from the consolidated financial statements of MHP for 2020–2024.

The data provided indicate a consistent increase in MHP's investment activity in the field of fixed assets renewal. The growth in the volume of capital investments in 2023–2024 is particularly significant, which was accompanied by an increase in the net book value of fixed assets and an expansion of unfinished capital investments. This confirms that the company directs resources not only to maintaining existing production capacities, but also to their modernization, infrastructure development and the formation of prerequisites for further technological renewal.

The structure of investments by operating segments of MHP is presented in Table 2.9.

Table 2.9

Structure of MHP's investments in fixed assets by operating segments in 2023–2024, million USD

Operating segment	2023	Specific gravity, %	2024	Specific gravity, %	Deviation 2024/2023, ±
Poultry farming and related operations	130	62.5	186	60.6	+56
Oil segment	3	1.4	8	2.6	+5
Agricultural operations	25	12.0	35	11.4	+10
European operating segment	50	24.0	78	25.4	+28
Total by reporting segments	208	100.0	307	100.0	+99

Source: compiled from the consolidated financial statements of MHP for 2023–2024.

Analysis of the structure of MHP's investments in fixed assets by operating segments in 2023–2024 indicates the presence of clearly defined priorities in the implementation of the holding's investment policy. The largest volumes of capital investments have traditionally been concentrated in the poultry farming and related operations segment, which in 2023 accumulated 130 million USD, or 62.5% of the total volume of investments by segments, and in 2024 - 186 million USD, or 60.6%. This gives grounds to assert that this segment continues to be the basic link in the MHP business system, the development of which determines the general directions of updating the material and technical base and technological modernization of the holding. At the same time, a slight decrease in its specific weight with a simultaneous increase in the absolute volume of capital investments indicates not a weakening of the role of the poultry farming sector, but an intensification of investment activity in other business segments.

Along with this, the data provided indicate the expansion of MHP's investment activity in related and externally oriented areas of activity. The total volume of investments by reporting segments in 2024 compared to 2023 increased from 208 to 307 million USD, i.e. by 99 million USD, or almost 47.6%. A significant increase in capital investments was recorded in the European operating segment, where their volume increased from 50 to 78 million USD, and the share in the total investment structure increased from 24.0% to 25.4%. Such dynamics indicates the increasing importance of the international direction in the holding's strategic development system and reflects the company's desire for geographical diversification of assets and market presence. At the same time, an increase in investments in agricultural operations from 25 to 35 million USD The USA confirms the company's attention to strengthening its own raw material base, while the increase in investments in the oil segment from 3 to 8 million USD characterizes the desire to develop related areas of processing and more fully utilize production potential.

Summarizing the results of the analysis, it is appropriate to note that the structure of MHP's investments in fixed assets in 2023–2024 reflects a combination of two interrelated development vectors. On the one hand, priority financing of the poultry segment indicates the continued modernization of the holding's key production core, which forms the bulk of its income and competitive advantages. On the other hand, the increase in capital investments in the European, agricultural and oilseed segments indicates a gradual expansion of the investment base and strengthening of the company's multi-vector development. This allows us to conclude that MHP's investment policy is not only reproducible, but also strategically transformative in nature, since it is aimed simultaneously at technological renewal of existing capacities, increasing the sustainability of the business model and creating prerequisites for long-term growth in a changing external environment.

A separate area of investment activity is the introduction of digital technologies. The use of information systems for managing production processes, monitoring logistics and financial control allows to increase the transparency of operations and reduce resource losses. Digitalization creates conditions for the integration of circular practices, as it ensures accurate accounting of material and energy flows.

A summary of the main areas of innovative investments is presented in Table 2.9.

Table 2.9

Main areas of innovative investments of the holding

Investment direction	Content of the events	Expected economic effect
Production modernization	Equipment upgrades, automation	Productivity growth
Digitalization	Implementation of IT management systems	Reducing operating costs
Bioenergy	Construction of biogas complexes	Energy autonomy
Logistics infrastructure	Expansion of warehouse capacity	Optimization of transportation costs
Processing	Development of deep processing of products	Increasing added value

An important characteristic of innovative activity is its systematic nature. Innovations should not be fragmentary, but should be integrated into a long-term development strategy. In this context, it is advisable to evaluate not only the volume of investments, but also their effectiveness. For this purpose, indicators of return on investment, project payback period, operating profit growth and unit cost reduction are used.

Analysis of innovative activity also involves assessing the structure of investments by funding sources. The use of equity capital indicates the financial stability of the company, while the attraction of credit resources or international financing indicates investor confidence and a high level of corporate governance. In modern conditions, access to "green" financial instruments aimed at supporting environmentally friendly projects is of particular importance.

MHP's innovative activity should be assessed not only by absolute investment volumes, but also through the transformation of the cost structure, which reflects a change in priorities in the use of resources. In 2024, the volume of additions to fixed assets increased to 307 million USD compared to 208 million USD in 2023, i.e. by almost 47.6%. At the same time, the share of such investments in revenue increased from approximately 6.9% to 10.1%, which indicates a strengthening of the investment and innovation component in the holding's financial model. It is important that the company itself associates the increase in capital investments primarily with the expansion of operations in the EU, the implementation of projects to maintain and modernize existing capacities, compliance with compliance requirements, the development of energy projects, in particular in the field of BioLNG and gas generation, as well as the creation of new capacities for the production of products with higher added value. This gives grounds to argue that the growth in costs for asset renewal is not of a regenerative, but of a strategically transformative nature (Table 2.10).

Table 2.10

Structural changes in the cost of MHP as an indicator of innovation activity in 2023–2024.

Indicator	2023, million USD	2024, million USD	Absolute deviation, ±	Share in cost price 2023, %	Share in cost price 2024, %	Change in specific gravity, c.p.
Costs of raw materials and other supplies used in production	1,579	1,548	-31	67.7	66.4	-1.3
Labor costs and related charges	352	394	+42	15.1	16.9	+1.8
Service costs	255	223	-32	10.9	9.6	-1.3
Depreciation and wear	148	168	+20	6.3	7.2	+0.9
Total cost	2,334	2,333	-1	100.0	100.0	—

Source: compiled from the official integrated reporting of MHP for 2023–2024; calculated from data on the composition of cost

Changes in the cost structure also confirm the strengthening of the company's innovative development vector. In 2024, costs for raw materials and other supplies used in production decreased from 1,579 to 1,548 million USD, and their share in cost decreased from approximately 67.7% to 66.4%. Similarly, costs for services decreased from 255 to 223 million USD, and their share from 10.9% to 9.6%. At the same time, depreciation and amortization expenses increased from 148 to 168 million USD, and their share in cost increased from 6.3% to 7.2%, which indirectly reflects the increased role of renewed fixed assets and higher capital intensity of production. Taken together, these dynamics indicate a gradual shift in emphasis from the predominance of current material costs to a more significant role for technological renewal and investment in production efficiency.

A separate confirmation of the innovative focus of costs is the development of energy-efficient and digital solutions. In 2024, the total amount of energy from renewable sources in the Ukrainian segment of MHP increased from 2,081 to 2,274 TJ, and their share in total energy consumption increased from 21% to 23%. The company also directly links the reduction in emissions to the implementation of ISO 50001-

certified energy management systems. In parallel, the development of digital infrastructure continued: a data warehouse based on Microsoft cloud architecture was built in Ukraine, the deployment of SAP infrastructure continued, a pilot project for digital working time planning was introduced at the Myronivka slaughter complex, and the first stage of digital transport logistics management was implemented at four logistics and distribution centers. Therefore, the analysis of the cost structure gives grounds to consider the innovative activity of MHP as a complex process, within which modernization, energy efficiency, and digitalization are interrelated areas of long-term development.

The systemic nature of innovation activity is manifested in the relationship between investments and increased competitiveness. An enterprise that constantly updates its technological base and integrates circular solutions creates sustainable advantages in the form of reduced costs, improved product quality, and expanded access to international markets.

Therefore, the assessment of innovation activity and investment in development indicates the presence of systematic modernization of the production base, orientation towards digitalization and implementation of energy-efficient technologies. The combination of these factors creates the prerequisites for the implementation of an innovative development strategy based on the principles of a circular economy and forms the basis for further analysis of the waste management system, bioenergy and closed production cycles.

The waste management system in a vertically integrated agro-industrial holding is one of the key elements of implementing the principles of the circular economy. In the specifics of agricultural production, waste is predominantly organic in nature, which creates opportunities for its reuse, processing and return to the production cycle. Thus, waste is considered not as a final product of production, but as a secondary resource capable of generating additional economic value.

In the structure of agro-industrial waste, several main groups can be distinguished: organic waste from livestock, by-products from crop production, processing waste and packaging materials. The effectiveness of managing these flows is determined by the availability of technological infrastructure, control systems and regulatory and organizational support.

Organic waste from poultry farming, in particular manure, is a valuable raw material for the production of biogas and organic fertilizers. The introduction of biogas complexes allows the transformation of biomass into renewable energy, and the residual mass into fertilizer used in crop production. Thus, a closed biological cycle is formed, within which nutrients are returned to the soil, contributing to the preservation of its fertility.

The bioenergy sector is an important element of the circular transformation of production. The use of biogas plants ensures the generation of electricity and heat, which reduces the company's dependence on traditional energy resources. At the same time, greenhouse gas emissions are reduced, which has a positive impact on environmental performance. Energy autonomy increases the financial stability of the holding in conditions of fluctuations in energy prices.

The waste management system involves a combination of technological and organizational mechanisms. Technological solutions include sorting, recycling, composting and anaerobic digestion of organic raw materials. The organizational component covers the control of waste generation volumes, planning their use and monitoring environmental indicators. Such a comprehensive approach allows you to minimize resource losses and optimize costs.

Closed production cycles are formed on the basis of the integration of crop and livestock activities. Growing grain crops provides a feed base that is used in the production of compound feed, after which by-products are returned in the form of organic fertilizers. This model contributes to increasing resource productivity and reducing dependence on external suppliers.

The analysis of the waste management system also involves assessing the share of secondary resources in the overall balance of material flows. The growth of this indicator indicates an increase in the level of circularity of production (Table 2.12). At the same time, it is important to consider the economic efficiency of the relevant measures, in particular the ratio between recycling costs and the resulting economic effect.

The systematization of the elements of a closed loop is presented in Table 2.11.

Table 2.11

Elements of a closed production cycle

Cycle stage	Main resource	Processing result	Reuse
Crop production	Cereal crops	Raw materials for feed	Production of compound feed
Poultry breeding	Compound feeds	Organic waste	Biogas and fertilizers
Bioenergy	Biomass	Electricity, heat	Production support
Fertilizers	Recycled organic matter	Nutrients	Return to the soil

Table 2.12

Waste management and circular solutions performance indicators of MHP in 2024

Indicator	Value	Analytical interpretation
Total waste volume in the Ukrainian segment, thousand m³	981.4	Characterizes the scale of the waste management system
Targeted for restoration, thousand m³	600.6	Indicates a significant level of waste recycling
Directed to composting, thousand m³	345.2	Confirms the development of biological methods for processing organic raw materials
Sent for disposal, thousand m³	13.9	Indicates a low proportion of final waste disposal
Share of waste diverted to useful use (recovery + composting), %	96.4	Characterizes a high level of circularity of the production system
Biogas produced, million kWh	309.6	Reflects the energy effect of using organic waste
Electricity produced, million kWh	125.7	Shows the result of converting waste into an energy resource
Thermal energy produced, million kWh	84.4	Confirms the complex nature of organic raw material utilization
Reduction in the use of synthetic fertilizers over the last three years, %	9.0	Demonstrates the resource-saving effect of using digestate and organic fertilizers

The waste management system in MHP is complex and is based on a combination of technological and organizational mechanisms aimed at minimizing resource losses and re-involving by-products in production turnover. The technological component of this system includes sorting, recovery, composting and anaerobic digestion of organic raw materials, while the organizational component involves accounting for waste generation volumes, planning directions for their further use and constant monitoring of environmental indicators. The practical effectiveness of this approach is confirmed by the fact that in 2024, in the Ukrainian segment of MHP, the total volume of waste covered by the management system amounted to 981.4 thousand m^3. Of this volume, 600.6 thousand m^3 was directed to recovery, and 345.2 thousand m^3 to composting, while only 13.9 thousand m^3 was allocated to landfill. Therefore, the total share of waste recycled reached 96.4%, which indicates a high level of circular organization of production processes.

An important direction of this system is the use of organic waste as a secondary resource for the production of energy and organic fertilizers. Within the bioenergy infrastructure of MHP, organic raw materials are converted into biogas, electricity, heat and digestate, which is further used in crop production. In 2024, the volume of biogas produced was 309.6 million kWh, electricity production reached 125.7 million kWh, and heat energy - 84.4 million kWh. The above indicators confirm that waste within the holding is considered not as a by-product of production, but as an additional resource capable of generating energy and economic effects. Along with this, the use of anaerobic digestion products in the fertilizer system has contributed to a 9% reduction in the use of synthetic fertilizers over the past three years, which indicates the resource-saving nature of the implemented solutions.

The waste management system at MHP performs not only an environmental, but also a distinct production and economic function. Its effectiveness is manifested in reducing the volume of waste disposal, increasing the share of secondary resources in material flows, reducing the need for primary resources and creating additional value through the production of energy and organic fertilizers. Taken together, this gives grounds to consider waste management as one of the key practical tools for increasing the level of circularity of production, optimizing costs and strengthening the long-term economic sustainability of the holding.

The efficiency of closed loops depends largely on the digital monitoring of resource flows. Management systems allow you to track waste generation, energy consumption and recycling efficiency. This ensures process transparency and creates the basis for optimizing technological solutions.

However, the implementation of closed loops comes with certain challenges. These include significant initial investments in bioenergy infrastructure, the need to adapt technological processes, and the need for qualified personnel. However, the long-term economic and environmental benefits outweigh the short-term costs, confirming the feasibility of implementing circular practices.

The waste management system, the development of bioenergy and the formation of closed production cycles are important components of the holding's innovative development. They ensure increased resource efficiency, reduced environmental burden and the formation of additional sources of value. The implementation of these areas creates the prerequisites for assessing the compliance of the company's activities with the principles of ESG and circular economy.

The current stage of development of agro-industrial holdings is characterized by a transition from exclusively financial assessment of performance to an integrated approach that takes into account environmental, social and managerial aspects of functioning. In this context, the ESG (Environmental, Social, Governance) system acts as a tool for comprehensive analysis of business sustainability and its compliance with the principles of sustainable development. For an enterprise implementing elements of a circular economy, ESG assessment is a logical continuation of the analysis of innovation and resource efficiency.

The environmental component of ESG covers the impact of the enterprise on the environment, the efficiency of the use of natural resources, the level of greenhouse gas emissions, waste management and energy consumption. In the case of a vertically integrated agro-industrial holding, the indicators of energy intensity of production, the share of renewable energy in the total balance, the volume of organic waste processing and the use of secondary resources are of particular importance. The presence of biogas complexes, resource flow monitoring systems and the introduction of closed production cycles indicate the gradual integration of circular principles into the production model.

The social component of ESG reflects the interaction of the enterprise with employees, local communities and other stakeholders. In the agro-industrial sector, this is manifested through the creation of jobs in the regions of presence, investments in social infrastructure, compliance with labor protection standards and the development of vocational training programs. The formation of a corporate culture focused on innovation and environmental responsibility is an important prerequisite for the successful implementation of a circular strategy.

Governance includes transparency of ownership structure, effectiveness of internal control system, compliance with anti-corruption standards and quality of corporate governance. For a large holding, it is important to ensure a clear division of powers, functioning of supervisory bodies and regular reporting to investors. A high level of governance transparency increases the trust of financial institutions and facilitates access to international capital markets, in particular to "green" financing instruments.

To assess the compliance of an enterprise's activities with ESG and circular economy principles, it is advisable to use a system of indicators that includes environmental, social, and management indicators (Table 2.13).

Table 2.13

Key indicators for assessing compliance with ESG principles

Indicator group	Main indicators	Meaning for the circular model
Environmental	Emission level, share of renewable energy, volume of waste recycling	Reducing environmental impact
Social	Employment level, investments in personnel training, social programs	Increasing social resilience
Management	Transparency of reporting, corporate governance structure	Investor confidence

Assessing compliance with the principles of the circular economy also involves analyzing the closedness of material flows, the level of resource reuse, and the integration of bioenergy solutions. The growth of the share of secondary resources in the production process, the reduction of waste, and the increase in energy efficiency indicate the formation of a circular business model.

An important component of the assessment is the comparison of actual indicators with international standards and industry benchmarks. Compliance with the environmental requirements of the European Union, participation in international initiatives to reduce emissions and the implementation of integrated reporting are indicators of the strategic orientation of the enterprise towards long-term sustainability.

Integrating ESG into corporate strategy allows you to align economic goals with environmental and social priorities. For an agro-industrial holding, this means combining production growth with the rational use of natural resources and the development of the regions of presence. Thus, compliance with ESG principles becomes not only an indicator of reputational stability, but also a factor in increasing competitiveness in international markets.

Therefore, the assessment of the company's activities from the standpoint of ESG and circular economy indicates a gradual transformation of its business model towards resource efficiency and environmental responsibility. A comprehensive analysis of environmental, social and management indicators creates the basis for the formation of strategic recommendations for the further development of the innovative and circular business model, which is considered in the next section of the study.

2.3. Assessment of the effectiveness of the innovation-circular model

Assessment of the economic efficiency of implemented innovations is a key stage in the analysis of the innovation-circular model of development of an agro-industrial holding. In conditions of high capital intensity of the industry and significant dependence on external markets, it is the financial performance of innovations that determines the feasibility of their further scaling. For a vertically integrated structure, the effect of innovations is manifested not only in the growth of profits, but also in the reduction of operating costs, optimization of logistics, increased productivity and reduction of resource losses.

The economic effect of innovations can be divided into direct and indirect. The direct effect is associated with increased income or reduced costs due to the introduction of new technologies. The indirect effect is manifested in increased production stability, strengthened market positions, improved reputation, and expanded access to international markets. Taken together, these results form a long-term competitive advantage.

One of the key areas of innovation is the modernization of production facilities. For example, the introduction of automated product processing and packaging lines allows reducing the labor intensity of processes by 10–15% and reducing production losses by 3–5%. Assuming that the annual production volume is 700 thousand tons of products, even a 3% reduction in losses provides an additional output of about 21 thousand tons, which at an average price of $ 1,500 per ton can generate additional income of more than $ 30 million per year.

Investments in bioenergy facilities also have a pronounced economic effect. Provided that the biogas complex generates 100 million kWh of electricity per year, and the average market price of electricity is 0.10 USD per kWh, the potential annual economic effect can exceed 10 million USD. An additional result is achieved by reducing the costs of organic waste disposal and the production of organic fertilizers, which partially replace mineral analogues.

To assess the economic efficiency of innovations, classical methods of investment analysis are used, in particular, the calculation of net present value (NPV), internal rate of return (IRR) and payback period (PP). If, for example, the amount of investment in the modernization of the production complex was 80 million USD, and the annual additional cash flow was 15 million USD, then the simple payback period would be about 5.3 years. At a discount rate of 10%, the net present value of the project over 10 years may exceed 40 million USD, which indicates its financial feasibility.

A summary of the possible economic results of implemented innovations is presented in Table 2.14.

Table 2.14

Assessment of the economic efficiency of the main innovation areas

Direction of innovation	Investment volume, million USD.	Annual economic effect, million USD.	Estimated payback period, years
Production modernization	80	15	5–6
Bioenergy complex	60	10	6
Digitalization of logistics	20	5	4
Development of deep processing	50	12	4–5

An important aspect is the reduction of production costs. If, thanks to the implementation of energy-efficient technologies, energy costs are reduced by 8%, and their share in the cost is 20%, then the total cost reduction can reach 1.6%. For a large production volume, this means savings in the millions. Similarly, optimizing feed formulations and digital control of their use can reduce costs by 3–4%, which further increases operational profitability.

The economic effect of innovations is also manifested in the growth of the marginality of products with high added value. Expanding the range of processed products allows you to increase the share of the marginal segment in the revenue structure. If the profitability of primary products is 10–12%, then in the deep processing segment it can reach 18–22%, which has a positive effect on the overall financial result.

Indirect economic benefits are associated with increasing the company's investment attractiveness. The presence of modern production facilities, bioenergy facilities and ESG reporting helps reduce the cost of capital and expand access to international financial markets. Reducing financial risks has a positive impact on the credit rating and reduces the cost of borrowed resources.

The systemic nature of the innovation-circular model allows for a synergistic effect. The interaction of modernized production complexes, digital management systems, and bioenergy facilities forms a comprehensive economic result that exceeds the sum of individual effects. This approach ensures long-term growth and increases adaptability to changes in the market environment.

Therefore, the implemented innovations demonstrate positive economic performance, which is manifested in cost reduction, revenue growth, increased profitability and strengthening financial sustainability. The economic efficiency of the innovation-circular model confirms the feasibility of its further development and creates the basis for the analysis of energy and resource efficiency, which is considered in the next subsection.

Energy and resource efficiency are key indicators of the effectiveness of the innovative and circular model of development of an agro-industrial holding. In the context of rising energy costs, increasing environmental requirements and limited natural resources, increasing the efficiency of their use is of strategic importance. For a vertically integrated company covering the full production cycle, optimizing energy and material flows allows not only to reduce costs, but also to increase competitiveness in international markets.

Energy efficiency is characterized by the ratio of energy consumed to output. In the traditional agro-industrial model, the energy intensity of production is quite high due to significant costs for growing raw materials, maintaining livestock complexes, processing and logistics. The introduction of innovative technologies, in particular automated control systems, modernization of equipment and the use of alternative energy sources, allows you to reduce specific energy costs per unit of output.

If we conditionally assume that the holding's total annual electricity consumption is 500 million kWh, and the production volume is 700 thousand tons of products, then the energy intensity is 714 kWh per ton. Thanks to the introduction of energy-saving technologies and digital monitoring of energy consumption, it is possible to reduce this indicator by 8–10%, which means savings of about 40–50 million kWh per year. At an average cost of 0.10 USD per kWh, this provides a direct economic effect of 4–5 million USD annually.

An important component of energy efficiency is the development of bioenergy. The use of organic waste for biogas production allows generating part of the necessary electricity and heat on its own. If bioenergy plants provide up to 20% of the enterprise's electricity needs, this not only reduces costs, but also increases energy autonomy and resistance to market fluctuations.

Resource efficiency encompasses the rational use of raw materials, water resources, land and materials. In crop production, the introduction of precision agriculture allows for the optimization of fertilizer and plant protection products, which reduces their costs by 5–7%. If annual costs for mineral fertilizers are $50 million, saving even 5% provides a cost reduction of $2.5 million.

In the livestock segment, an important indicator is the feed conversion ratio, which determines the efficiency of converting feed into finished products. Reducing this indicator by 2–3% through recipe optimization and feed consumption control allows reducing the cost of compound feed, which accounts for a significant share of the cost.

A systematization of the main indicators of energy and resource efficiency is presented in Table 2.15.

Table 2.15

Energy and resource efficiency indicators

Indicator	Before implementing innovations	After implementation	Economic effect
Energy intensity, kWh/t	714	650	Savings of 4–5 million dollars.
Share of renewable energy	5%	20%	Reducing market dependence
Fertilizer costs, million USD	50	47.5	Savings of $2.5 million.
Feed conversion	1.8	1.75	Reducing feed costs

Water efficiency deserves special attention. Process water reuse and wastewater treatment systems can reduce fresh water consumption by 10–15%. This has both economic and environmental benefits, especially in regions with limited water resources.

From the perspective of the circular economy, an important indicator is the material reuse rate. If the share of secondary resources in the production process increases from 10 to 25%, this indicates the formation of closed cycles and a decrease in the need for primary raw materials. Such a transformation helps stabilize costs and reduce dependence on external suppliers.

The cumulative effect of improving energy and resource efficiency is manifested in reducing production costs, increasing operating margins and strengthening the company's environmental reputation. In addition, reducing emissions and resource consumption has a positive impact on compliance with international standards and ESG requirements.

Analysis of the economic, energy and resource efficiency of the innovative circular model allows us to proceed to the definition of strategic reserves for the further development of the holding. Strategic reserves are considered as a set of unused or insufficiently implemented opportunities for increasing the effectiveness of activities, based on the improvement of managerial, technological, financial and organizational solutions. For a large vertically integrated agro-industrial enterprise, such reserves are formed both at the level of individual divisions and within the entire corporate structure.

The first group of strategic reserves is the technological capabilities for further modernization of production. Despite significant investments in automation and digitalization, the potential for increasing productivity remains significant. In particular, the implementation of artificial intelligence systems for predicting feed consumption, managing the microclimate in production complexes and optimizing logistics can provide an additional cost reduction of 2–4%. With an annual turnover of more than 2 billion USD, even 1% of savings is tens of millions of dollars of potential effect.

The second group of reserves is the expansion of the scale of bioenergy solutions. If the share of renewable energy in the total balance is 20%, potentially increasing this figure to 35–40% will not only reduce energy costs, but also reduce the carbon footprint. Under the conditions of increasing electricity prices to 0.12–0.14 USD per kWh, the economic effect of additional generation can exceed 5–7 million USD per year.

The third group of reserves is increasing the depth of product processing. Increasing the share of high-value-added products by 5–7% in the sales structure can increase the overall margin by 2–3 percentage points. If the average sales profitability is 15%, its increase to 17–18% can provide additional profit in the range of 40–60 million USD depending on the volume of sales.

A separate group of strategic reserves is formed by the optimization of logistics processes. The implementation of digital transportation management systems, route planning and warehouse logistics allows reducing transportation costs by 3–5%. Provided that annual logistics costs are 200 million USD, the potential savings can reach 6–10 million USD.

The systematization of strategic development reserves is presented in Table 2.16.

Table 2.16

Main strategic reserves for the holding's development

Development direction	Potential efficiency gains	Estimated economic effect
Digitalization of production	2–4% cost reduction	$20–40 million.
Expanding bioenergy	+15% renewable energy	$5–7 million.
Deep processing	+2–3 pp profitability	$40–60 million.
Logistics optimization	3–5% cost savings	$6–10 million.

An important strategic reserve is also the development of partnerships and cluster cooperation. Integration into regional agro-industrial clusters allows for the formation of a common infrastructure for processing, resource exchange, and logistics. This creates additional opportunities for implementing the principles of industrial symbiosis and increasing resource productivity.

No less significant is the reserve associated with attracting "green" financing and international investment programs. Participation in sustainable development support programs allows you to reduce the cost of capital and accelerate the implementation of innovations. If you attract credit resources at a reduced rate (for example, 5% instead of 8%), debt service savings can amount to several million dollars annually.

Additional potential is associated with increasing the efficiency of human capital management. Investments in personnel training, development of digital competencies and implementation of motivation systems focused on innovation can ensure an increase in labor productivity by 3–5%. This has both a direct economic and long-term strategic effect.

Summarizing the results of the analysis, it can be stated that the innovative circular model already provides significant economic and resource benefits, but its development potential is not exhausted. Strategic reserves are associated with the deepening of digitalization, scaling up bioenergy, expanding processing capacities and improving management mechanisms. The implementation of these opportunities can provide an increase in operating profit by 5–10% in the medium term.

Conclusions to Chapter 2

The second section provides a comprehensive analysis of the organizational and economic characteristics of the agro-industrial holding's activities, assesses financial and economic results, and determines the level of resource potential. It is established that the enterprise has a developed vertically integrated structure, significant production capacities, and stable financial indicators, which creates the prerequisites for the implementation of large-scale innovative projects.

The assessment of innovative activity and circular practices revealed the presence of bioenergy solutions, elements of digitalization and waste management systems. At the same time, reserves for increasing energy autonomy, reducing the energy intensity of production and deepening product processing were identified. The calculation of economic, energy and resource efficiency was carried out, which allowed to determine the potential for cost reduction and increasing operational profitability.

As a result of the analysis, the basis for developing strategic priorities for innovative and circular development was formed and key areas of enterprise transformation in the context of a circular economy were identified.

CHAPTER 3. FORMATION OF THE INNOVATIVE DEVELOPMENT STRATEGY OF MHP ON THE BASIS OF THE CIRCULAR ECONOMY

3.1. Justification of strategic development priorities

Defining strategic goals for the innovative development of an agro-industrial holding is a key stage in the formation of a long-term growth model based on the principles of a circular economy. Strategic goals reflect the desired state of the enterprise in the future 5–10 years and form guidelines for resource allocation, investment policy and management decisions. In the context of global competition and increasing environmental requirements, strategic planning must combine economic efficiency, technological modernization and environmental sustainability.

The formation of strategic goals is based on the results of the analysis of internal potential, assessment of the effectiveness of the innovation-circular model and identified strategic development reserves. Taking into account the scale of the holding's activities, vertical integration and international orientation, strategic goals should cover production, financial, energy, environmental and social areas.

The first strategic priority is to ensure sustainable growth in operational efficiency. This involves increasing the productivity of production complexes, optimizing costs and increasing product margins. In quantitative terms, the goal can be formulated as reducing the cost of production by 5–7% over five years or increasing operating profitability to 18–20%. Achieving this indicator is possible through scaling digital solutions, upgrading equipment and optimizing logistics processes.

The second strategic direction is to expand the share of products with high added value. The development of deep processing allows to increase competitiveness in international markets and reduce dependence on price fluctuations for raw materials. The target may be to increase the share of processed products in the total sales volume from 40% to 55% in the medium term. Such a redistribution of the income structure will contribute to the growth of the overall business margin.

The third strategic priority is to increase energy autonomy and develop bioenergy capacities. Given the significant potential for the use of organic waste, it is advisable to set a goal of achieving a 40% share of renewable energy in the holding's overall energy balance. This will not only reduce energy costs, but also reduce the carbon footprint of production, which is an important factor in the context of international environmental standards.

The fourth strategic direction is the deepening of digitalization of resource flow management. The implementation of integrated management information systems will ensure full transparency of material and energy flows, reduce losses and increase the speed of management decisions. A quantitative goal may be to reduce specific resource consumption by 8–10% through digital control and analytics.

A separate strategic guideline is to increase investment attractiveness and compliance with ESG principles. Achieving a high level of environmental and social responsibility will contribute to attracting "green" financing and reducing the cost of capital. The target indicator may be an increase in the share of investments directed to environmental projects to 30% of the total volume of capital investments.

The systematization of strategic goals of innovative development is presented in Table 3.1.

Table 3.1

Strategic goals of innovative development of the holding

Strategic direction	Quantitative benchmark	Expected result
Operational efficiency	–5–7% of cost price	Increasing profitability
Deep processing	55% in the sales structure	Increasing margin
Bioenergy	40% renewable energy	Energy autonomy
Digitalization	–8–10% of resource costs	Process optimization
ESG orientation	30% of green investments	Increasing investment attractiveness

An important condition for the implementation of these goals is their mutual coherence and systemic nature. Innovative development cannot be limited to individual projects, but must encompass the entire production and economic system of the enterprise. Achieving the set benchmarks will ensure an increase in operating profit by

8–12% in the medium term and strengthen the holding's position in international markets.

The formation of a circular business model of an agro-industrial holding is a logical continuation of the defined strategic goals of innovative development. If strategic guidelines set the direction of transformation, then the business model determines the mechanism for creating, delivering and preserving value in the context of the transition from a linear to a closed economic system. For a vertically integrated structure, the circular business model should cover all links of the production chain - from agricultural production to processing, energy and sales of finished products.

The traditional linear model of agribusiness is based on the principle of "production - consumption - disposal", which implies a one-way movement of material flows. The circular model, on the other hand, is focused on maximum conservation of resources in the production system, reuse of by-products and minimization of losses. For the holding, this means the integration of crop, livestock, processing and energy segments into a single closed cycle.

A key element of the circular business model is the management of material flows. The grown crops are used to produce compound feed, which ensures the functioning of poultry complexes. Organic waste is processed into biogas and organic fertilizers, which are returned to crop production. Thus, a biologically closed cycle is formed, within which resources are maximally retained in the system.

The second important component is the creation of added value through deep processing. The circular model involves expanding the range of products with high added value, using by-products to produce new goods and diversifying income. For example, the processing of by-products can ensure the production of feed additives or technical products, which creates additional sources of income.

The third element of the circular business model is energy integration. Bioenergy complexes allow the transformation of waste into renewable energy used in production processes. If the share of own generation reaches 40%, this provides not only economic savings, but also increases resilience to external risks. An additional effect is the reduction of emissions and compliance with international environmental standards.

The systematization of the structural components of the circular business model is presented in Table 3.2.

Table 3.2

Structural elements of the holding company's circular business model

Model element	Transformation content	Economic effect
Closed material cycles	Organic waste recycling	Reducing resource costs
Deep processing	Diversification	Marginal growth
Bioenergy	Own energy generation	Energy autonomy
Digital control	Resource flow monitoring	Cost optimization
ESG integration	Environmental and social responsibility	Access to green financing

Digitalization plays the role of an integrating element of the circular business model. The implementation of resource consumption monitoring systems, automated production management and analytical platforms allows coordinating all segments of the holding in a single information system. This creates the possibility of responding promptly to changes in the market situation and internal performance indicators.

The formation of a circular business model requires the adaptation of the financial structure and investment policy. A significant part of the capital investments should be directed to the modernization of production capacities, the development of bioenergy and digital solutions. Provided that the annual volume of investments is 150–200 million USD, it is advisable to provide for the allocation of at least 30–35% of these funds to circular transformation projects.

An important component of the model is interaction with stakeholders. Partnerships with local communities, scientific institutions and financial institutions contribute to the formation of an ecosystem of sustainable development. This approach allows not only to increase production efficiency, but also to strengthen the social legitimacy of the business.

As a result of the formation of a circular business model, the holding company is moving from a resource-dependent to a resource-efficient management system. The expected economic effect is to reduce total operating costs by 8–12%, increase profitability and increase investment attractiveness. At the same time, the model ensures environmental sustainability and compliance with international standards.

Thus, the circular business model serves as a systemic basis for the long-term development of the holding. It integrates innovative technologies, closed production cycles and environmental responsibility into a single strategic structure, which creates the prerequisites for further integration of innovative and environmental components into the corporate strategy.

The integration of innovation and environmental components into the corporate strategy is the final stage of forming a holistic model of the holding's development based on the principles of a circular economy. If in the previous divisions strategic goals were defined and a circular business model was formed, then at this stage it is a question of a systematic combination of innovation dynamics with environmental responsibility within a single strategic management logic.

Traditionally, the innovative activity of the enterprise is focused on increasing productivity, reducing costs and expanding sales markets. At the same time, environmental policy is often considered as a separate direction of corporate social responsibility. In modern conditions, these components must be integrated into a single strategic system, since it is environmentally oriented innovations that form long-term competitive advantages.

Integration involves including environmental goals in the list of key strategic performance indicators. For example, along with profitability and production volume indicators, it is advisable to include indicators of greenhouse gas emission reduction, energy intensity reduction, increase in the share of renewable energy and increase in the material reuse rate in the corporate KPI system. This approach ensures the equivalence of economic and environmental priorities in the process of making management decisions.

An important element of integration is strategic investment planning. Innovative projects should be evaluated not only from the standpoint of financial feasibility, but also taking into account their environmental impact. For example, when calculating the effectiveness of modernization of production complexes, it is advisable to take into account not only NPV or IRR indicators, but also the expected reduction in CO_2 emissions or water consumption. Provided that emissions are reduced by 50 thousand tons of CO_2 per year, the enterprise receives not only an environmental but also a potential economic effect in the event of the introduction of a quota trading system.

The integration of innovation and environmental components also involves the transformation of the organizational structure of management. It is advisable to create specialized units or functional areas responsible for sustainable development and circular initiatives. At the same time, it is necessary to ensure coordination between production, financial and environmental services to agree on strategic decisions.

The systematization of integration directions is given in Table 3.3.

Table 3.3

Directions for integrating innovative and environmental components into the strategy

Integration direction	Content of the events	Expected result
Strategic KPIs	Inclusion of environmental indicators in the assessment system	Balancing economic and environmental goals
Investment policy	Priority of "green" innovations	Reducing resource dependence
Organizational structure	Coordination of sustainable development functions	Improving process controllability
Financing	Attracting "green" loans and bonds	Decrease in the cost of capital
Reporting	Integrated financial and ESG reporting	Increasing transparency

An important tool for integration is an integrated reporting system that combines financial and non-financial indicators. Public disclosure of information on achievements in the field of resource efficiency, bioenergy and emission reduction increases the trust of investors and partners. Given the growing role of ESG factors in international capital markets, this becomes a significant competitive advantage.

The integration of innovation and environmental components also affects corporate culture. Creating awareness among staff of the importance of resource efficiency and environmental responsibility stimulates initiative and support for innovation. Training programs, internal process optimization projects and motivational mechanisms contribute to the dissemination of sustainable development principles at all levels of management.

From an economic point of view, integration allows for a synergistic effect. The combination of innovation and environmental modernization can provide an additional growth in operating profit by 5–8% in the medium term by simultaneously reducing costs and increasing investment attractiveness. At the same time, reducing environmental risks reduces the potential costs of fines, compensation and reputational losses.

The integration of innovation and environmental components into the corporate strategy forms a holistic model of sustainable development of the holding. It ensures the consistency of economic and environmental goals, increases the efficiency of resource management and creates the prerequisites for long-term growth in the context of global transformation of the agro-industrial sector.

The formation of a set of innovative and circular measures for an agro-industrial holding involves the identification of specific technological solutions capable of increasing resource efficiency, reducing environmental impact, and strengthening competitive positions in the market. Within the framework of the innovative and circular model, technologies that contribute to the closure of material flows, increasing energy autonomy, and modernization of production infrastructure are prioritized.

The first key area is the scaling of bioenergy solutions. A feasible measure is the construction of additional biogas complexes on the basis of poultry farms, which ensure the processing of organic waste into biogas and organic fertilizers. The justification for such a decision is based on the significant volume of biomass generated in the production process and the possibility of its effective utilization. The expected result is an increase in the share of renewable energy in the overall balance to 40%, a decrease in electricity costs and a minimization of environmental risks.

The second direction is the introduction of biogas-based cogeneration technologies. The use of cogeneration plants allows for the simultaneous production of electrical and thermal energy, which increases the overall fuel efficiency to 80–85%.

This approach ensures the optimization of energy flows and increases the autonomy of production complexes, especially in conditions of unstable energy markets.

The third technological measure is the modernization of production equipment to reduce the energy intensity of processes. It is advisable to gradually introduce energy-efficient engines, heat recovery systems and automated control of resource consumption. The justification is the high share of energy costs in the cost of production. The expected effect is a reduction in the energy intensity of production by 8–10% within five years.

The next direction is the introduction of precision farming technologies in the crop segment. The use of GPS control systems, differentiated fertilizer application, and soil condition monitoring allows optimizing the use of material resources. This helps reduce costs for mineral fertilizers, minimize negative environmental impacts, and increase yields.

Of particular importance is the development of technologies for deep processing of by-products. It is advisable to create production lines for processing by-products into feed additives or technical products. The justification for this measure is based on the need to increase business margins and diversify income. The expected result is an increase in the share of products with high added value and an increase in operating profitability.

The systematization of the proposed technological measures is presented in Table 3.4.

Table 3.4

Technological innovations and bioenergy activities

Activities	Justification	Expected result
Construction of biogas complexes	Availability of organic raw materials	40% renewable energy
Cogeneration plants	Increasing efficiency	Reducing energy costs
Equipment modernization	High energy consumption	–8–10% of energy consumption
Precision farming	Optimization of fertilizer costs	Increasing yield
Deep processing	Growth in added value	Increasing Marginality

An important complement to technological innovations is the implementation of environmental monitoring systems that allow for real-time monitoring of emissions and resource consumption. This creates the basis for further improvement of circular practices and increases the transparency of the company's activities.

The proposed set of measures is systemic in nature and is aimed at forming a closed production cycle, increasing energy autonomy, and strengthening economic efficiency.

Digitalization of resource flow management is a key tool for increasing the efficiency of the holding's innovative and circular model. If technological and bioenergy solutions form the material basis of transformation, then digital systems ensure coordination, control and optimization of all production, energy and logistics processes in real time. It is the integration of information technologies that allows achieving systematicity and scalability of circular practices.

The first direction of digitalization is the implementation of an integrated ERP system with a resource flow management module. Such a system provides centralized accounting of raw materials, feed, energy resources, waste and finished products. The justification for this measure is the need to eliminate information fragmentation between the holding's divisions. The expected result is increased transparency of material flows and a reduction in internal losses by 3–5%.

The second measure is the implementation of an energy management system based on the ISO 50001 standard using digital sensors and analytics platforms. The installation of smart meters and automated data collection systems allows for continuous monitoring of electricity, heat and water consumption. This creates the prerequisites for the prompt detection of overspending and making management decisions to optimize the load. The expected effect is a reduction in energy costs by 5–7% within the first two years after implementation.

The third direction of digitalization is the creation of a platform for monitoring agricultural production based on precision farming technologies. The use of satellite data, drones and geographic information systems allows analyzing the condition of crops, soil moisture levels and applying fertilizers in a differentiated manner. The justification is a significant share of costs for agrochemical resources and the risks of yield reduction due to climate fluctuations. The expected result is a 5% reduction in fertilizer costs and a 3–4% increase in yield.

The next measure is the implementation of a digital logistics management system (TMS – Transport Management System). It allows you to optimize transportation routes, reduce idle runs and increase the efficiency of transport. The justification is the high share of logistics costs in the overall cost structure. The expected result is a reduction in transportation costs by 3–5% and a reduction in emissions from vehicles.

An important element of digitalization is the implementation of a product lifecycle tracking system (traceability system). Such a system allows you to trace the path of products from the raw material producer to the end consumer. This increases the level of trust from partners and meets the requirements of international food quality and safety standards. In addition, the system allows you to quickly respond to possible risks and minimize reputational losses.

The systematization of the proposed digital measures is presented in Table 3.5.

Table 3.5

Digital solutions for managing resource flows

Activities	Justification	Expected result
Integrated ERP system	Eliminating information fragmentation	–3–5% internal losses
Energy management system	Energy consumption control	–5–7% energy consumption
Precision farming platform	Optimization of agricultural costs	+3–4% yield
TMS for logistics	High transportation costs	–3–5% of logistics costs
Traceability system	Requirements of international markets	Increasing trust and exports

The integration of these digital solutions should be carried out in stages, ensuring staff training and adapting business processes. Particular attention should be paid to cybersecurity and data protection, as centralized information systems become critical for the functioning of the holding.

The expected synergistic effect of digitalization is to increase the manageability of resource flows, reduce costs and form a single analytical base for strategic planning. The combined result can provide a reduction in operating costs by 5–8% in the medium term and create the prerequisites for further scaling of the circular business model.

Thus, digitalization of resource flow management is a necessary condition for the effective implementation of technological and bioenergy innovations. It ensures the integration of all segments of the holding into a single information system.

The effectiveness of implementing technological and digital innovations directly depends on the availability of effective organizational and economic mechanisms for their implementation. For a large vertically integrated holding, innovative and circular transformation requires not only investments, but also changes in management procedures, financial architecture and motivation systems. It is organizational and economic mechanisms that ensure the consistency of strategic goals with the current activities of the enterprise.

The first mechanism is to create a centralized function for managing innovation and circular projects. It is advisable to form a separate department for sustainable development and innovation or appoint a responsible manager at the top management level. The justification is the need for coordination between production, finance, energy and logistics departments. The expected result is an increase in the manageability of the transformation process and a reduction in project implementation times.

The second mechanism is the implementation of a budgeting system for innovative and circular projects. It is advisable to provide for a separate investment fund within the corporate budget, which will accumulate at least 30% of annual capital investments to finance “green” and innovative initiatives. This approach will ensure the stability of financing and minimize the risks of suspending strategic programs during periods of market turbulence.

The third important mechanism is the use of economic incentives for units that demonstrate increased resource efficiency. The introduction of an internal motivation system that takes into account indicators of energy consumption reduction, waste reduction and productivity improvement will promote the active participation of personnel in the transformation process. The expected effect is an increase in labor productivity by 3–5% and the formation of a corporate culture of innovation.

The next mechanism is the use of financial instruments of "green" financing. Attracting loans at preferential rates, issuing "green" bonds or participating in international programs to support sustainable development will reduce the cost of capital and accelerate the implementation of projects. The rationale is the growing demand from investors for environmentally responsible companies. The expected result is a reduction in the financial burden and an increase in investment attractiveness.

An important element is the integration of the internal control system and monitoring of the effectiveness of measures. It is advisable to introduce regular assessment of the implementation of strategic indicators through a KPI system, which includes economic and environmental indicators. Such a mechanism will allow timely adjustment of actions and minimize the risks of deviation from strategic guidelines.

The systematization of organizational and economic mechanisms is presented in Table 3.6.

Table 3.6

Organizational and economic mechanisms for implementing innovative and circular measures

Mechanism	Justification	Expected result
Department of Sustainable Development	Project coordination	Management consistency
Investment fund	Financing stability	Continuity of modernization
Motivation system	Staff engagement	Productivity improvement
"Green" financing	Decrease in the cost of capital	Accelerating transformation
KPI monitoring	Results control	Timely adjustment

An additional mechanism is the development of partnership programs with scientific institutions and technology companies. This will allow attracting modern technologies, testing innovative solutions and forming the intellectual capital of the enterprise. Interaction with universities and startups will contribute to the implementation of advanced digital and bioenergy developments.

The set of these mechanisms forms the organizational infrastructure of innovative and circular transformation. Their implementation will ensure increased management efficiency, optimization of financial flows, and creation of incentives for innovative activity at all levels of the holding.

3.2. Economic justification and assessment of the effectiveness of the strategy

The economic justification of the innovation-circular strategy involves a quantitative assessment of the effectiveness of the measures proposed in subsection 3.2. For calculations, a generalized model of a holding with annual revenue of 2.2 billion USD, operating profitability of 15%, energy costs of 180 million USD per year and logistics costs of 200 million USD is used.

The list of measures subject to economic evaluation includes:

1. construction of two additional biogas complexes;
2. modernization of production equipment;
3. implementation of ERP and energy management systems;
4. implementation of a precision farming system;
5. logistics optimization through a digital platform.

1. Calculation of the effect of bioenergy complexes

It is assumed that the two biogas complexes will generate a total of 120 million kWh of electricity per year. At an average price of 0.11 USD/kWh, the savings are:

120,000,000 × 0.11 = 13.2 million USD/year.

Additional effect from replacing mineral fertilizers with organic ones (savings of 4 million USD/year).

Cumulative annual effect:

13.2 + 4 = 17.2 million USD.

Investment: 70 million USD.

Simple payback period:

70 / 17.2 ≈ 4.1 years.

2. Modernization of production equipment

Investments – 90 million USD.

The expected cost reduction is 5%.

Assuming a cost of $1.87 billion (at a 15% margin), the savings are:

1.87 billion × 0.05 = 93.5 million USD/year.

Even if the actual effect is only 40% of the predicted one (due to partial implementation), this is:

93.5 × 0.4 = 37.4 million USD/year.

Payback period:

90 / 37.4 ≈ 2.4 years.

3. ERP and energy management system

Investments – 25 million USD.

Reduction of internal losses – 3% of operating costs.

1.87 billion × 0.03 = 56.1 million USD.

Even when realizing 25% of the potential:

56.1 × 0.25 = 14 million USD/year.

Payback period:

25 / 14 ≈ 1.8 years.

4. Precision farming

Investments – 18 million USD.

Reduction in fertilizer costs – 5%.

Annual fertilizer costs are $60 million.

60 × 0.05 = 3 million USD/year.

An additional increase in yield is 3%, which, with a sales volume of 400 million USD of crop products, gives:

400 × 0.03 = $12 million in additional revenue.

Cumulative effect:

3 + 12 = 15 million USD/year.

Payback period:

18 / 15 ≈ 1.2 years.

5. Digital logistics optimization

Investments – 15 million USD.

Reduction in logistics costs – 4%.

200 million × 0.04 = 8 million USD/year.

Payback period:

15 / 8 ≈ 1.9 years.

Cumulative economic effect

Table 3.7

Total assessment of economic effect

West	Investments, $ million	Annual effect, $ million	Payback period, years
Biogas complexes	70	17.2	4.1
Modernization	90	37.4	2.4
ERP and energy management	25	14	1.8
Precision farming	18	15	1.2
Logistics digitalization	15	8	1.9
Together	218	91.6	—

The total annual economic impact is $91.6 million.

Average investment payback period:

218 / 91.6 ≈ 2.4 years.

NPV calculation (generalized)

At a discount rate of 10% and a horizon of 7 years:

NPV ≈ 91.6 × 4.87 – 218

NPV ≈ 446 – 218

NPV ≈ 228 million dollars. USA.

A positive NPV value indicates a high economic feasibility of implementing the strategy.

Overall economic result

The implementation of a set of measures allows:

– increase operating profit by 5–6 percentage points;

– reduce the cost by 6–8%;

– increase the share of renewable energy to 40%;

– ensure an increase in net profit by 80–100 million USD annually.

Thus, the innovation-circular strategy is economically justified, has an acceptable payback period and generates a long-term financial effect. The next section provides a risk assessment and scenario analysis of the implementation of the proposed strategy.

The economic justification of the innovation-circular strategy should be accompanied by a systematic assessment of risks that may affect the implementation of planned activities and the achievement of projected financial results. For a large agro-industrial holding, risks are multi-level in nature and are associated with macroeconomic conditions, technological factors, financial constraints and environmental challenges.

Within the framework of this study, risk assessment is carried out in three areas: identification of key risks, quantitative assessment of their impact on the economic effect, and scenario analysis of strategy implementation.

1. Identification of key risks

The most significant risks of implementing innovative and circular measures include:

– investment risk of exceeding the estimated cost of projects;

– market risk of a decrease in product prices;

– energy risk of tariff changes;

– technological risk of not achieving planned performance indicators;

– regulatory risk of changes in environmental or tax legislation;

– operational risk of delay in the implementation of digital systems.

The systematization of risks is presented in Table 3.8.

Table 3.8

Key risks of strategy implementation

Risk group	Probability	Potential impact	Minimization mechanism
Investment	Medium	+10–15% to costs	Reserve budget 10%
Market	Medium	–5% of revenue	Diversification of markets
Energetic	Low	±3% of costs	Development of bioenergy
Technological	Medium	–10% effect	Pilot projects
Regulatory	Low	Additional costs	Adaptive planning

2. Quantitative risk assessment

The basic annual economic effect from the implementation of the measures is 91.6 million USD.

In case of technological risk realization (failure to achieve 10% of the predicted effect):

$91.6 \times 0.9 = 82.4$ million USD.

If at the same time there is an excess of investment costs by 10%, total investments will increase from 218 to:

$218 \times 1.10 = 239.8$ million USD.

In this case, the payback period will be:

$239.8 / 82.4 \approx 2.9$ years.

Even with negative developments, the strategy remains economically feasible.

3. Scenario analysis

For a more complete assessment of performance, three scenarios were applied: optimistic, baseline, and pessimistic.

Optimistic scenario

Assumes achievement of 110% of the predicted effect and stable market conditions.

Annual effect:

$91.6 \times 1.1 = 100.8$ million USD.

NPV (7 years, 10%):

$100.8 \times 4.87 - 218 \approx 490 - 218 = 272$ million USD.

Baseline scenario

Annual effect: $91.6 million.

NPV ≈ 228 million dollars. USA.

Pessimistic scenario

Reduction of effect by 20%, excess investment by 10%.

Annual effect:

91.6 × 0.8 = 73.3 million USD.

Investment: 239.8 million USD.

NPV:73.3 × 4.87 – 239.8 ≈ 357 – 239.8 = $117 million. USA.

Table 3.9

Scenario analysis of strategy performance

Scenario	Annual effect, $ million	Investments, $ million	NPV, $ million	Payback period
Optimistic	100.8	218	272	2.1 years
Base	91.6	218	228	2.4 years
Pessimistic	73.3	239.8	117	3.3 years

Overall risk tolerance assessment

Scenario analysis demonstrates that even in the pessimistic scenario, the net present value remains positive, and the payback period does not exceed 3–3.5 years. This indicates a sufficient margin of financial sustainability and economic feasibility of the proposed innovation-circular strategy.

An important factor in reducing risks is the phased implementation of measures, diversification of funding sources, and the use of pilot projects before scaling up technologies.

Thus, the results of the risk analysis confirm the economic viability of the proposed strategy and its ability to provide a stable financial effect even under adverse conditions.

The implementation of the holding's innovative and circular development strategy will have not only financial, but also complex socio-economic and environmental consequences. Forecasting of such results is carried out taking into account the calculated economic effect, the scale of investments and the impact of the proposed measures on regional development, employment, environmental indicators and resource sustainability of the enterprise.

1. Forecast of economic results

According to the baseline scenario, the annual additional economic effect is 91.6 million USD. If the strategy is implemented stably over 7 years, the total cash flow will exceed 640 million USD.

Expected macroeconomic effects include:

– increase in net profit by 70–90 million USD annually;

– increase in operating profitability from 15% to 20–21%;

– increasing the company's investment attractiveness and market capitalization by 10–15%;

– increase in tax revenues to the budget by 20–25 million USD per year.

Taking into account the multiplier effect for related industries (transport, processing, service companies), the total economic contribution to regional development could amount to an additional 120–150 million USD annually.

2. Forecast of social outcomes

The social effect of the strategy is manifested in the creation of new jobs, increasing the level of personnel qualifications, and the development of local communities.

The construction and operation of bioenergy complexes and new production lines is expected to create about 250–300 new jobs. Additionally, 100–150 highly qualified specialists are expected to be involved in digitalization and maintenance.

The average wage level at innovative facilities, as a rule, exceeds the industry average by 15–20%, which will positively affect the well-being of employees and social stability in the regions of presence.

In addition, the growth in tax revenues will allow for increased funding for social infrastructure, education, and medicine in the holding's regions of operation.

3. Forecast of environmental outcomes

The environmental impact of implementing the strategy is one of the most significant. The main indicators of the projected changes are:

– reduction of CO_2 emissions by 120–150 thousand tons per year through the development of bioenergy and increased energy efficiency;

– reduction in electricity consumption from traditional sources by 100–120 million kWh;

– reduction of organic waste volumes subject to recycling by 80–90%;

– reduction in the use of mineral fertilizers by 5–7% due to the use of organic analogues.

Table 3.10

Forecast of socio-economic and environmental outcomes

Direction of influence	Quantitative result	Strategic importance
Additional profit	$70–90 million/year	Increasing financial stability
New jobs	350–450 people	Regional development
CO_2 reduction	120–150 thousand tons/year	Reducing carbon footprint
Share of renewable energy	40% of energy balance	Energy autonomy
Waste reduction	up to 90% organic waste	Closed production cycles

4. Long-term strategic effect

In the medium term (5–7 years), the implementation of an innovation-circular strategy will allow:

– to create a competitive advantage in international markets; – to ensure compliance with ESG requirements and EU environmental regulations; – to reduce dependence on the volatility of energy markets; – to increase resilience to macroeconomic and regulatory risks.

The synergistic effect of combining economic, social and environmental results forms the basis of the holding's long-term stability and contributes to its positioning as an innovative and environmentally responsible leader in the agro-industrial sector.

Thus, the predicted results confirm that the implementation of the innovation-circular strategy has a comprehensive positive impact, ensuring the growth of financial indicators, increasing social responsibility and reducing environmental burden. The totality of the results obtained indicates the strategic feasibility of the chosen direction of development.

Conclusions to Chapter 3

The third section substantiates the strategic priorities of the innovative development of the enterprise and develops a set of innovative and circular measures. A circular business model has been formed, which provides for closed material cycles, the development of bioenergy, the modernization of production processes and the digitalization of resource flow management. Organizational and economic mechanisms for implementation are proposed, in particular the creation of specialized management structures, the formation of an investment fund and the use of "green" financing instruments.

The economic justification demonstrated the feasibility of implementing the strategy: the cumulative annual effect exceeds 90 million USD, the average payback period is about 2–3 years, and the net present value is positive even under the pessimistic scenario. The forecast of socio-economic and environmental results confirmed the growth of profitability, the creation of new jobs, and a significant reduction in emissions and waste.

Therefore, the proposed innovative and circular strategy is economically sound, risk-resistant and capable of ensuring long-term sustainable development of the enterprise in the face of modern transformational challenges.

CONCLUSIONS

The master's thesis carried out a comprehensive theoretical, methodological and applied study of the problems of managing the innovative development of an enterprise in a circular economy using the example of a large agro-industrial holding. The results obtained allowed us to form a holistic vision of the transformation of the linear management model into a resource-efficient system of closed production cycles.

The theoretical section clarifies the economic essence of innovative development as a continuous process of structural and technological modernization of the enterprise, aimed at the formation of long-term competitive advantages. It is proved that innovative development in modern conditions cannot be considered in isolation from the principles of the circular economy, since it is precisely closed resource flows, waste minimization and energy efficiency improvement that form a new paradigm of strategic management. The generalization of scientific approaches made it possible to determine the relationship between innovative, environmental and economic components in the corporate strategy system.

As a result of an analytical study of the organizational and economic characteristics of the enterprise, a high level of vertical integration, the presence of a developed production base and significant resource potential for the implementation of innovations were established. An assessment of innovative activity and circular practices showed the presence of prerequisites for scaling bioenergy solutions, digitalization of resource flow management and deepening of product processing. At the same time, strategic development reserves were identified, associated with increasing energy autonomy, reducing operating costs and expanding the share of products with high added value.

The project section substantiates the strategic priorities of innovative development, which involve the integration of technological, digital and environmental solutions into the corporate strategy. A circular business model has been developed, which is based on closed material cycles, the development of bioenergy, the modernization of production processes and the implementation of digital monitoring systems. A set of innovative and circular measures has been proposed, which includes the construction of biogas complexes, the modernization of equipment, the implementation of ERP systems and precision farming technologies, as well as the formation of organizational and economic mechanisms to support the transformation.

The economic justification of the proposed measures has demonstrated their high financial feasibility. The cumulative annual economic effect is over 90 million USD, the average investment payback period is about 2.4 years, and the net present value of the project over a seven-year horizon exceeds 200 million USD. The scenario analysis conducted confirmed the sustainability of the strategy even under pessimistic conditions, which indicates its financial reliability and investment attractiveness.

The forecast of socio-economic and environmental results showed that the implementation of the innovation-circular strategy will ensure increased profitability, creation of new jobs, improvement of personnel qualifications and reduction of greenhouse gas emissions. Achieving a share of renewable energy at 40% and a significant reduction in waste volumes will contribute to increasing the environmental sustainability of the enterprise and compliance with international ESG standards.

Thus, the goal set in the work has been achieved, and the formulated tasks have been fully completed. The results obtained confirm that the management of innovative development of the enterprise in the conditions of a circular economy is a strategically justified direction of transformation of agro-industrial enterprises. The proposed model provides a combination of economic efficiency, environmental responsibility and social stability, which creates the prerequisites for the long-term sustainable development of the enterprise and strengthening its competitive positions in the domestic and international markets.

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