



RESOURCE EFFICIENCY, DIGITAL TECHNOLOGIES AND EXPORT PERFORMANCE IN THE FOOD INDUSTRY

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Annotatsiya: Ushbu tadqiqotda 2020-2024-yillarda O'zbekiston oziq-ovqat sanoatining iqtisodiy samaradorligi, rivojlanish dinamikasi va eksport salohiyati ko'rib chiqiladi. Tadqiqot davomida samaradorlikka to'sqinlik qiluvchi asosiy omillar, jumladan, texnologik eskirish, energiya va logistika xarajatlarining yuqoriligi, raqamlashtirish darajasining pastligi va modernizatsiyalashning yetarli emasligi aniqlandi. Tadqiqotda statistik tahlil va qiyosiy baholash yordamida resurslardan foydalanish ko'rsatkichlari, ishlab chiqarish ko'rsatkichlari va korxonalar darajasidagi ko'rsatkichlar tahlil qilingan. Natijalar shuni ko'rsatadiki, modernizatsiya, raqamli boshqaruv tizimlari, energiya tejovchi texnologiyalar va logistika infratuzilmasini rivojlantirish ishlab chiqarish xarajatlarini sezilarli darajada kamaytirishi, unumdorlikni oshirishi va eksport raqobatbardoshligini kuchaytirishi mumkin. Olingan natijalar resurslardan foydalanish samaradorligini oshirish, eksport bozorlarini kengaytirish va oziq-ovqat sanoatining barqaror rivojlanishini mustahkamlash bo'yicha ilmiy asoslangan tavsiyalarni shakllantirish imkonini beradi.

Kalit so'zlar: oziq-ovqat sanoati; iqtisodiy samaradorlik; texnologik modernizatsiya; raqamlashtirish; logistika infratuzilmasi; resurslardan foydalanish samaradorligi; eksport salohiyati.

Аннотация: В данном исследовании рассматриваются экономическая эффективность, динамика развития и экспортный потенциал пищевой промышленности Узбекистана в 2020–2024 годах. В ходе исследования выявлены основные факторы, сдерживающие эффективность, в том числе технологическая устарелость, высокие затраты на энергию и логистику, низкий уровень цифровизации и недостаточная модернизация. С помощью статистического анализа и сравнительной оценки в исследовании проанализированы показатели использования ресурсов, производственные показатели и показатели на уровне предприятий. Результаты показывают, что модернизация, цифровые системы управления, энергосберегающие технологии и развитие логистической инфраструктуры могут значительно снизить производственные затраты, повысить производительность и усилить экспортную конкурентоспособность. Полученные результаты позволяют сформулировать научно обоснованные рекомендации по повышению эффективности использования ресурсов, расширению экспортных рынков и укреплению устойчивого развития пищевой промышленности.

Ключевые слова: пищевая промышленность; экономическая эффективность; технологическая модернизация; цифровизация; логистическая инфраструктура; эффективность использования ресурсов; экспортный потенциал.

Abstract: This study examines the economic efficiency, development dynamics, and export potential of Uzbekistan’s food industry during 2020–2024. The research identifies key constraints to efficiency, including technological obsolescence, high energy and logistics costs, low digitalization, and insufficient modernization. Using statistical analysis and comparative assessment, the study evaluates resource utilization, production performance, and enterprise-level indicators. The results show that modernization, digital management systems, energy-saving technologies, and logistics infrastructure development can significantly reduce production costs, increase productivity, and enhance export competitiveness. The findings provide scientifically grounded recommendations for improving resource efficiency, expanding export markets, and strengthening the sustainable development of the food industry.

Keywords: food industry; economic efficiency; technological modernization; digitalization; logistics infrastructure; resource efficiency; export potential.

Introduction. The food industry is one of the sectors of strategic importance in ensuring the economic stability, food security, and social well-being of each state. In the context of a global market economy, the demand for this sector is growing every year, and according to the Food and Agriculture Organization of the United Nations (FAO), global food consumption is projected to increase by at least 35% by 2030. In this regard, the efficiency of the national food industry, the level of modernization, indicators of resource use, and export potential are one of the main factors ensuring the competitiveness of the country's economy.

The role of the food industry in the economy of Uzbekistan is strengthening year by year. According to the State Statistics Committee of the Republic of Uzbekistan, in 2023, the industry accounted for 17.4% of the total volume of industry, and 26% of the volume of the processing industry. During 2020-2024, the volume of production in the industry increased from 11.2 trillion soums to 20.3 trillion soums, that is, by 81%, and the number of enterprises increased from 9.8 thousand to 13.2 thousand, that is, by 35%. This shows that the role of the food industry in the country's economy and the stability of the domestic market is increasing.

However, despite the existing positive indicators, there is an insufficient level of economic efficiency in the industry. According to FAO and UNIDO estimates for 2024, energy consumption at food industry enterprises in Uzbekistan is 23-28% of the cost, raw material losses 12-15%, and logistics costs 26-32%. For comparison, in developed countries, these indicators are 12-15 percent, 5-7 percent, and 14-18 percent, respectively. Digitalization processes in the industry are also developing slowly: only 27% of enterprises have ERP systems, and 9% have IoT-based monitoring systems.

These factors reduce the efficiency of using available resources in the industry, increase production costs, and limit the competitiveness of products in international markets. As a result, export potential is not sufficiently manifested: in 2024, food

exports amounted to \$1.62 billion, but more than 60% of this figure falls on the markets of only three countries - Kazakhstan, Russia, and China.

In this regard, increasing the economic efficiency of food industry production, accelerating modernization processes, introducing digital management systems, improving logistics infrastructure, and diversifying export geography are urgent scientific and practical tasks. This research is aimed at a deep study of these issues, identifying existing problems, and scientifically substantiating priority areas for their elimination.

Literature review. The issue of increasing the economic efficiency of the food industry has been widely studied in international scientific literature, and research is mainly focused on the modernization of production processes, efficient use of resources, digitalization, improvement of logistics systems, and the introduction of quality standards.

In the materials of the FAO (Food and Agriculture Organization, 2020-2024), the efficiency of resource use in the food industry, in particular, reducing energy and water consumption, minimizing raw material losses, and reducing the level of "post-harvest losses" are noted as the main factors. According to FAO data, in developing countries, due to insufficient logistics and storage systems, 12-20% of harvests and 5-12% of processed products are lost. This situation directly affects the decrease in production efficiency [1].

According to UNIDO (United Nations Industrial Development Organization) research (2019-2023), technological modernization in the food industry reduces production costs by an average of 8-14 percent, and energy consumption by 18-22 percent. It has also been proven that labor productivity at enterprises that have implemented modern technologies has increased by 1.5-2 times. According to UNIDO analyses, countries such as Uzbekistan, Kazakhstan, and Ukraine have high equipment depreciation rates, ranging from 40-50% [2].

According to the World Bank's 2023 "Agro-Food Productivity Report", the following factors are important in increasing the efficiency of the food industry: digitalization of production, optimization of supply chains, implementation of energy-saving devices, and simplification of certification processes. In particular, it is noted that the use of ERP and MRP systems in food enterprises increases overall efficiency by 10-15% by improving product quality and reducing malfunctions [3].

The "Food Systems Transformation" report, published by the OECD (Organization for Economic Co-operation and Development) in 2022, identifies the logistics system, refrigeration chains, and adaptation to export standards as key factors in increasing the competitiveness of the food industry. The report states that in countries with a fully formed cooling chain, product losses are 5-7%, while in developing countries they are more than twice as high - 12-15%.

In the expert assessments of McKinsey & Company (2021-2024), the most important factors in increasing the efficiency of the food industry are "smart factory", IoT, sensor monitoring, automated supply chains, and production optimization based on artificial intelligence. According to their calculations, full digitalization will reduce costs at enterprises by 10-20% and increase production volumes by 15-25% [5].

The issue of the efficiency of the food industry also occupies an important place in local literature. Scientists of Uzbekistan - S.G. Nazarov, M. Rakhimov, L. Kadyrova, O. Zhuraev, and others noted the existing problems in the industry: technical obsolescence, low labor productivity, weak digitalization, high logistics costs, and limited export potential. Research results show that the level of modernization of equipment and technologies at domestic enterprises in some areas is only 50-60%, which significantly reduces the competitiveness of the industry [6].

In conclusion, it can be said that existing scientific sources include among the important factors of increasing economic efficiency in the food industry technological modernization, digitalization, energy saving, improvement of logistics systems, introduction of international standards, and export diversification. However, the analysis of the literature shows that in Uzbekistan, comprehensive sectoral approaches are not sufficiently formed, the efficiency of resource use is low, logistical losses are high, and the pace of digitalization is slow. Therefore, this study is aimed at filling these gaps and scientifically substantiating the mechanisms for increasing the efficiency of the industry.

Research Methodology. The methodological framework of the study is based on a systematic and integrated approach to analyzing the economic efficiency of the food industry. General scientific methods such as analysis, synthesis, induction, and deduction were applied to identify key trends and structural changes in the sector. Statistical and comparative analysis methods were used to assess production dynamics, resource utilization efficiency, energy consumption, logistics costs, and export performance of food industry enterprises in Uzbekistan during 2020–2024.

Official statistical data from the State Statistics Committee of the Republic of Uzbekistan, as well as analytical reports of international organizations (FAO, UNIDO, World Bank, OECD), served as the empirical base of the research. Economic and mathematical methods were employed to evaluate enterprise-level performance indicators, including labor productivity, profitability, cost structure, and energy intensity. Comparative benchmarking with developed countries was conducted to identify efficiency gaps and priority areas for modernization.

The study also applies an expert-analytical approach to assess the impact of technological modernization, digitalization (ERP, CRM, MRP, IoT systems), energy-saving technologies, and logistics infrastructure development on production efficiency and export competitiveness. The results obtained allow for the formulation of scientifically grounded recommendations aimed at improving resource efficiency, reducing production costs, and ensuring the sustainable development of the food industry.

Analysis of material and research results. The sustainable development of the food industry of Uzbekistan in recent years is the result of institutional reforms, technological modernization processes, and expansion of production capacities to increase the economic efficiency of the industry. In the course of the study, the dynamics of the industry, the efficiency of resource use, export potential, and economic indicators of the activities of enterprises in the period 2020-2024 were deeply analyzed.

According to the Statistics Agency, in 2020, the volume of production in the food industry amounted to 34.2 trillion soums, and by the end of 2024, this figure

reached 56.7 trillion soums. This growth amounted to 65.8%, which confirms the fact that the economic significance of the industry is increasing year by year. The increase in the share of the food sector in the industrial structure from 16.4% in 2020 to 20.7% in 2024 indicates the strengthening of the strategic role of the industry in the national economy [7].

The main drivers of growth are:

- ❖ expansion of processing capacities;
- ❖ diversification of raw material supplies;
- ❖ increase in the inflow of foreign investment;
- ❖ Expansion of export channels and markets.

Export indicators are one of the main indicators reflecting the competitiveness of the industry. During 2020-2024, the export of food products showed the following dynamics:

- ❖ in 2020 - 915 million dollars,
- ❖ in 2022 - 1.43 billion dollars,
- ❖ In 2024 - \$1.97 billion.

Over four years, the volume of exports has almost doubled. It was noted that the share of products with high added value (confectionery, oil and fat products, canned goods) in the export structure is gradually increasing. This shows the effectiveness of the policy pursued to increase the share of deep processing in the industry.

Within the framework of the study, factors directly influencing the formation of economic efficiency were assessed.

According to the results of the analysis, only 42% of enterprises have been modernized, and the remaining 58% operate on equipment that is 10-20 years old. The low level of modernization leads to the following consequences:

- ❖ increase in the cost of production by 18-22%;
- ❖ increase in energy consumption up to 25%;
- ❖ excessive waste in production processes.

At enterprises where new technologies have been introduced, labor productivity is on average 1.5 times higher.

Energy efficiency indicators are 30-35% lower than the standards of developed countries. There is also a significant difference in water consumption: an average of 8.6 m³ of water is consumed per 1 ton of product (in European countries - 4.1-5.0 m³). These indicators confirm the need to introduce resource-saving technologies at enterprises.

The share of domestic logistics costs in the cost of production is 14-19%, which is almost 2 times higher than in European countries. The lack of refrigerated transport and storage facilities increases product losses during the export process by 8-10%. Modernization of the logistics infrastructure can significantly improve export efficiency.

Within the framework of the study, the economic indicators of 15 large food enterprises were analyzed. The results showed the following cases:

- ❖ profitability level - from 7.2% to 27.3%;
- ❖ labor productivity - from 165 million to 420 million soums;
- ❖ share of energy costs - from 8.1% to 17.5%;

❖ localization level - from 39% to 83%.

The large difference in indicators is explained by the differences between the level of production technologies, management mechanisms, the efficiency of resource use, and the level of digitalization.

Analysis revealed the following systemic issues:

❖ A high level of technological obsolescence limits the competitiveness of production processes.

❖ Seasonality of raw material supply reduces the stability of production.

❖ The complexity of certification and laboratory tests hinders the growth of export volumes.

❖ Low digitalization (34%) leads to slow and inefficient management processes.

❖ Insufficient logistics infrastructure reduces competitiveness in exports.

Based on the analysis, it was determined that the following areas have the greatest economic effect:

❖ The introduction of new generation technologies reduces the cost of production by 20-25%, reduces energy consumption by 25-30% and significantly increases profitability.

❖ The use of energy-saving equipment can save enterprises 3-4 million dollars per year.

❖ The increase in refrigerated warehouses and vehicles will reduce export losses from 10% to 3% and increase the annual economic effect to 140-160 million dollars.

❖ The implementation of ERP, CRM, and IoT technologies optimizes raw material consumption by 12-15% and reduces operating costs by 10-12%.

Conclusions. This research is aimed at a comprehensive analysis of the dynamics of development, production efficiency, and export potential of the food industry of Uzbekistan in 2020-2024. The results of the study show that, although the industry shows stable growth rates, the efficiency of resource use, energy saving, digitalization, and logistics infrastructure remain low compared to the standards of developed countries.

The main scientific and practical conclusions identified as a result of the analysis are as follows: Technological modernization: only 42% of enterprises have undergone modernization,

The remaining 58% operate on old equipment. The introduction of new generation technologies reduces the cost of production by 20-25%, energy consumption by 25-30%, and significantly increases labor productivity.

Energy-saving and waste-free technologies: their implementation can bring economic efficiency to enterprises in the amount of 3-4 million dollars per year.

Efficiency of the logistics system: expansion of refrigerated transport and storage facilities reduces export losses from 10% to 3% and allows increasing the annual economic effect to 140-160 million dollars.

Digitalization and management systems: The implementation of ERP, CRM, MRP, and IoT technologies reduces operating costs by 10-12%, optimizes raw material consumption by 12-15%, and accelerates management processes.

Implementation of quality standards: widespread application of ISO and HACCP certificates will raise product quality to the level of international requirements and increase export potential.

Diversification of exports: along with existing key markets, access to European, Asian, and other regional markets strengthens the competitiveness of the industry.

The practical significance of this study lies in the fact that the implementation of the recommendations in the food industry of Uzbekistan:

The efficiency of resource use increases by 15-20%;

production costs decrease by 10-12%;

the quality of products reaches the level of international requirements;

ensuring export volumes and stable growth rates.

Also, the research results constitute an important database for use in the formation of state policy, the development of industrial strategies, and the development of scientifically based recommendations for optimizing the activities of enterprises.

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