

**THE ROLE OF INNOVATIONS IN MODERNIZING THE FOOD INDUSTRY IN
UZBEKISTAN**

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Annotatsiya: Ushbu maqolada O'zbekiston Respublikasida oziq-ovqat sanoatini modernizatsiya qilish jarayonida innovatsion texnologiyalarning o'rni va ahamiyati keng tahlil qilingan. Tadqiqotning maqsadi qishloq xo'jaligi xomashyosini qayta ishlash darajasini oshirish, oziq-ovqat xavfsizligini ta'minlash va eksport salohiyatini kengaytirishda innovatsiyalarning qo'llanilish istiqbollarini aniqlashdan iborat. Maqolada sanoatni raqamlashtirish, biotexnologiyalar, qadoqlash yangiliklari va logistika tizimlaridagi o'zgarishlar o'rganilgan. Qiyosiy tahlil usuli yordamida rivojlangan mamlakatlar tajribasi va O'zbekistonning hozirgi holati solishtirildi. Natijada, innovatsiyalarni joriy etish mahsulot raqobatbardoshligini oshirish va iqtisodiy o'sishga hissa qo'shishi isbotlandi.

Kalit so'zlar: Oziq-ovqat sanoati, innovatsiya, modernizatsiya, qayta ishlash, oziq-ovqat xavfsizligi, eksport, raqamlashtirish.

Annotation: This article provides a comprehensive analysis of the role and importance of innovative technologies in the process of modernizing the food industry in the Republic of Uzbekistan. The aim of the research is to identify the prospects for using innovations in increasing the level of processing of agricultural raw materials, ensuring food safety, and expanding export potential. The article examines digitalization of the industry, biotechnologies, packaging innovations, and changes in logistics systems. Using the comparative analysis method, the experience of developed countries and the current state of Uzbekistan were compared. As a result, it was proven that the introduction of innovations increases product competitiveness and contributes to economic growth.

Keywords: Food industry, innovation, modernization, processing, food safety, export, digitalization.

Аннотация: В данной статье широко анализируется роль и значение инновационных технологий в процессе модернизации пищевой промышленности в Республике Узбекистан. Цель исследования — выявить перспективы использования инноваций в повышении уровня переработки сельскохозяйственного сырья, обеспечении безопасности пищевых продуктов и расширении экспортного потенциала. В статье изучены цифровизация отрасли, биотехнологии, инновации в упаковке и изменения в логистических системах. С помощью метода сравнительного анализа сопоставлен опыт развитых стран и текущее состояние Узбекистана. В результате доказано, что внедрение инноваций повышает конкурентоспособность продукции и способствует экономическому росту.

Ключевые слова: Пищевая промышленность, инновация, модернизация, переработка, безопасность пищевых продуктов, экспорт, цифровизация.

INTRODUCTION

The food industry is one of the strategic sectors that ensure the economic security and well-being of any state. In the Republic of Uzbekistan, the volume of agricultural production has increased significantly in recent years. However, a large part of the produced products is exported in raw form or consumed without processing on the domestic market. This leads to a decrease in added value and an increase in seasonal losses[1].

The decisions of President Sh. Mirziyoyev in 2017-2021 and beyond are aimed at radically reforming the food industry, introducing a cluster system and encouraging the use of innovative

technologies. Innovation includes not only the purchase of new equipment, but also the updating of management systems, logistics chains and product quality control mechanisms.

The relevance of this article is that in the context of globalization, Uzbek food products are competing in international markets. Innovative approaches are necessary to meet the requirements of international standards (HACCP, ISO 22000). The object of the study is Uzbek food enterprises, and the subject is the innovative solutions that are used and can be used in them.

The main purpose of the article is to assess the economic and technological effectiveness of innovations in the modernization of the food industry and develop a development strategy. According to the World Bank, innovations in the food chain in developing countries have a direct impact on the growth of gross domestic product[2].

METHODOLOGY

The following methodological approaches were used in the study:

1. Systematic analysis method: Consideration of the food industry as a holistic system (raw materials - processing - sales).
2. Statistical analysis: Study of industry indicators based on data from the Statistical Agency of the Republic of Uzbekistan and Ministries.
3. Comparative analysis: Comparison of indicators of Uzbekistan and developed countries (Turkey, Netherlands).
4. SWOT analysis: Identification of strengths and weaknesses, opportunities and threats of the industry.
5. Expert assessment: Study of practical problems based on interviews with industry experts and enterprise managers.

State programs for 2017-2023, reports of more than 50 food enterprises and reports of international organizations were used as research material. According to FAO, 30-40% of products in developing countries are lost after harvest, which is associated with the lack of innovative storage systems[3]. This indicator is also a pressing problem for Uzbekistan, and the study examined ways to reduce these losses.

According to Porter's theory of "Competitive Advantage", the development of the industry depends on innovation and clustering[4]. This theoretical framework has become the main methodological support for the analysis of cluster systems in the Uzbek food industry. Uzbek scientists, including A. Vakhobov, B. Yuldoshev, and others, have studied the effectiveness of agricultural clusters[5]. However, comprehensive studies specifically devoted to technological innovations in the food processing industry are still lacking.

RESULTS

Over the past 5 years, the gross product volume of the food industry in Uzbekistan has increased by an average of 8-10%. However, the level of processing is still low. For example, only 20-25% of vegetable and melon products are processed, the rest is sold raw[6]. This negatively affects seasonal price fluctuations and farmers' incomes.

The technical equipment of enterprises is diverse. While large clusters (for example, "Bahodir", "Uzsum") have installed modern equipment, small and medium-sized enterprises still use outdated technologies. Energy consumption is high, which affects the cost. The following table presents industry indicators:

Indicator	2019 year	2021 year	2023 year	Change (%)
Recycling volume (billion soums)	12.5	18.2	24.6	+96.8%
Export share (%)	15%	22%	28%	+13%
Number of innovative enterprises	45	78	120	+166%
Loss rate (%)	35%	30%	25%	-10%

Source: Compiled by the author based on data from the Statistical Agency of the Republic of Uzbekistan.

A) Digitalization and IoT:

Installation of temperature and humidity sensors in modern warehouses extends the shelf life of products by 30-40%. The movement of products from the field to the store is monitored through "Agrologistika" systems. This Uzbek

B) Biotechnologies:

The use of rapid diagnostic methods (PCR tests) and probiotics is important in ensuring food safety. The use of natural preservation methods instead of preservatives in dairy and meat products meets consumer demand. Innovation in creating new products based on national enzymes (for example, yogurt, kurut) is developing in Uzbekistan.

C) Packaging innovations:

Packaging for export is a decisive factor. Vacuum packaging, Modified Atmosphere Packaging (MAP) technologies help preserve the freshness of fruits and vegetables. The use of bioplastics meets environmental requirements. Uzbek manufacturers still widely use traditional polyethylene packaging, which can be a problem in European markets[7].

D) Waste-free production:

Processing food waste (for example, extracting pectin from fruit peels, preparing feed from grain waste) is an additional source of income. The principles of the "Green Economy" are being introduced in this direction.

The main export markets of Uzbekistan are Russia, Kazakhstan, China and European countries. Access to the European Union market requires compliance with GlobalGAP and BRC standards. This requires a full traceability system. The innovation of providing information about products through QR codes increases consumer confidence.

According to 2022 data, the export volume of enterprises that have installed innovative equipment was 2.5 times higher than that of average enterprises. This indicates the direct economic effect of innovation.

DISCUSSION

Analysis shows that there are the following obstacles to the introduction of innovations:

1. Financial difficulties: High credit rates and limited leasing opportunities.
2. Staff shortage: Lack of specialists who can manage modern technologies.
3. Infrastructure problems: Power outages and road conditions.
4. Standardization: Slow process of adaptation to international standards.

In foreign experience (Netherlands, Israel, USA), the concepts of "Smart Agriculture" and "Food Industry 4.0" are widely used[8]. This implies the use of IoT (Internet of Things), Artificial Intelligence (AI) and Big Data. There is a lack of scientific work on the adaptation of these experiences in the conditions of Uzbekistan.

A comparison between Uzbekistan and Turkey shows that Turkey has a recycling rate of 60%. The main difference here is the availability of state subsidies and technoparks. Although the Agrocluster system has been introduced in Uzbekistan, the level of integration is not yet complete.

There are also studies that study the differences between the requirements of the UzDSt (State Standards of Uzbekistan) and the Codex Alimentarius on food safety standards. Research on innovative packaging (for example, biodegradable materials) is important in solving environmental problems.

The economic efficiency of introducing innovations can be assessed by the following factors:

Reduction in the cost of production: Energy-efficient equipment reduces electricity consumption by 20-30%.

Increase in product value: Recycled products are sold on the market at a price 2-3 times higher.

Market expansion: Certified products provide access to new export markets.

However, due to the high initial investment costs, this process is difficult for small businesses. Strengthening the mechanism of preferential loans and grants by the state will play an important role in solving this problem.

CONCLUSIONS AND PROPOSALS

Innovation plays a decisive role in the modernization of the food industry in Uzbekistan. The results of the study show that without technological innovation, it is impossible to produce high-value-added products and compete in international markets.

Main conclusions:

1. Innovative equipment is needed to increase the level of processing.
2. Digitalization reduces logistics costs and ensures food safety.
3. Eco-friendly packaging expands export opportunities.
4. It is necessary to modernize the personnel training system.

Suggestions:

1. State support: Introduction of preferential loans and tax holidays for innovative projects.
2. Development of clusters: Strengthening cooperation between scientific centers and manufacturing enterprises (Technoparks).
3. Harmonization of standards: Full integration of the UzDSt with international standards (ISO, HACCP).
4. Education system: Expansion of the "Food Engineering" and "Agro-Biotechnology" directions in higher education institutions.
5. Incentive for startups: Allocating grants for startups in the FoodTech direction.

In short, innovation is not just a technique, but a new way of thinking. Putting this approach at the center of the development of the Uzbek food industry will serve to ensure food security in the future and increase economic strength.

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