



ENHANCING FOOD SYSTEM RESILIENCE IN UZBEKISTAN THROUGH DIGITAL TECHNOLOGIES AND AGRARIAN MODERNIZATION

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Abstract. This article examines the priority directions for ensuring food security in Uzbekistan under conditions of an innovation-driven economy. The study considers food security as a multidimensional system that combines food availability, economic accessibility, quality, stability of supply and efficient use of natural resources. Particular attention is paid to the role of digital agriculture, water-saving technologies, food processing, storage infrastructure and modern logistics. The research applies systematic, comparative, statistical and analytical methods. The results indicate that increasing agricultural production alone is insufficient to ensure sustainable food security. The transition toward an innovation-oriented food system requires the integration of technological modernization, resource efficiency, digital monitoring and value-chain development. Based on the analysis, practical recommendations are proposed for strengthening the resilience and efficiency of Uzbekistan's food-security system.

Keywords: food security, innovation-driven economy, agricultural innovation, digital agriculture, food supply, resource efficiency, food processing, logistics, value chain, food market, Uzbekistan.

Introduction

Food security is increasingly recognized as an important component of national economic security. In contemporary conditions, its meaning extends beyond the physical availability of agricultural products. A stable food system should provide the population with sufficient, safe and nutritious food, while ensuring that households have the economic and physical ability to obtain it and that such access remains stable over time [1]. The relevance of food security has increased because agricultural systems are exposed to several interconnected risks. Climate variability, water scarcity, changes in production costs, fluctuations in food prices and disruptions in supply chains can influence both production and consumer access to food. Consequently, food security should be treated as a complex economic system rather than as an isolated agricultural indicator.

This issue is particularly significant for Uzbekistan. Agriculture remains an important component of the national economy, rural employment and domestic food supply. At the same time, agricultural development is constrained by the availability of land and water resources and by the need to improve productivity. Official investment information indicates



that agriculture accounted for approximately 18.9% of Uzbekistan's GDP in 2025, demonstrating the sector's continuing economic significance.

The transition toward an innovation-driven economy creates opportunities to address these constraints. Digital agriculture, satellite monitoring, precision farming, automated irrigation, agricultural drones, modern breeding technologies and data-based decision-making can increase productivity while reducing the pressure on natural resources. The empirical situation also demonstrates positive changes in agricultural production. According to official government data, agricultural, forestry and fishery production in Uzbekistan increased by 4.4% in 2025 compared with 2024. Crop production increased by 7.2%, while livestock production grew by 1.6%. Grain production increased by 13%, cotton by 25.4%, melons by 16.2%, fruits by 6.4%, grapes by 7.7% and eggs by 7%.

However, production growth itself does not automatically guarantee food security. A food system may produce increasing quantities of agricultural commodities while simultaneously experiencing problems related to affordability, post-harvest losses, storage, logistics, price volatility or inefficient use of water.

Therefore, the central research problem is to determine how innovation can transform increasing agricultural production capacity into a more stable, efficient and resilient national food system.

Research methodology

The study applies a combination of statistical, comparative, systemic and analytical methods. The systematic approach is used to interpret food security as an interconnected system consisting of production, processing, storage, transportation, distribution and consumption.

The comparative method is used to identify differences among the major dimensions of food security and to assess the relative significance of economic, technological and infrastructural factors. Statistical analysis is applied to recent official indicators of agricultural production and food-related activities, with particular attention to 2025 data.

The factor-analysis approach is used to classify the main determinants of food security into economic, environmental, technological, infrastructural and institutional groups. The study also uses scientific abstraction, synthesis and generalization to develop an innovation-oriented conceptual framework. The empirical basis consists primarily of official information from the National Statistics Committee and government institutions of Uzbekistan, complemented by international scientific and institutional sources.

Analysis and results

Food security as a multidimensional economic system

One of the main methodological problems in food-security assessment is the tendency to use agricultural production as the principal indicator. Although production is fundamental to food availability, it does not provide sufficient information about affordability, quality, stability or resource efficiency.

FAO's conceptual framework shows that availability, access, utilization and stability must be considered together [1].

Based on this approach, the following system of indicators can be proposed for Uzbekistan.

Table 1.

Main dimensions and indicators of food security

Dimension	Indicator	Economic interpretation	Policy significance
Availability	Domestic food production	Capacity to supply the domestic market	High
Economic access	Real household income	Ability to purchase adequate food	High
Price stability	Food-price volatility	Stability of household food expenditure	High
External dependence	Import dependence	Exposure to external market risks	High
Food quality	Compliance with safety standards	Protection of consumer health	High
Resource efficiency	Output per unit of water and land	Efficiency of natural-resource use	High
Supply stability	Strategic reserves and diversification	Ability to withstand disruptions	High

Source: Developed by the author based on the conceptualization of food security.

The table demonstrates that food security is simultaneously an agricultural, economic, social and technological phenomenon.

The first dimension concerns the physical supply of food. However, even sufficient domestic production does not guarantee food security if households cannot afford available products. Therefore, income and food prices should be analyzed together with production indicators.

The resource-efficiency indicator is particularly important for Uzbekistan. Agricultural expansion based on increasing water and land consumption may generate short-term output growth but create long-term production risks. Hence, the efficiency of resource use should become one of the central criteria of agricultural modernization.



Current agricultural production dynamics

The 2025 results demonstrate that agricultural production in Uzbekistan continued to expand. According to the Ministry of Economy and Finance, agricultural, forestry and fishery production grew by 4.4% in 2025. Crop production increased by 7.2%, whereas livestock production increased by 1.6%. The stronger growth of crop production is explained partly by the expansion of vegetable, grain and other crop production. In particular, grain production increased by 13%, cotton by 25.4%, melons by 16.2%, fruits by 6.4% and grapes by 7.7%.

An important characteristic of Uzbekistan's agricultural structure is the contribution of household and dehkan farms. Government data for 2025 indicate that 5.1 million household plots in 8.9 thousand mahallas produced more than 8 million tons of agricultural products. This demonstrates that food-security policy must include small producers rather than focusing exclusively on large agricultural enterprises. The involvement of household and dehkan farms is also important from the perspective of technological modernization. The introduction of accessible digital advisory services, modern irrigation technologies, improved seeds and small-scale processing equipment could substantially increase their productivity.

Government information also reports that 1,103 projects worth 5.3 trillion soums were implemented in livestock and related sectors during 2025. These included projects in cattle breeding, sheep and goat farming, poultry, fish farming, beekeeping and meat and milk processing. This indicates that investment activity is expanding beyond crop production and increasingly covers the livestock and processing segments.

Conclusions and recommendations

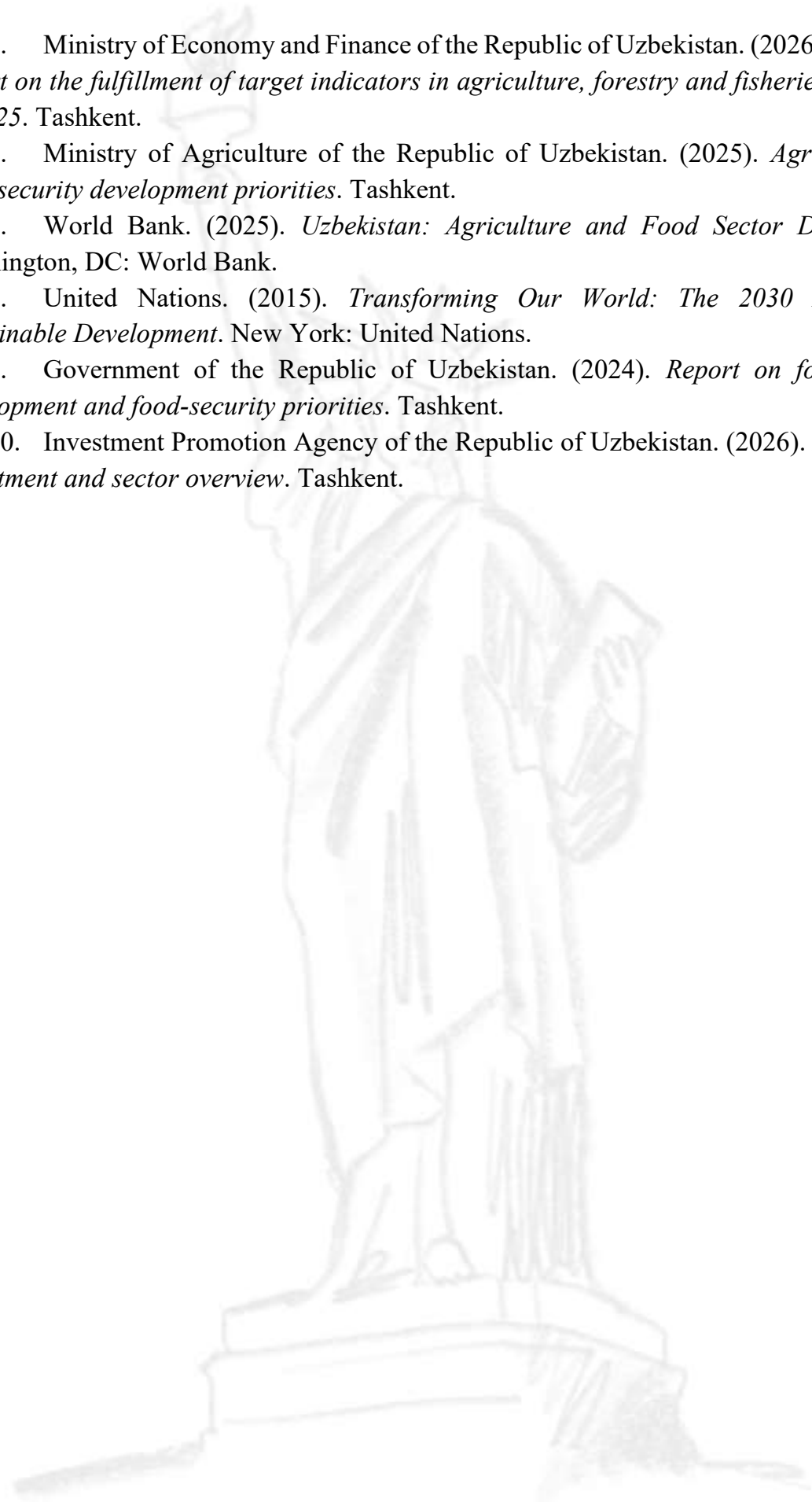
The study demonstrates that Uzbekistan has considerable potential to strengthen food security through technological modernization and innovation.

Agricultural production recorded positive growth in 2025. Agricultural, forestry and fishery production increased by 4.4%, while crop production increased by 7.2%. Grain, cotton, melons, fruits and grapes all recorded increases compared with the previous year.

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