Research Article

Central Asian Studies of Social Science and History
e-ISSN 2660-6836 | Volume 7 | Issue 1 (2026) | Page 49-52

# The Role of Innovative Technologies in Quality Storage and Delivery of Agricultural Products

**Annamuratov Shukur Khayitmurat o`g`li [1], Toshtukhtarova Farangis Abdusattarovna [2], Annamuratov Ikrom Khayitmurat o`g`li [3]**

[1]Student Termez State University of Engineering and Agrotechnology, annamuratovshukurbek1@gmail.com

[2] Student Termez State University of Engineering and Agrotechnology, farangiztoshtuhtarova@gmail.com

[3] Student Termez State University of Engineering and Agrotechnology, annamuratovikrom60@gmail.com

**Abstract**

Today, innovative technologies are important in the process of delivering quality agricultural products, and modern technologies help increase efficiency in food collection, storage, processing and logistics systems. In particular, smart packaging systems, IoT (Internet of Things) devices, blockchain technology and automated logistics processes serve to ensure product quality and safety. According to the Food and Agriculture Organization (FAO), about 30-40 percent of food produced in the world annually is lost during storage or transportation. Therefore, the introduction of innovative technologies in the system of high-quality storage and delivery of products is one of the urgent tasks of today. The purpose of this article is to analyze the role, advantages and practical effectiveness of innovative technologies in the quality storage and delivery of agricultural products.

**Keywords:** Innovative technologies, agriculture, product quality, storage system, agrologistics, digital technologies, cold chain, IoT, artificial intelligence, food safety, sustainable development, export potential, " Cold Chain" technologies, refrigerated transport.

## 1. Introduction

Global agricultural systems are harvesting the highest amount of food to date, but a substantial portion still never arrives at consumers in edible condition [1]. Even in countries with well-developed agriculture (Uzbekistan for, example) the loss of fruits, vegetables, and auxiliary products (dairy, meat) is still tangible because the storage and supply systems do not meet modern requirements, Most facilities run with an antiqued cooling system, poor thermal regulation, and no digital oversight. Accordingly, worldwide experience indicates that technologies such as smart packaging, IoT sensors, automated cold chains and clear digital platforms can help minimise wastage and maintain the quality of the product [2]. While these technologies have been extensively trialled in high-income markets, the practical integration of such technologies into low-income farming economies, and the implications for policy, remain under-explored.

*Corresponding author : annamuratovshukurbek1@gmail.com
Article history : **submitted;** 2025/8/15 **revised;** 2025/9/23 **accepted;** 2025/10/10 **published;** 2025/11/29

The study addresses the problem from the angle of integrated rather than isolated functionalities of modern technologies. Due to the nature of earlier research, which typically focused on adoption of single tools (for example IoT sensors or improved cold rooms) we lacked insights into how digital monitoring, real time data analysis, blockchain traceability and energy efficient cooling could be integrated across the supply chain. In order to fill this gap, we analyze international experience and compare it with what is happening now in Uzbekistan [3]. We analyse how countries reduced losses, specific conditions related to storage and transport and how AI supported logistic and static sensor-based quality control would fit into the existing system.

With this evidence available we forecast that with these technologies post harvest losses can be reduced drastically, transport costs can be reduced and the quality of goods bound for domestic markets or export can be increased. Initial findings from comparable projects reveal that losses fall from almost one-quarter of output to just a few percent with the implementation of digital systems [4][5]. The improvements create new benefits as well: greater transparency in the market, greater trust between producers, buyers and consumers. The results highlight that investment in digital agrologistics centers, increased adoption in smart sensors, and fortifying competency in innovative agricultural technology can help a country such as Uzbekistan transition to a more efficient and sustainable food supply chain.

## 2. Research Method

The following innovative technologies are a set of new technical, software, or management solutions aimed at digitizing, automating, and optimizing the processes of storing, transporting, and delivering products. Cold Chain technologies - ensure the maintenance of constant temperature and humidity during the stages of product collection, storage, transportation and sale [6]. In case of temperature violations, the biological activity of the product increases and rapid deterioration occurs. In smart cold storage systems, temperature and humidity sensors operate in real time, and data is transmitted to a central server via IoT. IoT (Internet of Things) and sensor monitoring - smart sensors installed in each warehouse or transport container measure temperature, humidity, pressure and light levels [7]. The data is analyzed using artificial intelligence, which allows determining the optimal shelf life of the product and reducing energy consumption.

AI algorithms forecast supply and demand, select the shortest delivery route, and balance vehicle load levels. Digital logistics platforms (e.g. AgroLog, SmartAgro) enable farmers, transporters, and buyers to quickly communicate with each other [8]. Blockchain technology transparently records the path of each product from producer to consumer. As a result, confidence in product quality and safety increases, and counterfeit products are prevented. The introduction of solar-powered compressors or heat recovery systems in cold storage rooms ensures environmental sustainability and reduces operating costs [9].

## 3. Result

We are witnessing demonstrable and measurable advancements across the farm supply chain already with new technologies rolling out. Farmers and suppliers say losses of product, that once exceeded 1/3 of total harvests, are now reducing to 5-7% of totals due to improved storage availability and the ability to quantify storage conditions on-the-go. The cost of transport is also declining– logistics costs have dropped by about 15 to 20 per cent as new routing processes and automated systems replace old, inefficient systems [10]. The efficiency of energy use in storage facilities has improved too, resulting in savings of about 10 to 15 percent. These enhancements are primarily elevating the standard of agricultural products, turning them extremely competitive in global markets and increasing the potentiality of the country in exports [11].

In recent years, agrologistics centers, digital trading platforms (“Agroplatforma.uz”) and energy-efficient cold storage facilities have been established in the country. For example, AgroFresh Logistics has implemented an IoT system that monitors the temperature and $CO_2$ level in each container in real time [12]. According to international experience (Figure 1): In the Netherlands, product losses have been reduced to 3% through the “Precision Agriculture & Smart Storage” system; In Israel, temperature and gas composition are controlled using IoT sensors and artificial intelligence in the storage of agricultural products; In Japan, the “Farm-to-Table Blockchain” system shows the origin of the product to the consumer through a scanner.

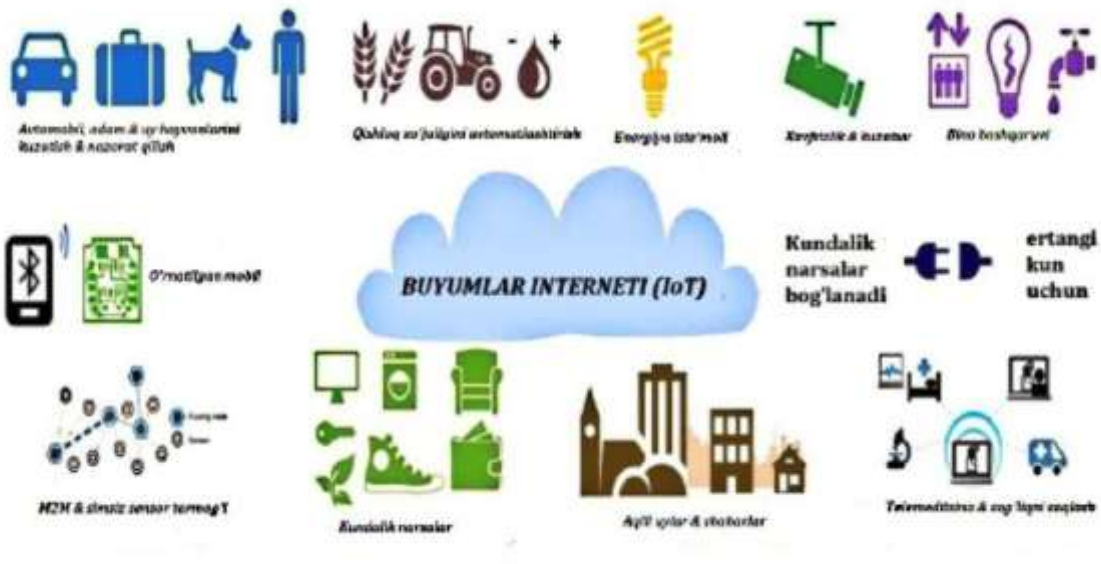


**Figure 1.** Application areas of the Internet of Things.

Also, advanced logistics and traceability systems, such as digital platforms and blockchain technologies, allow the entire chain of production to be tracked and controlled, from production to direct delivery to the consumer [13]. This not only prevents product quality degradation, but also helps to adapt it to global markets. Refrigerated transport and mobile refrigerators protect products from spoilage. In the US, Walmart has organized the search for products in 2 seconds using IoT and blockchain. Another important aspect is the economical use of resources [14]. Innovative technologies, such as precision farming methods and water-saving systems, not only reduce production costs, but also ensure environmental safety. These factors ensure that agricultural products improve their quality and meet market requirements. Land area in the software environment an analysis of existing approaches and methods for designing (land area determination, device placement,

sensor detection, plant species analysis) was carried out (Figure 2) [15].


**Figure 2.** Modern materials processing.

The results of the analysis showed the need to develop and develop existing methods and algorithms to ensure real-time data exchange under different conditions and equipment.

## 4. Conclusion and Recommendation

The introduction of innovative technologies in the system of high-quality storage and delivery of agricultural products is not only a technical upgrade, but also a transformation of the entire food chain. With the help of these technologies, product quality will increase, digital control systems will be introduced over product quality, market transparency will be ensured, costs will be reduced, and farmers' competitiveness will increase, export volumes and income will increase. In the future, the integration of artificial intelligence, robotics, and green energy will make agriculture more sustainable. I would like to suggest that it is necessary to establish digital agrologistics centers in each region, develop logistics platforms based on artificial intelligence, retrain personnel in digital agricultural technologies, and implement sustainable food chain projects in cooperation with international organizations.

## 5. References

[1] Mirziyoyev, S., “Resolution on measures to accelerate the introduction of renewable energy sources in 2023,” Feb. 16, 2023.
[2] Mirziyoyev, Sh. M., *Uzbekistan Republic President Shavkat Mirziyoyev's Address to the Meeting: People’s Word*, 2022.
[3] *O‘zbekiston Respublikasi Qonuni: Yo‘l harakati xavfsizligi to‘g‘risida*, Uzbekistan Legislation.
[4] Khalima, A., Markhamat, K., and Malika, M., “Development of hardware and software complex for monitoring system of agricultural crops,” *Universum: Tekhnicheskie Nauki*, no. 9-5 (102), pp. 5–7, 2022. Available: https://cyberleninka.ru/article/n/development-of-hardware-and-software-complex-for-monitoring-system-of-agricultural-crops3
[5] Nurmurodov, S. D., Rasulov, A. Kh., and Bakhodirov, Q. G., *Materials Science and Technology of Construction Materials*. Tashkent: Science and Technology Publishing House, 2015.
[6] Tirkashev, F., and Boytemirov, B., *Qishloq xo‘jaligini raqamlashtirish: kelajak texnologiyalari*. Digital agriculture, IoT, and sensor applications.
[7] Abasxanova, X. Yu., *Geo-information system development methods for monitoring agricultural lands*. Tashkent: Fan va Texnologiyalar, 2021. Available: https://scholar.google
[8] Anusha, M., Sri, K. R., Lokesh, M., Deepthi, N. M., and Malleswari, M. D., “Postharvest management techniques for improved shelf life of horticultural crops: A review,” *Journal of Experimental Agriculture International*, vol. 46, no. 11, pp. 362–380, 2024.
[9] Murtazoyev, O., and Akhrorov, F. B., *Agricultural Economics*. Tashkent: Ilm Ziyo, 2021.
[10] Annamuratov, S., “Reducing fuel consumption and emissions by converting modern cars to electronic systems,” *International Journal of Artificial Intelligence*, vol. 1, no. 4, pp. 645–648, 2025. Available: https://inlibrary.uz/index.php/ijai/article/view/98919
[11] Annamuratov, Sh., and Khurramov, R., “The importance of foreign language knowledge in teaching and learning engineering sciences,” *Journal of Multidisciplinary Sciences and Innovations*, vol. 1, no. 2, pp. 786–788, 2025. Available: https://inlibrary.uz/index.php/jmsi/article/view/89965
[12] “Using the best methods to produce quality steel today.” Available: https://www.academicpublishers.org/journals/index.php/ijai/article/view/4444/5419
[13] Available: https://unilibrary.uz/literature/7474
[14] Available: https://lex.uz/ru/docs/-6303230?ONDATE=11.10.2023
[15] Available: https://gov.uz/dustlik/news/view/35434