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INNOVATIVE APPROACHES TO MODERNIZATION OF THE AGRICULTURAL SERVICES SYSTEM AND THEIR PRACTICAL SIGNIFICANCE

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AGROXIZMATLAR TIZIMINI MODERNIZATSIYA QILISHDA INNOVATSION YONDASHUVLAR VA ULARNING AMALIY AHAMIYATI

ИННОВАЦИОННЫЕ ПОДХОДЫ К МОДЕРНИЗАЦИИ СИСТЕМЫ СЕЛЬСКОХОЗЯЙСТВЕННЫХ УСЛУГ И ИХ ПРАКТИЧЕСКОЕ ЗНАЧЕНИЕ

Abstract

Methodological principles for the development of the agro-services sector in the process of agricultural production in the republic constitute an important theoretical and methodological basis for the formation of this system on the basis of a systematic approach, increasing its functional efficiency and ensuring its adaptability to market conditions. These principles determine the conceptual foundations of the agro-services system and make it possible to identify priority methodological directions in the development of mechanisms for its development. The methodological approach proposed by the author is aimed at ensuring the integration of economic, organizational-institutional, technological and social factors, taking into account the multidisciplinary and multi-level characteristics of the agro-services system. Based on this approach, the opportunities for strengthening the stability of agricultural production and increasing its competitiveness are expanded through the integrated development of the agro-services sector.

Keywords

agriculture, economic factors, organizational factors, technological factors, social factors, integrated development, sustainability, competitiveness.

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Intraduction. Innovative agro-services play a special role in the effective organization of production, processing, storage, transportation, and sales processes in agriculture, the creation of competitive products, the rational use of resources, and ensuring sustainable development. This includes a set of advanced technologies, digital management systems, scientific achievements and new service models. These services include the following main areas:

✓ AgroIT services – drones for field monitoring, artificial intelligence for crop forecasting, online resource management on agro-platforms.

✓ Agro-technological diseases – smart greenhouses, drip irrigation systems, automated fertilization and pesticide spraying.

✓ Agro-marketing and logistics services – e-commerce platforms, supply chains, certification for export.

The State of Israel is one of the countries with the most advanced experience in the world in the formation and implementation of innovative agro-services in the agricultural sector. These achievements are of particular scientific and practical importance, as they were achieved despite the country's complex natural and climatic conditions, limited land and water resources, and unfavorable geographical factors. Israel is located on the eastern coast of the Mediterranean Sea, and most of its territory falls into arid and semi-arid climatic zones. Precipitation is extremely low, mainly observed in October-April, and is unevenly distributed throughout the country. The highest rates are in the northern regions. Israel is located on the eastern coast of the Mediterranean Sea, and most of its territory falls into arid and semi-arid climatic zones. Precipitation is extremely low, observed mainly from October to April, and is unevenly distributed across the country. The highest rates are in the northern regions. Also, fertile soil resources in Israel are limited, and only about 20 percent of the total land area is suitable for agricultural activities. Ensuring agricultural efficiency under such natural constraints requires the development of an innovative agro-service system based not on traditional methods, but on science-based, resource-efficient and high-tech. It is these factors that have led to the rapid development of a system of services in Israel based on drip irrigation, smart water management, agro-technological consulting, digital monitoring, and scientific research. The Israeli experience scientifically substantiates the crucial importance of innovative agro-services in the sustainable development of agriculture in countries with severely limited natural resources. Agriculture in Israel is concentrated mainly in the central and northern regions of the country, and field crops are grown in the northern regions of the Negev Desert and in fertile valleys. It is worth noting that the Negev region, despite the fact that it accounts for more than half of the country's area, is characterized by difficult

natural and climatic conditions for agricultural activities. Nevertheless, despite severe weather conditions, constant water shortages, and the fact that almost two-thirds of the country's territory falls within the desert zone, the growth rate of agricultural production in Israel in 2005-2015 was approximately 19 percent, which is considered an important scientific and practical result. According to the author, such stable growth rates were achieved due to close cooperation between the agricultural sector and research institutions, the systematic introduction of advanced agricultural technologies, and the development of innovative agro-services infrastructure. The fact that a large part of agricultural land in Israel is located in desert areas and the severe limitation of water resources used for irrigation have determined the priority areas for the development of innovative agro-servicesIn particular, these areas are aimed at saving water resources, increasing productivity, efficient use of resources, and digitalization of production processes. The author notes that drip irrigation technology, introduced in Israel since the 1960s, has been recognized not only at the national level, but also globally as one of the most effective water-saving technologies. Today, Israeli companies such as Netafim, Metzerplas, and Rivulis occupy leading positions in the global irrigation technology market and export innovative solutions to many countries. The economic efficiency of Israel's experience also deserves special attention. According to FAO and the World Bank, the value of agricultural products obtained from each hectare of land in Israel is 2.5 times higher than the world average. The share of the population employed in agriculture in the country is relatively low (4-5%), but the volume of products they produce is sufficient not only to meet national needs, but also for export. In this process, the share of the agri-services sector is about 40%, which means that more than half of production is carried out through services and technological support. Public-Private Partnership plays an important role in the Israeli model. The Ministry of Agriculture, technology companies and farmer associations work on the basis of mutual integration. For example, through the “MOP” (Water Planning for Agriculture) program, a single electronic platform for water resource allocation, water pricing, and financing of innovative technologies has been introduced. This platform not only ensures the efficient use of resources, but also increases transparency and accountability. Israel’s approach to agri-services is also relevant for Uzbekistan, since the issues of water scarcity, land scarcity, and climate change adaptation are also important in our country. In adapting the Israeli experience, drip irrigation, digital monitoring, and expanding research services are particularly important.

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Table 1.3.1

Israeli agribusiness strengths[1]

Direction	**Innovative solution**	**Implementation mechanism**	**Result**
Drip irrigation	Netafim systems	Design, installation, service	Reduce water consumption by 30–50%
Water treatment	Using recycled water	Filtering and monitoring services	Restoration of water resources, environmental sustainability
Climate monitoring	Meteorological stations and satellites	Mobile applications and consulting service	Harvest planning accuracy increases
Innovative greenhouses	Automated climate control	Service through agro-technoparks	Productivity increases 2–3 times

The Netherlands is a small country with limited natural resources, but it ranks second in the world in terms of agricultural exports after the United States. The key factors in achieving this result are the excellence of the innovative agri-services system and a high level of scientific and technological approach. The country has achieved high efficiency in agriculture through high intensity, efficient use of resources, digital management and clustered production systems. The agri-services sector in the Netherlands is developed through integrated cooperation between research institutes, universities, technology companies and farmer associations. For example, Wageningen University & Research (WUR) not only conducts scientific research, but also provides advice and services to farmers on the implementation of the technologies it develops. Hundreds of agro-startups, technological laboratories and innovation centers operate around WUR. The main areas of innovative agro-services in the Netherlands are as follows: Closed greenhouse technologies - modern greenhouses, developed based on the “Greenhouse Horticulture” concept, provide maximum yield and minimum resource consumption. They allow for complete control of climatic conditions, accurate dosing of water and fertilizers, and the use of energy-saving technologies. Digital agriculture — agri-service platforms based on artificial intelligence (AI) and Big Data analysis allow for yield forecasting, pest detection, and resource optimization. Vertical farming — the

[1] Author's development

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practice of organizing multi-story closed farm systems within cities to ensure food security in the context of urbanization has been widely implemented. Aquaponics and hydroponics services — consulting and technical support services on soilless cultivation technologies allow farmers to quickly master innovative production. The economic effectiveness of the Dutch experience is that the country has one of the highest values of agricultural products per hectare in the world. According to FAO, the yield of greenhouse vegetables in the Netherlands is 500-600 tons per hectare, which is 3-4 times higher than the world average. State policy plays an important role in this process. The Dutch government provides financial and institutional support for the development of agro-services, the introduction of innovative technologies and increasing export potential through the "Top Sector Agri & Food" program. Within the framework of this program, the connection between scientific research and production is strengthened, grants and soft loans are allocated for innovative projects. The Dutch model also widely uses public-private partnership (PPP) mechanisms. For example, the "Greenports Netherlands" platform provides a unified logistics, marketing and technical service system between farmers, technology suppliers, exporters and research centers. This platform not only effectively creates a central internal market, but also simplifies the process of market entry.

Table 1.3.2.

Main directions of the Dutch agri-services system[2]

Direction	**Innovative solution**	**Implementation mechanism**	**Result**
Agro-technoparks	"Food Valley" cluster	Scientific research and technology transfer	Growth in exports of innovative products
Digital technologies	Drones, GPS, IoT systems	through Agroservice centers	Productivity and resource efficiency increase
Greenhouses	LED, hydroponics, aeroponics	Large greenhouse complexes	Crop quality and export potential will increase
Sustainable services	Organic production technologies	Consulting and training	Environmentally sustainable production

Wageningen University & Research (WUR) has recently launched its **Digital Innovation Hub (DIH)**. The hub is an online platform designed to support agribusiness companies in their digital transformation journey. While digital technologies are gradually expanding in the European Union, maintaining competitiveness, creating new jobs and ensuring social equality in the global

[2] Author's development

economy remains at risk. For this reason, the European Commission has launched the Digitalizing European Industry programme. The main goal of this initiative is to ensure that all businesses have access to the latest digital innovations. DIHs are an integral part of this initiative. They allow companies to gain a deeper understanding of how to improve processes, products and services using digital technologies. In this context, WUR has launched its own dedicated agribusiness website. DIHs are non-profit, one-stop centers that provide the following services:

giving companies the opportunity to test new technologies in practice, so they can assess the potential opportunity and level of return before investing;

- Organizing training and development programs, online courses and internships;
- Assisting in finding investment, e.g.: feasibility studies, business plan development, incubation and acceleration programs;
- Creating ecosystem and collaboration opportunities, expanding networking through marketplaces and brokerage activities.

For example, imagine that a robotic solution is being developed that can spray herbicides in a precise and cost-effective manner to protect field crops. The company is looking for a test bed for this. WUR can make its existing test beds available for this use. , they can help find or eliminate sources of funding for the prototype and develop innovative business models. The relevance of the Dutch experience for Uzbekistan is that areas such as maximizing yields from small areas of land, developing high-tech greenhouses, introducing digital management systems, and expanding urban agriculture formats can also be effective in our country

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