EFFECTIVENESS OF USING INNOVATIVE METHODS IN THE APPLICATION OF DIGITAL TECHNOLOGIES IN AGRICULTURE

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Abstract: *The article deals with the issues of improving the efficiency of the agricultural economy due to the transition to the digital economy, system categories of a complete innovation complex in the organization of intelligent agriculture.*
Key words: *digital economy, innovative methods, virtual agriculture, networking platforms.*

Agriculture plays a major role in the country's economy. It not only supplies the state and population with food, but also forms agricultural raw materials for production sectors, primarily light and food. Its level of development determines the country's economic security. Today, agriculture is facing many challenges. The main ones are: the problem of depletion of land resources; high dependence on natural and climatic factors; seasonality of production; excessive depletion of food products, etc. Taking into account the role of agriculture in the national economy, its development is one of the priority tasks of the state. The country's government actively supports the agricultural sector of the economy. The modern stage of social development is characterized by high-speed technological progress. Over the past 30 years, computers and information technologies with them have firmly entered the life of society, including the industrial and non-productive sectors of the economy. Agriculture is no exception. Today, the acceleration of informatization serves as a basis for ensuring the stability of future development. Innovation is at the heart of progressive economic growth. As mentioned above, agriculture, as one of the main sectors of the national economy of many countries, faces many challenges and problems. To solve them, it is necessary to: reduce man-made environmental loads on the agricultural sector; improvement of applied technologies; increasing human capital; increase the safety of food products during their production. It allows to increase the efficiency of agriculture, it is called digital agriculture. Modern information technologies, starting with crop planning, irrigation automation and digital crop modeling, and ending with the calculation of feed for feeding livestock, are firmly entering the agricultural culture.

Thanks to the development and implementation of modern information technologies in agriculture, not only its productivity increases, but also financial and labor costs are reduced. As a result, product quality increases and profit increases. In order to overcome the current and future threats to biological and food security, society needs a new type of agricultural economy based on the use of modern information technologies compatible with the principles of sustainable development and the zero-waste economy model. Modernization of the agricultural sector is based on the transition to "smart" agriculture. "Intellectual" agriculture is agriculture based on complex automation and production robotization, modern technologies for the use of automated decision-making systems, modeling and ecosystem design. Intellectualization of the agricultural sector, on the one hand, allows to reduce the excessive use of external resources (agrochemicals, inorganic fertilizers, fuel, etc.), and on the other hand, local production factors (organic fertilizers, bioactive, renewable energy sources , etc. to maximize usage). It allows to use modern technologies of "intellectualization" of agriculture: preservation and restoration of beneficial properties of underground water and soil; provide environmentally safe and effective pest control; remote compliance with organic agriculture certification requirements. As a result, the agricultural sector,

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including production opportunities, is expanding, and the efficiency of using the resources of agricultural sectors is increasing.

In agriculture, the digital economy ensures the sustainability of agricultural development, the development of agricultural science, agricultural education and compliance with environmental standards.

Digitization can rapidly expand the possibilities of interaction of all factors of the agro-industrial system, smooth the factors that prevent the increase of efficiency in every way, and eliminate the existing obstacles. Stable Internet access allows farmers to access technical information and share such information with counterparts in other countries, helping to increase productivity, strengthen immunity to external influences, and access markets.

The introduction of these digital technologies enables farmers representing different parts of the agro-industry supply chain to collaborate in a sustainable agro-eco system.

In addition, mobile technologies and Internet services can connect farmers with supply chains, giving them access to high-quality seeds and fertilizers, which can significantly increase production and sell products directly to consumers, bypassing middlemen, increasing farm profitability. .

The use of sensors and new technologies, including big data analytics, provides real-time data collection and in-depth analysis of field conditions to give farmers access to the information they need to make informed decisions and improve yields through real-time weather forecasts and alerts. increases, adapts well to the effects of climate change and strengthens immunity to climate effects.

Other technologies, such as blockchain, can make a more perfect food tracking system, help reduce food spoilage, and increase the level of transparency and trust in all parts of the supply chain. Using deep learning, machine learning, and artificial intelligence technologies to improve crop management, disease detection, species identification, and water, land, and forest resource management will help improve food security.

Digital agriculture covers various aspects of agricultural production, its main components include the construction of a database, metadata standard, monitoring system, forecasting and decision-making system, and information dissemination system, and all these are roughly divided into four levels, namely the information base level. , the level of functional modules, the level of the integrated program and the system framework of the integral web portal level, which are integrated with each other (Fig. 1).

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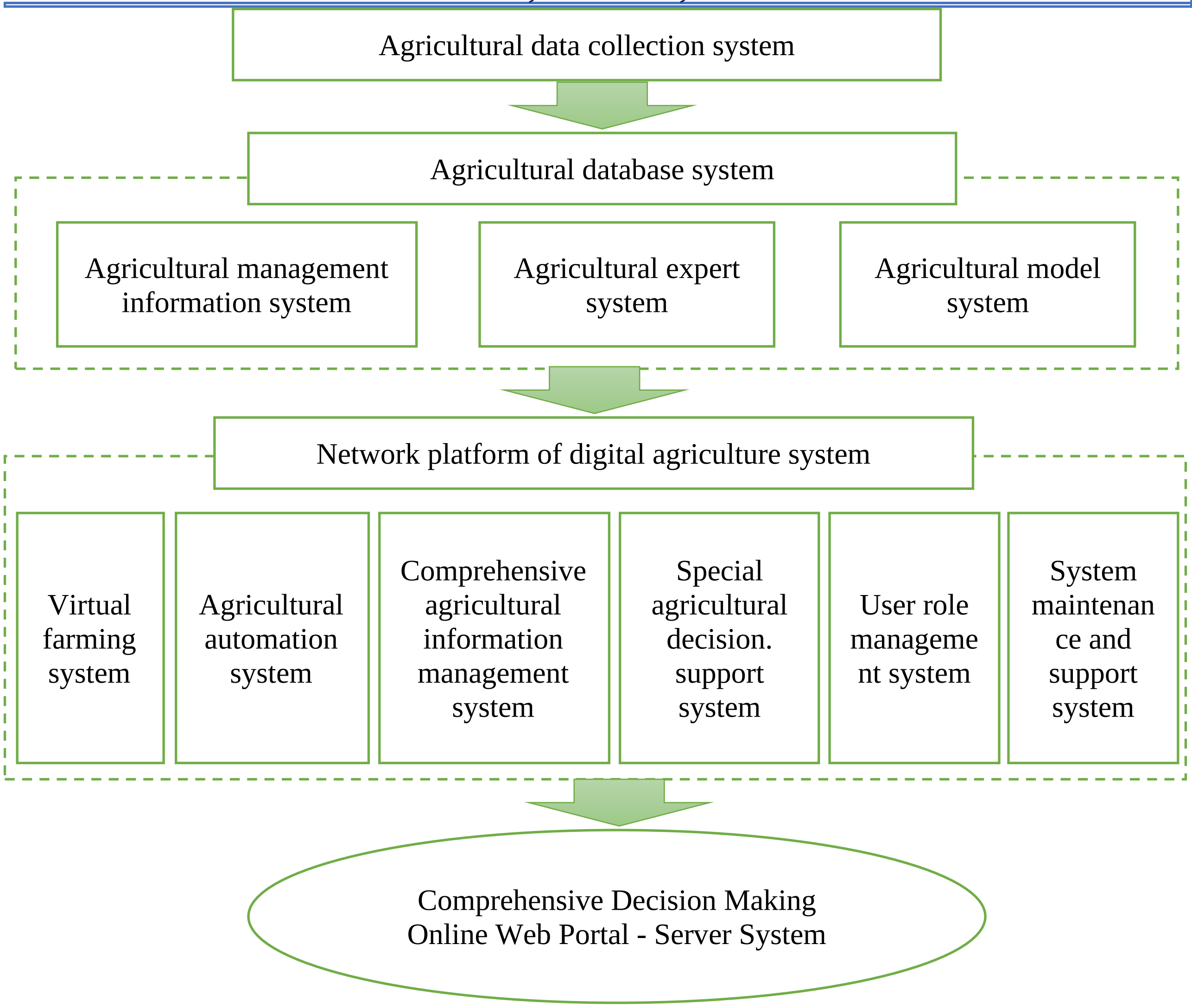

Figure 1. System framework of digital agriculture

The current level of technical support for Uzbekistan's agriculture and the level of production technologies used include the use of new innovative developments aimed at reducing labor costs for workers. For this, high-quality equipment supplied to agricultural producers of Uzbekistan should be equipped with modern control devices, computer and satellite navigation tools, programs for fuel consumption management, load optimization and efficient use of equipment. This, in turn, is adapted to the needs of modern agriculture and allows rapid monitoring of production processes in agriculture through modern information and communication technologies based on the construction and development of the agricultural system in the agrarian sector of Uzbekistan's economy.

The environment of agricultural land is a very complex ecological system and includes various factors including soil, fertilizer, moisture, brightness, temperature, atmosphere, etc. All these data have huge, dynamic, regional and sequential characteristics. Moreover, the collection and expression of agricultural data includes not only directly related factors but also recessively related factors that are indirectly related. Thus, the level of the information base, which undertakes the collection, processing and analysis of data, is an important and complex foundation level of the digital agricultural system.

This level includes media database, attribute database, and spatial database tools. The public information base includes laws, rules, regulations and technology standards. An attribute database

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handles non-spatial attribute data management. Spatial database is a consistent, integral geospatial information and service system, including the spatial data structure of digital agriculture, the coordinated management, update and distribution system of spatial data, the standard of spatial data and metadata exchange, etc. (2 pictures).

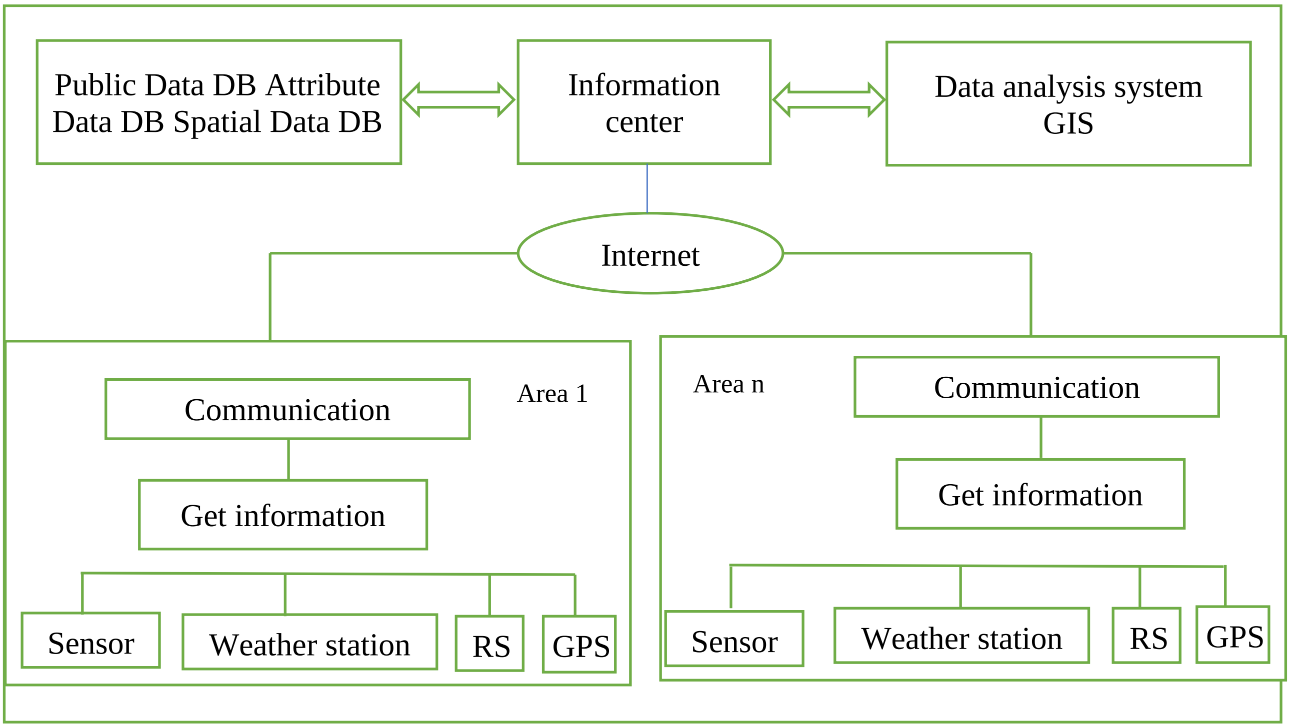

Figure 2. The level of information bases

Acquiring this level of data is a key process, and how to get field data quickly and efficiently, and how to deliver data cheaply and with high reliability, is an important research topic. The specific characteristics of the agricultural production environment and the production process of agricultural products make agricultural areas a characteristic of dispersed data collection points, average collection period, low speed, small amount of data, and poor field conditions.

This, in turn, increases the difficulty of obtaining complete information on all factors. In recent years, the method and technology of data collection has been mainly carried out by manual measurement, statistical and experimental data analysis, and modern automatic collection methods. In these methods, modern automatic collection has high accuracy, speed, wider range and other characteristics, and has gradually become the main method of data collection. It mainly includes RS (Remote Sense), GIS (Geographic Information System), GPS (Global Position System) and network technologies, etc.

The level of functional modules are mainly agricultural-based database management, updating, searching and analysis, agricultural BAT (management information system), agricultural ET (expert system) and agricultural NT (model) which are expert database and agricultural model database. system) takes over the systems (Fig. 3).

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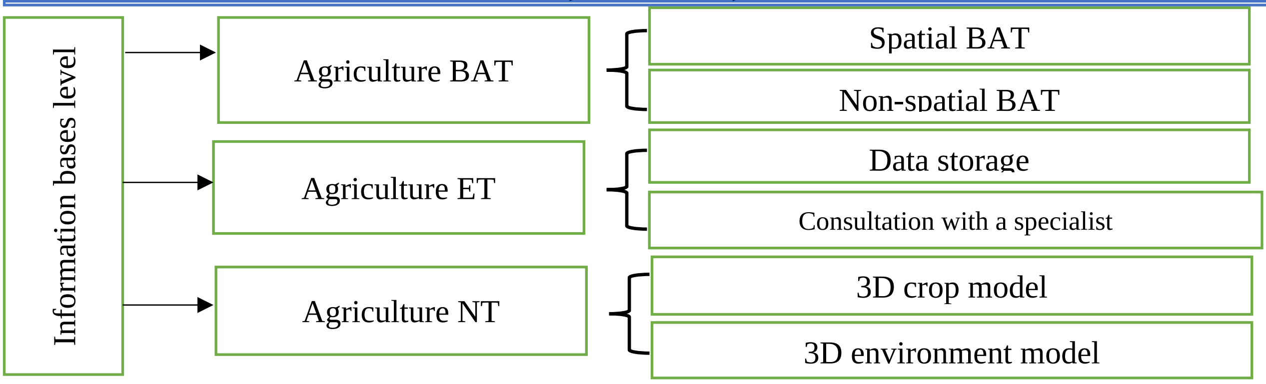

3- fig. The level of functional modules

Agricultural BAT function includes basic agricultural attribute data (product, biological, scientific and technical, economic data, etc. management, updating, search, statistics and production) and geographic data (environmental resources, agricultural status, etc. generates data, etc.), and also includes the functions of managing, searching, analyzing and generating attribute data and spatial data.

Agricultural ET mainly includes knowledge base creation, expert consultation, knowledge retrieval and production, etc. The knowledge base mainly stores and manages specialized agricultural knowledge, which includes basic agricultural evidence (test samples), theoretical knowledge from books, common sense, and inferential knowledge from agricultural experts. The quantity and quality of knowledge is a key factor in ET and affects the accuracy of solving the user's problem.

The integrated application level, based on the network platform and taking on the integration of the system of various special modules of the digital system, is mainly a comprehensive agricultural BAT, a virtual agricultural system, an agricultural decision support system (hereinafter referred to as a decision support system - QQQT), includes automatic agricultural monitoring system and others. Agricultural FRM refers to the use of FRM in agriculture and can be considered a computer-based system that allows the user to solve semi-structured processes using large data sets and analytical models.

One of the most important basic subsystems of digital agriculture is virtual agriculture. The rationale of virtual agriculture is based on the fact that the relationships between crops and the environment can be calculated, and the agricultural system takes networks and computers as a platform for simulating the studied objects of each link in agriculture and their emergence. It also achieves the goals of visualization and interaction of the studied objects and the environment. In a broad sense, virtual agriculture includes virtual crops (Figure 3), virtual animals, production of virtual agricultural machinery, virtual farm, etc. This, in turn, is important in determining the various experiences and account books and the future perspective of the network. For this, it is necessary to organize the architecture of the virtual crop system of agricultural crops.

The digital economy serves as a basis for the future development of the economy of Uzbekistan and also stimulates the effective development of certain industries, including agriculture. The use of information and communication technologies in agriculture creates equal opportunities for promoting products between large and small enterprises, which increases the efficiency of their activities and creates equal opportunities to ensure competition in the field.

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