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Solutions to Promote Digital Transformation in Agriculture in Vietnam

Dr. Doan Thanh Thuy
University of Labor and Social Affairs, Vietnam

Corresponding Author: **Dr. Doan Thanh Thuy**

Abstract
Digital transformation in agriculture is the process of applying digital technologies to all traditional agricultural activities, from production to processing, distribution and consumption. The goal of digital transformation in agriculture is to improve productivity, quality, efficiency and competitiveness of the agricultural industry. Agricultural digital transformation includes the use of information technology, sensors, artificial intelligence (AI), machine learning, Internet of Things (IoT)... Applications of digital transformation in agriculture can include collecting data from sensors to monitor and manage crops, soil moisture, air quality and livestock health. Blockchain technology can also be used for traceability and supply chain management in agriculture.
In the "National digital transformation program to 2025, orientation to 2030", agriculture is considered one of eight priority areas in digital transformation in Vietnam. Although currently, this process has achieved certain achievements, many challenges still exist such as low level of mechanization, little technology, farming and production activities are still carried out based on farmers' experience. The article researches and clarifies the content of digital transformation in agriculture. Based on the assessment of achieved results and limitations, the author offers solutions to promote digital transformation in agriculture in Vietnam.

Keywords: Digital Transformation, Digital Technology, Agriculture, Economy, Vietnam

Introduction
Vietnam is a country with a strongly developed agriculture (ranked 15th in the world, second in Southeast Asia). However, for the agricultural sector to develop further, Vietnam needs to promote digital transformation in agriculture. This is considered a major barrier and challenge, but it is also an opportunity for businesses to reach an international level.
In Vietnam, compared to industry and service sectors, the proportion of agriculture in GDP is decreasing, but agriculture plays a particularly important role. In the context of international integration, especially the Fourth Industrial Revolution, digital transformation in agriculture is an inevitable trend and a key solution for sustainable development of Vietnam's agricultural sector, minimize risks and damages due to negative impacts of climate change. Digital transformation helps the agricultural industry improve productivity, quality, production efficiency and product consumption. Applying digital technology to agriculture helps analyze data about the environment, soil types, crops, and plant growth stages, from there, producers will make appropriate decisions (fertilization, watering, spraying, harvesting,...), thereby reducing costs, reducing water and land pollution, and protecting biodiversity. In addition, the application of digital technology helps consumers access and monitor agricultural product quality parameters and use them with peace of mind. Digital transformation in agriculture also plays a particularly important role in restructuring the agricultural sector, developing towards modernization, enhancing value and sustainability. This work is being promoted by industries, localities, businesses and people to create a breakthrough in quality, productivity, and increase competitive advantage.

Research Results
1. Overview of digital transformation in agriculture
Digital transformation in agriculture is the process of changing the production model using technology as the foundation, applying technology to agricultural production activities, making the most of raw materials, waste by-products, and recycling them, creating a circular mechanism in production, contributing to environmental protection and sustainable development. This is the core content of developing high-tech agriculture in a multi-functional direction.

In the agricultural sector, many countries around the world have built national digital transformation programs as a top development priority policy. Digital transformation of agriculture contributes to transforming the agricultural product system towards increasing added value, helping to solve the problem of productivity to meet increasing demand, thereby helping the agricultural sector develop towards lasting. Therefore, digital transformation is the solution to the difficulties that agriculture and rural areas face in the current period.

Digital transformation in agriculture is the process of applying digital technologies from production to processing, distribution and consumption of agricultural products, helping to form digital agriculture and smart agriculture. The basic difference between digital agriculture and traditional agriculture is the application of digital technologies to the entire operation, changing the way of managing, producing and consuming agricultural products from traditional to modern and smart. Digital transformation in agriculture is demonstrated through applications in 4 main activity groups, including: (1) monitoring; (2) control; (3) forecast; (4) logistics.

From a management perspective, digital transformation in agriculture helps make the management and operation of the agricultural industry in general and agricultural enterprises in particular more effective. The application of information technology and digitalization in operations and management will help make decisions faster and more accurately thanks to a smooth and timely reporting system, increasing management effectiveness and efficiency of state management agencies on agriculture. For agricultural businesses, digital transformation helps increase operating efficiency, cut operating costs, and reach more customers. Thanks to that, the operating efficiency and competitiveness of the business are enhanced. Digital transformation helps strengthen the connection between producers and consumers, between supply and demand, limiting the situation of "good season, loss of price", "loss of good price", thereby, effective agricultural production and more sustainable. Therefore, digital transformation in agriculture is defined as creating a smart agricultural environment and ecosystem to develop an effective and sustainable agriculture.

Digital transformation will bring outstanding benefits and be an important contributor to the sustainable development of Vietnam's agricultural industry, this is demonstrated through the main roles below:

Minimize damage caused by climate change: Digital technology can be used to collect, analyze, and forecast weather and climate information. Accurate forecasts of weather and climate can help farmers determine the best time to plant, harvest and care for crops. In addition, climate modeling can provide information about climate trends and changes so farmers can adjust plans and develop response measures. In addition, digital technologies also help farmers install monitoring and early warning systems about crop health status, the spread of diseases, and the impact of environmental factors such as temperature and humidity. Farmers can receive early notification of potential problems and take timely preventive or intervention measures to minimize losses.

Help farmers connect directly with consumers: Blockchain technology and geographic information management system (GIS) can be used to create a traceability system. Thereby, farmers can provide information about the origin and production process of agricultural products. Consumers scan the QR code or search the system to see detailed information about the product, ensuring they know its quality and origin. Digital transformation also provides communication and feedback channels between farmers and consumers. Online platforms allow consumers to submit feedback, ask questions and receive information from farmers. In contrast, farmers can provide information about products, receive feedback and create direct relationships with consumers without having to go through traders.

Save time and resources: Modern agricultural machinery and equipment can automatically perform many tasks, helping farmers save time and effort. For example, tractors can automatically plow and harrow, harvesters help harvest agricultural products quickly and conveniently. Digital transformation also provides smart agricultural management systems, allowing farmers to manage and monitor operations remotely. Including monitoring information about weather and irrigation systems. This helps them save time and resources by optimizing farm management and responding to problems quickly.

Improve labor productivity: Smart support devices can automate labor processes such as planting, harvesting and caring for plants. Using automatic machinery and robots in agricultural work also helps reduce labor effort and increase efficiency. For example, an automatic planting system can accurately locate the planting location and save time compared to manual planting. Digital transformation in agriculture provides smart tools and equipment equipped with sensors, which significantly increases labor productivity. For example, soil sensors can measure soil moisture, pH and nutrients so farmers know exactly what to add.

Improve product quality: Technologies applied in agricultural digital transformation allow farmers to collect and manage data related to agricultural production. This data includes information about weather, nutrition, fertilizer and pesticide use, and crop care. From here, they can analyze and evaluate the quality of agricultural products, such as nutrient concentration, preservative content, and pollutants. This helps farmers control and improve the quality of agricultural products. By using QR codes, barcodes or blockchain technology, consumers can easily retrieve information about the product's origin, growing method, fertilizer and pesticide use. This helps reliability in agricultural products, meeting the increasing requirements for safety and quality of consumers.

2. The need and current situation of digital transformation in agriculture in Vietnam

To develop agriculture in a sustainable way, it is necessary to apply science and technology to agriculture. Therefore, developing digital agriculture is an inevitable direction. Applying high technology in agricultural production will solve challenges in agricultural development with superior features of technology, such as greenhouse technology, automation technology, sensor technology..., thereby helping to save costs, increase productivity, lower prices and improve the quality of agricultural products, protect the environment, and at the same time help reduce the dependence of the production process on natural factors, such as weather, climate. Therefore, the development of

high-tech agriculture is becoming a mainstream trend, the key to success for countries with developed agriculture and also an inevitable trend for Vietnam's agricultural sector in the context of digital transformation today.

High-tech agriculture is agriculture that applies the fourth generation of technology to digitize and realize connected, centralized and intelligent farms, workshops and value chains in a real and virtual interactions environment, ensuring the production and business process is continuous, effective and sustainable. High-tech agriculture is smart agriculture, an agriculture in which most developed countries have completed mechanized and electrified agriculture and are striving to build automated agriculture.

In Vietnam, sustainable development according to the United Nations' millennium goals has been receiving attention. Therefore, developing digital agriculture is an inevitable trend in the process of developing Vietnam's agriculture in a sustainable and effective direction.

Currently, digital transformation in agriculture is changing the production model using technology as the foundation, applying technology to all agricultural production activities, making the most of raw materials, waste, and by-products, recycling them into products, creating a circular mechanism in production, contributing to environmental protection, creating a circular economic model and sustainable development in the future. Therefore, promoting digital transformation and applying science and technology to agricultural production creates high-tech agriculture, and high-tech agriculture itself must become a multifunctional agricultural model to have circular agriculture. On the other hand, high-tech agricultural production is a form of sustainable agricultural production, so connecting with the circular economy can bring prospects in reducing pollution and reducing greenhouse gas emissions, reducing input materials; conserve and regenerate natural resources; improve competitive efficiency; create new markets; create jobs; and increase social value.

Resolution of the XIII Congress (February 2021) of the Communist Party of Vietnam determines: The goal of striving in 5 years (2021-2025), the digital economy will reach about 20% of the country's total GDP, and become a driving force for growth and socio-economic development. To achieve that goal, digital transformation is a problem for the Government, businesses and people at all levels, industries and fields. Digital transformation in agriculture is an important step in that process, a basis for restructuring the economy, making Vietnamese agriculture develop towards large, modern and sustainable commodity production.

Implementing the Party's policy, on December 31, 2021, the Ministry of Agriculture and Rural Development issued Decision No. 5275/QD-BNN-VP promulgating the Digital Transformation Plan to:

- Launch the Digital Transformation Program in Agriculture and Rural Development; create change from awareness to action on digital transformation of agencies, units in the industry and organizations and individuals participating in the agricultural value chain.
- Set out orientations, plans, and roadmaps for implementing digital transformation of the agricultural sector and rural development by 2025, with a vision to 2030 as a basis for building annual plans and organizing implementation of the digital transformation uniformly and effectively.

With goals:

- 100% of online public services provided at level 4 are authenticated once; The ratio of dossiers processed through online public services to the total number of dossiers reached 70%; Integrate 50% of online public services with the National Public Service Portal; 90% of people and businesses are satisfied with the handling of administrative procedures.
- Complete digitization and data updates of at least 60% of results of administrative procedures under the jurisdiction of the Ministry of Agriculture and Rural Development.
- 100% of the reporting regime and periodic reporting targets under the Ministry's management (excluding confidential content) are digitally signed, sent through the Ministry's reporting information system, and shared with the National's reporting information system.
- 80% of work records are processed online (except for work records that are state secrets).
- Ensuring network information security according to the 4-layer model, 100% of the Ministry's servers and workstations have anti-malware solutions deployed; Complete determination of information system security level; Develop scenarios and plans to respond to information insecurity incidents for important information systems of the Ministry; Organize 1-2 drills to respond to incidents causing information insecurity; 100% of information systems are monitored, ensuring information safety and security. 6.80% of officials, civil servants and public employees of the Ministry are trained and fostered in digital skills; Of which 10% are trained and fostered in in-depth data analysis and processing skills.

To achieve the above goal, the Ministry of Agriculture and Rural Development has deployed the construction of a database system and information system for each specific field of the agricultural sector. In particular, for cultivation, the land database system evaluates the current status and degradation of agricultural land, composition, land area and is updated on digital maps. Along with that is building a database to serve the issuance and management of growing area codes, issuing instructions and digitizing the issuance process, and deploying online issuance of growing area codes. For livestock farming, build a database of animal feed and livestock facilities. For forestry, build a coastal forest database and integrate it into the management information system of the forestry industry. For fisheries, build a geographic database (GeoDatabase), a database for aquaculture area management. In quality management and market development, along with building a database on processing, trading, quality management, and agricultural - forestry - fishery food safety; The data system for managing supply and demand of agricultural products and forecasting information on key agricultural export markets is also gradually being formed.

Thus, digital transformation in Vietnamese agriculture is reflected in the application of new technologies in management, production processes and bringing products to consumers. New technologies applied are AI, Big Data, Internet of Things - IoT, cloud computing - Cloud, biotechnology... Businesses and farmers can automate production processes such as temperature regulation and lighting in farms. Using AI to monitor the growth of plants and animals through growth cycles. Technology software

helps determine the quantity and quality of plant food in the soil of plants. AI also helps record growth patterns and analyze data, ensuring farmers can promptly adjust production processes to increase productivity and reduce costs. The application of digital technology in agriculture has created a clear difference between digital agricultural production and traditional agricultural production. Applied technology makes the process of plant breeding and farming techniques more effective. Typically, the application of techniques for selecting somatic mutant cell lines, *in vitro* propagation, asexual hybridization, producing haploid plants, or the nutrient film method and hydroponic system are used. Embryo culture technology, creating disease prevention products for livestock, breeding livestock breeds...

With the attention of the Party and State and the direct direction of the Ministry of Agriculture and Rural Development, Agricultural Digital Transformation has achieved many important achievements, specifically:

In farming: digital technology, IoT, Big Data with software that analyzes data about the environment, plant types, and monitors the growth process of plants are used relatively commonly. Biotechnology is applied to selecting and breeding high-yield plant varieties that are disease resistant and tolerant to the environment, such as biofloc technology and nanotechnology. Some technologies are used to connect and control remote farm operations such as Akisai technology from Japan. According to 2022 data, our country has 4.8 million hectares of crop land. Currently, farmers, businesses and cooperatives are applying technologies to the production process, commonly: smart sensors for automatic irrigation, measuring temperature, humidity… These software can be used on phones and linked to the Database to monitor the growth and development of plants. Technology changes from farming to land preparation, fertilization, irrigation and harvesting for farmers. Through technology application, farmers and businesses have created products that meet quality standards, halved production costs and labor, reduced greenhouse gas emissions by 50%, and increased productivity by 30% salary[1]. Currently, localities are implementing software to trace the origin of agricultural products. This is one of the central issues of digital transformation of farming. Farmers link and deploy with businesses to make products transparent with QR codes. Through scanning QR codes, consumers can retrieve information about origin, time and production process. Currently, the whole country has about 7,000 issued growing area codes and more than 1,600 packaging facilities. In Hanoi, 22 growing area codes have been issued for key export crops. In Ba Ria - Vung Tau, as of April 2023, 21 area codes for growing durian, green grapefruit, bananas, etc. have been issued for export to China, the United States, Europe, Australia, and Japan markets. With large output. For tea plants, some cooperatives have applied GPS to locate production areas and register planting area codes. Along with the digital transformation process in production, digital agricultural services are also developing. Farmers and businesses have the opportunity to connect directly with consumers and customers at home and abroad to introduce and promote products, bypassing intermediary transactions and reducing trade promotion costs. Digital agricultural services are provided through e-commerce platforms such as Sendo, Shopee, Postmart... bringing agricultural products to consumers faster.

In animal husbandry: building a database system for managing animal feed and livestock facilities is currently being piloted for businesses and farmers. The software has been deployed in 7 provinces and 269 animal feed factories across the country. Provide 600 accounts to update the database to factories, commune-level veterinary staff, farms and large livestock enterprises. In fact, on large farms, farmers and businesses have applied IoT technology, Blockchain, and biotechnology to monitor and promote the growth and development of livestock. Dairy farming has the most application of digital technology, with prominent models being the farms of TH True Milk Group, Vinamilk Company... The use of automation technology and AI in management, farm operation, diet management, nutrition, health, dairy herd management with strict technical procedures, ensuring individual cows have good health, high productivity and fresh milk, standard ingredients.

In forestry: digital transformation in forestry has initially been implemented and achieved significant results. IoT and Big Data are applied to build DND barcode technology in seed and forest product management. The software is used to early detect and warn of forest fires from satellite images, monitor green cover, and monitor biological populations to promptly detect and warn of deforestation and forest degradation. In some localities such as Thanh Hoa, the Forest Protection Department is applying information technology, database systems, flycams, satellite images to early detect forest fires, and apply technology to automatically predict fire risk 5 level. Automatic meteorological stations are installed with sensor systems, monitoring data from the stations is transferred to the server via the Internet, combined with the use of satellite images via Google Earth, ArcGIS Earth... to improve capacity forecast[2].

In order to promote digital transformation in forestry, on May 29, 2023, the Department of Forestry issued Decision 34/QD-LN-CĐS on the digital transformation plan for 2023, in which the goal is to complete the list of specialized databases under management; promulgate specific plans and roadmaps to build and deploy databases in the portfolio; Upgrade and improve the forestry industry management information platform system (Formis) to meet data standardization requirements. Maintain the application of information technology in handling administrative procedures, ensuring 100% of administrative procedures under the Department's jurisdiction are updated and implemented on the Ministry's electronic single-window information portal. This is the basis for implementing synchronous digital transformation in the forestry sector in particular, promoting digital transformation in the entire agricultural sector in general. Fourth, digital transformation in aquaculture and fishing Technology is applied from the

[1] Do Huong (2022), *Deployment of planting area code information*, https://baochinhphu.vn/trien-khai-he-thong-thong-tin-ma-so-vung-trong-102220819185808825.htm.

[2] Linh Huong, *"Promoting digital transformation of the forestry industry*", 2023, https://baothanhhoa.vn/chuyen-doiso/day-manh-chuyen-doi-so-nganh-lam-nghiep/181805.htm.

stage of seed production, farming, and processing of seafood such as shrimp and pangasius. Ultrasonic fish detectors, flow meters, automatic net trawlers, and global positioning systems (GPS) help manage offshore fishing fleets more effectively. In Ca Mau and some localities, farmers and cooperatives have applied microbiological technology and biofloc technology to improve productivity and quality of shrimp seeds, and 3-stage semi-biofloc circulation technology for shrimp farming.

3. Some solutions to promote digital transformation in agriculture in Vietnam today

Vietnamese agriculture is currently in the process of digital transformation. The industry's activities have drastically changed in the way of management, production and consumption of products. The goal of developing digital agriculture, smart and modern agriculture is gradually being realized. However, it must also be assessed objectively that the digital transformation of Vietnamese agriculture is taking place on a small scale and at a slow pace, with many localities still confused and lacking synchronization.

To further accelerate the digital transformation of agriculture, it is necessary to focus on the following solutions:

Firstly, increase investment in agricultural digital infrastructure. First of all, it is necessary to build a wide telecommunications infrastructure, implement 4G and 5G coverage to meet the needs of using Internet services and other telecommunications services, especially in remote and border areas. To facilitate the deployment of databases to people, cooperatives, and businesses, and carry out digital transformation synchronously between localities, it is necessary to invest in new information technology equipment for these organizations, especially at the commune level. It is necessary to build and complete an agricultural data warehouse for each specific field of the industry. Build software and basic database system platforms, urgently deploy to farmers, businesses and cooperatives. Standardize the process of connecting and synchronizing data with the national one-stop electronic system and online public service system. The state also needs to focus on investing more resources in developing rural infrastructure in mountainous areas and ethnic minority areas (electricity systems, telecommunications transmission stations) to truly create a breakthrough for digital transformation in agricultural industry nationwide. In addition, choosing and using a digital transformation technology platform suitable for the conversion content is also a requirement. The State and businesses should have investment plans, support and training for farmers and businesses to use technical means to serve agricultural production and services.

Second, raise awareness of localities, businesses and especially farmers about the role and importance of applying digital technology to production and business in the agricultural industry. To successfully transform digitally, it is necessary to change people's thinking and awareness, and improve the scientific and technological level of farmers, businesses and cooperatives. First, it is necessary to make farmers and businesses clearly understand the nature and process of digital transformation in agriculture and the economic benefits from digital transformation. When farmers and businesses understand and correctly perceive digital transformation, realizing that this is the foundation and driving force to create a breakthrough in labor productivity, improve product quality and product competitiveness, then they will proactively receive knowledge about digital transformation, research, and application of science and technology into the production process. Digital transformation is related to technology, basically farmers are limited in accessing and using technology. Therefore, they need to be held by the hand, guided, trained and consulted directly. It is necessary to organize seminars, send technical experts to share and teach farmers and businesses digital production skills and e-commerce skills, helping them understand science and technology and technical processes, garden management, markets, agricultural materials... Along with digital transformation, the comprehensive development of farmers and businesses will create a highly qualified and knowledgeable workforce, creating a basis for the development of modern Vietnamese agriculture.

Third, build and perfect policies to serve digital transformation in agriculture in an appropriate and timely manner, creating motivation to promote the digital transformation of the agricultural sector in a focused and effective manner. First of all, the Ministry of Agriculture and Rural Development presides and coordinates with relevant ministries and branches to advise the Government to build a policy system to serve digital transformation that is appropriate, focused, and focused according to direction to create favorable conditions for the industry's digital transformation; Support agricultural entities to have enough resources to apply digital technology, develop digital human resources, and link the digital business community; review, amend and supplement the contents and norms of State support for the application of high technology and digital technology in agriculture; simplify procedures for accessing technological infrastructure, land, and capital; review and supplement policies to encourage organizations and businesses providing digital services in the fields of economics, trade, health, education... to invest in agriculture. Strengthen connections between the Government, ministries, central departments, localities, businesses and farmers in digital transformation. Digital transformation in agriculture is inevitable. To facilitate digital transformation in agriculture, it requires the participation and coordination of agencies and departments from central to local levels, and especially farmers must be willing to change their thinking, approach science, technology.

Conclusion

In the context of international integration, climate change, epidemics and especially the Fourth Industrial Revolution, digital transformation in agriculture is an inevitable trend, the "key" to sustainable development of the Vietnamese culture. Digital transformation of agriculture and rural development is an indispensable objective requirement and is the responsibility, obligation and right of the whole system, industry, businesses, science and technology and especially farmers; is a method to achieve the goal of developing smart agriculture and modern rural areas, increasing the proportion of digital agriculture in the production, processing, market and economy chain.

With the Party's correct policies, the Government's strong decisions, and the participation of central and local ministries, farmers and businesses are gradually accessing technology and applying modern technology into the following stages: cultivation, animal husbandry, processing and agricultural services. However, in order to accelerate the process of digital transformation in agriculture in the coming time, it is necessary to further promote the role, initiative and creativity of the entire political system to create a breakthrough for Vietnamese agriculture.

References

1. Central Economic Committee, Workshop, Digital transformation of agriculture and rural areas in the process of industrialization and modernization to 2030, vision to 2045, Hanoi, December 17, 2021.
2. Electronic information portal of the Ministry of Agriculture and Rural Development: Online conference on digital transformation in the field of agriculture and rural development, June 18, 2021. https://www.mard.gov.vn
3. Do Huong, Deployment of planting area code information, 2022. https://baochinhphu.vn/trien-khai-he-thong-thong-tin-ma-so-vung-trong-102220819185808825.htm
4. Linh Huong. Promoting digital transformation of the forestry industry, 2023. https://baothanhhoa.vn/chuyen-doiso/day-manh-chuyen-doi-so-nganh-lam-nghiep/181805.htm
5. Chu Khoi, Duc Long. Digitizing the value chain of agricultural production and consumption, http://vneconomy.vn, November 17, 2021.
6. General Statistics Office. Press release on the results of the mid-term rural and agricultural survey in 2020.