Vietnam Journal of Agricultural Sciences

p-ISSN 2588-1299
e-ISSN 3030-4520

VJAS 2026; 9(1): 2898-2914
https://doi.org/10.31817/vjas.2026.9.1.10

A Review on Digital Transformation in the Management of Agricultural Cooperatives: Theoretical Foundations and Policy Implications

Nguyen Xuan Hoa[1], Le Thanh Ha[2]*, Nguyen Thi Thanh Phuong[3], Nguyen Trong Tuynh[2], Nguyen Ngoc Diep Linh[2] & Do Tuan Minh[4]

[1]Faculty of Natural Resources and Environment, Vietnam National University of Agriculture, Hanoi 12400, Vietnam

[2]Faculty of Accounting and Business Management, Vietnam National University of Agriculture, Hanoi 12400, Vietnam

[3]Institute of Accounting and Auditing, University of Economics, Hanoi 12000, Vietnam

[4]Office of International Cooperation, Vietnam National University of Agriculture, Hanoi 12400, Vietnam

Abstract

Digital transformation in the management of agricultural cooperatives has emerged as a strategic solution to enhance operational efficiency, transparency, and competitiveness in the era of agriculture 4.0. This paper develops an analytical framework grounded in established theories, including the technology - organization - environment framework, to identify the key factors influencing digital transformation. These include the technological infrastructure, enabling institutional frameworks, human resource capacity, market-driven imperatives, and organizational digital readiness. Based on this framework, the study proposes a five-stage digital transformation roadmap, ranging from basic data digitization to the integration of intelligent management. The findings suggest that small-scale cooperatives should start with low-cost technologies such as Excel and basic accounting software; mid-sized cooperatives can adopt e-commerce platforms and product traceability systems; and leading cooperatives may incorporate advanced technologies such as artificial intelligence and blockchain. Some policy implications are proposed to improve the digital transformation process in cooperative management.

Keywords

Digital transformation, agriculture 4.0, management, digital technology, agriculture policy

Received: June 7, 2025
Accepted: January 23, 2026

Correspondence to
Le Thanh Ha
ltha@vnua.edu.vn

ORCID
Le Thanh Ha
https://orcid.org/0000-0003-1997-7973
Nguyen Xuan Hoa
https://orcid.org/0000-0003-3934-8760

Introduction

Global agriculture is entering a new phase of development with the strong influence of digital technology. Some digital technology

such as sensor systems, the Internet of Things (IoT), artificial intelligence (AI), big data, blockchain and cloud computing platforms are fundamentally changing the way production, consumption, and management are organized in the agricultural sector (Sarker *et al.*, 2019). In this context, digital transformation (DT) has evolved from a trend into a strategic imperative for all entities participating in the agricultural value chain, including cooperatives (Araújo *et al.*, 2021). A survey conducted by the Vietnam Cooperative Alliance (2025) highlighted the urgent need for digitalization in the management of cooperatives, particularly in areas such as the management activities of the cooperative; management of members' communication and participation; transparency and communication with clients; and transparency and communication with other stakeholders. Modern technologies that are increasingly being adopted in cooperative management digitalization include information technology (IT) system security, management software, e-commerce, cloud computing, and remote management of services and infrastructure. It is evident that the digital transformation in cooperative management has received considerable attention from cooperatives in many countries as a means to improve management efficiency. The development of cooperative models around the world in places such as in Europe, China, Africa, and Japan, among others, shows that DT is the key to improving productivity, management efficiency, and market integration (Phan Trong An, 2022; Qin *et al.*, 2022) .

Although Vietnam issued the National Digital Transformation Strategy and has integrated digital agriculture objectives into national programs such as the New Rural Development Program, empirical evidence reveals a significant implementation gap at the cooperative level, mainly due to constraints in digital infrastructure, a limited organizational capacity, and inadequate institutional arrangements (Nguyen Huu Nhuan *et al.*, 2022). Policy instruments supporting digital innovation in cooperatives also remain fragmented and insufficiently targeted, reducing the effectiveness of policy implementation and hindering the adoption of digital technologies across diverse cooperative structures (Duong, 2023).

In general, both international and domestic research on DT has primarily focused on enterprises, while studies specifically addressing cooperatives remain limited. At the international level, reports and multilateral initiatives on agricultural digitalization mainly regard cooperatives as actors within the rural digital ecosystem (Joshi, 2024), but in-depth studies on the internal management structure of cooperatives and the ways in which digitalization reshapes management processes are scarce (. Many recent reviews and studies have concentrated on the digital capacity or the extent of technology adoption in agricultural cooperatives in general, yet have paid little attention to management mechanisms such as decision-making, organizational structure, membership rights, and internal control (Zheng *et al*., 2024; Shirwa *et al.*, 2025). In Vietnam, research has also tended to emphasize DT in agricultural production within cooperatives rather than delving into cooperative management specifically (Vu Thi Hai *et al*., 2022; Duong Hoai An *et al*., 2025). Consequently, in order to improve the theoretical and practical framework for DT in cooperative management and to propose appropriate solutions, this article aimed to: (i) clarify the concept, contents, and factors influencing digital transformation in cooperative management; (ii) propose several solutions for promoting DT in cooperative management in the current Vietnamese context; and (iii) suggest a number of policy implications to facilitate DT in cooperative management in Vietnam.

To accomplish the above objectives, first, data sources were systematically identified. Only peer-reviewed journal articles, official institutional reports, and policy documents published between 2010 and 2025 were considered. Databases such as Scopus, Web of Science, ScienceDirect, and Google Scholar were searched using keywords including "digital transformation," "agricultural cooperatives," "agriculture 4.0," and "technology–organization–environment (TOE) framework." Only documents that met the following quality criteria were included: (i) publication in peer-reviewed journals or official institutional reports; (ii) explicit discussion of digital transformation or accounting information systems in cooperative or business contexts; and (iii)

sufficient methodological transparency for coding. In total, more than 120 documents were initially collected, and 63 were retained after screening for relevance and quality. Reference arrangement method is shown in **Table 1.**

Second, a coding scheme was applied. Each selected source was coded according to the three dimensions of the TOE framework (Tornatzky & Fleischer, 1990). Within each dimension, sub-categories were inductively generated. For example, under the "Technology" dimension, the codes were technological readiness (infrastructure, internet access), compatibility (alignment with cooperative practices), and complexity (perceived ease of use). Under "Organization," the codes captured leadership capacity, financial resources, and organizational culture. Under "Environment," the codes focused on policy support, market pressure, and external partners. To ensure coding consistency, two researchers independently coded the samples, and then discussed the results to reach a consensus on the coded content.

Theorical Literature about Agricultural Cooperative Management in the Context of Agriculture 4.0

Contents of agricultural cooperative management

Agriculture 4.0 involves the integration of digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data, blockchain, cloud computing, and autonomous robots to optimize the agricultural value chain from input to output. According to Araújo *et al.* (2021), agriculture 4.0 is not simply the application of technology to production but also creates a comprehensive digital ecosystem in which production, harvesting, processing, consumption, and traceability activities are connected and coordinated in real time. The evolutionary model of agriculture is often divided into four stages: (1) Agriculture 1.0: Manual labor, mainly dependent on human power and animal traction; (2) Agriculture 2.0: Mechanization, applying machinery to land preparation, planting, and harvesting; (3) Agriculture 3.0: Applying precision technology such as GPS, sensors, and climate models to make production decisions; and (4) Agriculture 4.0: Automation, IoT, big data analytics, AI, blockchain, and digital services across the entire value chain.

The DT roadmap in agricultural cooperatives can be explained in two dimensions: the level of digital technology application (vertical axis) and the level of impact of those technologies on the cooperative's value chain (horizontal axis). This model shows that the digitalization process is a gradual process, divided into four levels of digital strategy corresponding to the level of technological development and the scope of influence. At the basic level, cooperatives start with accessing the internet and using the web and social networks to promote products - this is called the "*Low Digital Strategy*", mainly aimed at communication and customer approach. As they develop further, cooperatives apply e-commerce and cloud computing to manage orders and customer data, creating an "*External Oriented Digital Strategy*" focusing on consumption and marketing.

Table 1. Reference arrangement method

Dimension	Sub-categories	Number of encrypted documents (N)
Technology (22)	Technological readiness	9
	Compatibility	7
	Complexity	6
Organization (21)	Leadership capacity	8
	Financial resources	7
	Organizational culture	6
Environment (20)	Policy support	8
	Market pressure	6
	External partners	6

At a higher level, cooperatives deploy technologies such as robotization, big data, and the IoT to optimize production, crop management, and input-output, thereby forming an "*Internal Oriented Digital Strategy*". The pinnacle of the transformation process is the "*Smart Digital Strategy*", when cooperatives integrate AI for decision-making and blockchain to ensure value chain transparency. This model shows that a clear digital strategy is a prerequisite for cooperatives to successfully implement large-scale digital initiatives (Ciruela-Lorenzo *et al.*, 2020) .

The process of digital transformation involves investment in digital capabilities and leadership capabilities for transformation (Westerman *et al*., 2014). These two dimensions can be combined to identify four types of organizations in the digital transformation journey: beginners, fashionistas, conservatives, and digital masters (Westerman *et al*., 2012). The successful realization of digital transformation depends not only on technology but also on strategic orientation and the organizational culture (Kane *et al*., 2015). This is considered a comprehensive approach to DT that includes planning, monitoring, and changing management steps, and these elements are key for effectively implementing the transformation of cooperative management in the context of digital agriculture (Zimmermann *et al.*, 2015). Building a DT program in cooperative management can be standardized, helping to turn this process into a specific and planned activity rather than a random activity (Cherepanov & Popov, 2022) . Digital transformation involves applying digital technologies to optimize and restructure business processes, thereby improving operational efficiency and promoting innovation (Wan *et al.*, 2023).

Digital transformation in cooperative management is the process of strategically integrating digital technologies into cooperative operations to improve business processes, operating models, and the overall performance of the cooperative. This concept plays a key role for cooperatives aiming to develop in the era of agriculture 4.0, as it helps businesses transform from traditional management models to flexible, adaptive, and technology-based approaches, keeping up with the trend of digital agricultural production and business.

Cooperative management contents in the context of the digitalization of agricultural cooperative management is a multidimensional system made up of four main components: membership management, financial management, production management, and consumption management. In the era of agriculture 4.0, each of these contents is enhanced through the application of DT, helping to increase operational efficiency and information transparency, and improve market responsiveness (**Figure 1**). Digital transformation in agricultural cooperative management is a shift from the traditional management model to a model based on data and digital technology, where the cooperative is not only a production unit but also a data center, a decision-making center, and an information bridge among farmers, businesses, and markets.

Cooperative management contents in the context of agriculture 4.0

Digital transformation not only helps with effective internal management but also expands connectivity among cooperatives, its members, the market, and management agencies in a smart agricultural ecosystem. The complex of agricultural cooperative management activities includes member management, financial management, production management, and consumption management (**Figure 2**).

Membership management includes recording, storing, and updating information about each member's personal information, capital contributions, production capacity, and level of participation in activities (Golmohamma, 2018). Digital transformation allows the construction of an electronic record system, integration of an online voting platform, and monitoring of members' contributions and distribution of benefits in the cooperative.

Financial management is associated with the process of budget planning, cash flow control, fund allocation, and transparency of financial reporting (National Assembly of the Socialist Republic of Vietnam, 2012). Digital technology supports the use of cloud accounting software and dashboards to visualize revenue and expenditure data, control spending, and connect electronic invoices with tax authorities (Poppe *et al.*, 2023) .

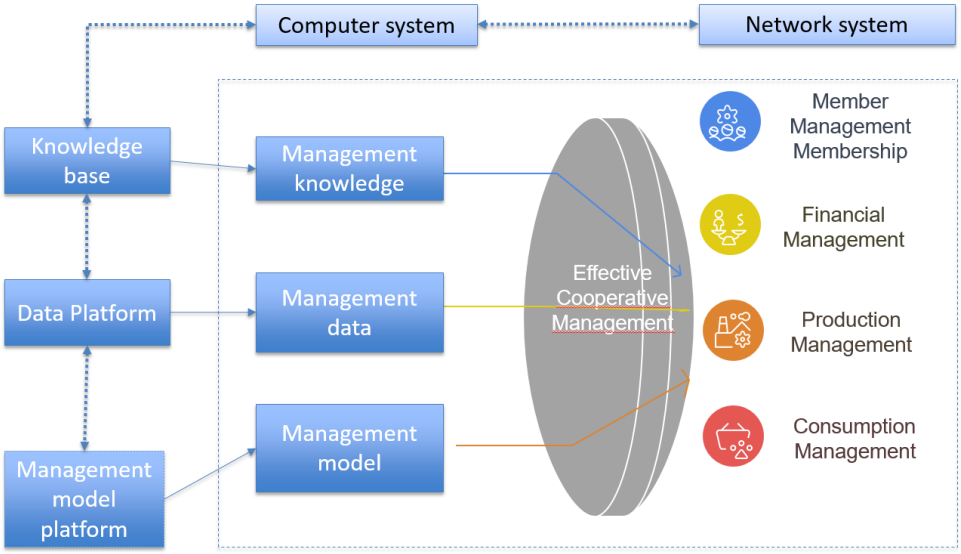

Figure 1. Agricultural cooperative management model in the context of agriculture 4.0
Source: Adapted from Araújo *et al.* (2021)

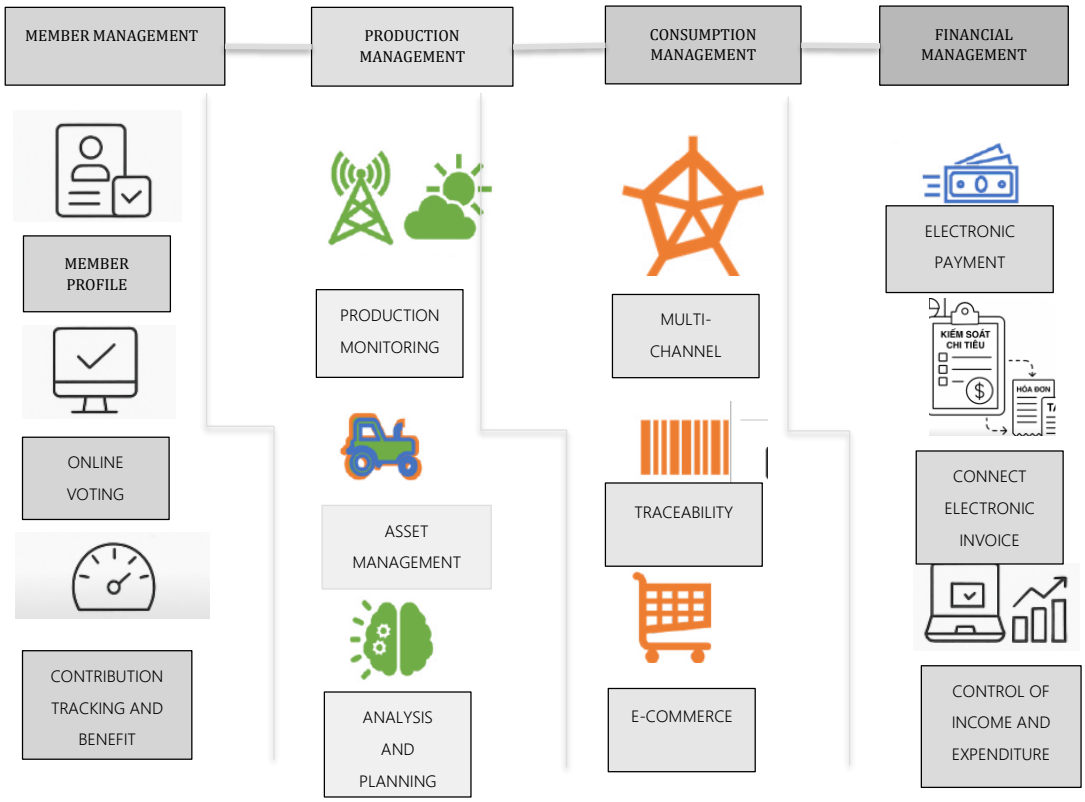

Figure 2. Digital transformation ecosystem in cooperative management
Source: Adapted from Montesclaros & Teng (2023)

Production management includes seasonal planning by raw material area, production log management, quality control, and technical process standardization. IoT technology, environmental sensors, weather forecasting software, traceability, electronic logs, and digitalized growing area maps help monitor and coordinate production in real time (Sarker

et al., 2019). In agricultural cooperatives, production management is the easiest area to apply DT because it can integrate quantitative data (crops, equipment, fertilizers, weather) and coordinate actions in real time. Currently, digital technologies are mainly designed to serve the convenience of agricultural production management.

Consumption management is the activity of coordinating products to the market, connecting with distributors, building brands, and taking care of customers. Cooperatives can use e-commerce platforms, integrate blockchain systems to ensure transparent traceability, use software to track consumer behavior, and deploy multi-channel digital marketing campaigns (Montesclaros & Teng, 2023). It can be said that the emergence of DT has made the market expansion efforts of agricultural cooperatives more convenient.

The context of agriculture 4.0 has created changes in the way cooperatives are governed. This is reflected in changes in management tools, decision-making, information transparency, monitoring mechanisms, member participation, market access, consumer feedback, flexibility, operating costs, and increased competitiveness of cooperatives. However, it can be seen that the application of management in the context of agriculture 4.0 faces difficulties in initial investment costs for technology, equipment, software, training, and maintenance. This is a difficult problem for most small-scale cooperatives (Krisnawati, 2019). Cooperatives are susceptible to dependence on technology suppliers, which poses risks in updating, maintaining, or converting platforms if they are not standardized and supported by independent training (Vinogradova & Galimova, 2021).

Factors affecting the digital transformation of cooperatives

The process of approaching and evaluating the factors affecting cooperative management in the context of agriculture 4.0 needs to ensure systematicity and consistency. The model of factors affecting the DT process in agricultural cooperative management can be approached through the TOE **(**technology - organization - environment) theory developed by Tornatzky & Fleischer (1990). With this model approach, the influencing factors will include issues related to technology, the organizational structure, and the operating environment of cooperatives. The factors affecting cooperative management in the context of agriculture 4.0 can be identified as follows **Table 2.**

Technology factors

Technological readiness: Access to telecommunications infrastructure, software for accounting, production, and consumption, and open agricultural data plays a fundamental role in technological readiness. This also includes production equipment, warehouse systems, and logistics networks. Integrating technology with existing infrastructure is a significant challenge in the DT process of agricultural cooperatives (Rajchelt-Zublewicz *et al.*, 2019). Technological resources include a variety of software, hardware, connectivity, and security systems. Digital transformation requires cooperatives to have access to technology appropriate to the scale of their operations (Schoemaker *et al.*, 2018).

Technology compatibility: Digital management systems need to be compatible with the current production processes and technology levels of cooperative members. The educational levels, digital skills, and ages of the cooperative's board of directors and members are factors that influence the speed of adoption of new technologies (Geng *et al.*, 2024). The agricultural business environment creates its own socio-cultural characteristics for cooperative members and cooperative management board members. The speed of technology adoption of agricultural cooperative management board members can be much slower than that of businesses in other sectors.

Organizational factors

Internal management capacity: According to Vinogradova & Galimova (2021), cooperatives fail in DT largely due to the lack of a transformation plan, failure to link technology with strategic goals, or untrained personnel. The acumen of the cooperative's board of directors in adapting to technology and their management capacity are decisive factors in the success of the cooperative's DT performance (Shakir *et al*., 2020).

Table 2. Summary of the factors affecting the digital transformation of cooperatives according to the TOE framework

Ingredient	Specific factors	Describe	References
Technology	Technology readiness level	Infrastructure, software, equipment	Rajchelt-Zublewicz *et al.* (2019)
	Compatibility	Suitable for cooperative capacity	Golovina *et al.* (2023)
Organization	Internal management capacity	IT skills, management skills	Vinogradova & Galimova (2021)
	Organizational structure	Decentralization, internal processes	Igbokwe (2017)
	Financial resources	Ready to accept new things	Barney(1991); Rajchelt-Zublewicz et al. (2019)
Environment	Institutions - policies	Regulations, funding, incentives	Zheng et al. (2024)
	Market pressure	Demand for transparency and traceability	Montesclaros & Teng (2023)
	External partners	Technology enterprises, support organizations	Ayamga *et al.* (2023)

Cooperative financial resources: Research in Kenya shows that digital credit policies and financial support, including equity, financial reserves, and the ability to mobilize capital, have a significant impact on the ability to adopt technology. These are prerequisites for investing in digital infrastructure (Barney, 1991; Rajchelt-Zublewicz *et al.*, 2019). Stable financial resources, access to credit, and cost control determine whether cooperatives have the capacity to deploy technology, maintain digital operating systems, and scale up operations (Krisnawati, 2019).

Organizational structure and culture of cooperatives: Consensus and open-mindedness within cooperatives are factors that promote the application of technology in cooperative management. The fear of innovation and loss of benefits in the digital model are common barriers in cooperatives in the context of agriculture 4.0 (Igbokwe, 2017).

Environmental factors

Institutions - policies: The roles of policies and the government are important keys in creating a favorable legal environment for the digitalization of cooperatives (Igbokwe, 2017). Regulations related to digital signatures, electronic invoices, open data standards, and information technology support policies in agriculture are important foundations. According to Zheng *et al.* (2024), cooperatives can only effectively digitize when there is clear institutional support, mandatory conventions for cooperatives when participating in cooperative alliance networks, or support from local authorities.

Market pressure: The need for value chain transparency, e-commerce connectivity, and quality standardization are the driving forces behind the digitalization of cooperative processes (Montesclaros & Teng, 2023). Competitive pressure and increasing consumer demand for transparency in production and consumption information create pressure for cooperatives to transform their management process from manual to digital data management. Therefore, the digitalization process needs to be implemented to meet these objectives.

External partners: The participation of technology companies, NGOs, and research institutes play a role in providing technical support and sharing the risk of DT (Ayamga *et al*., 2023). With support and companionship from third parties such as businesses, universities, and other consulting institutions, the DT process in cooperative management will be smoother and more effective.

Cooperative management capacity

Management capacity significantly affects the success of cooperative models (Vukelić & Rodić, 2014). Cooperative management capacity in the context of agriculture 4.0 is crucial to adapt to technological advances and sustainability challenges facing the agricultural sector. As the

agricultural sector develops with the application of 4.0 technology, the need for a skilled workforce that can take advantage of advanced technologies and manage complex systems becomes especially important. The process of cooperative management in the context of agriculture 4.0 needs to update the following key competencies:

(i) Technical knowledge and information technology skills: Proficiency in information technology and the ability to interact with modern interfaces are essential to manage smart farming technologies (Jurburg & Cabrera, 2019). Although technical factors are important in the stage of agricultural digitalization 4.0, administrators still need to control technological factors during system operation (Danielak & Niewiadomski, 2022).

(ii) Teamwork and communication: Effective collaboration among diverse stakeholders, including farmers, engineers, and policy makers, is critical to implementing sustainable practices (Arvanitis & Symeonaki, 2020). Negotiation skills are considered important in cooperative management.

(iii) Organizational skills and positive management attitude: Management capacity in agriculture depends not only on professional knowledge but also on organizational skills and the positive attitudes of management subjects (Bahua, 2018) .

(iv) Entrepreneurial spirit and intrinsic motivation: Successful cooperative management often aims to develop cooperative models into social enterprise start-up models, combining commerce, education, and culture (Yu *et al.*, 2023) .

The Current State of Digital Transformation in Agricultural Cooperative Management in Vietnam

Overview of digital transformation in agricultural cooperative management in Vietnam

The situation of digital technology used in cooperative management in Vietnam is synthesized in **Table 3.** According to a report by the Vietnam Cooperative Alliance (VCA) (2024), the level of DT of cooperatives nationwide has reached an average of about 32%. In which, 13.6% of cooperatives have completed DT, 50% of cooperatives are in the process of implementation, and 36.4% of cooperatives have not implemented DT. The digital technologies currently in use are mainly at the basic level such as basic management software (digital signatures, accounting software) and traceability stamps. For example, in Ninh Binh, about 70% of the 336 total cooperatives have applied digital technology to one of the activities of management, production, or the promotion of products. In which, about 50% of the cooperatives have applied DT in cooperative management and operation activities, about 30% of cooperatives in social networking platforms for product promotion and consumption activities, and about 20% of cooperatives have applied DT in production, processing, and traceability activities (Ninh Binh Provincial Cooperative Alliance, 2024). Common digital technologies used in cooperative management in Vietnam are still limited, such as digital

Table 3. Synthesis of digital technology used in cooperative management in Vietnam

Technology Team	Example of the technology in use	Applicability	References
Digital Administration	Digital signatures; e-invoices; accounting software (MISA, Fast); cooperative management and operation software	Popular, basic; most of the cooperatives have approached	Ministry of Agriculture and Rural Development (2024); VCA (2024)
Traceability	QR stamp; VNPT Check software; Local Retrieval System	Applied in cooperatives producing agricultural products and OCOP specialties; accounting for about 20% in the Ninh Binh survey	Ninh Binh Cooperative Alliance (2024)
Digital Payments & Finance	QR Pay; Mobile Banking; e-wallets; Online Financial Reporting	Gradually gaining popularity, depending on bank support	VCA (2024)
Digital Training & Networking	Zoom, Google Meet, Teams; Cooperative portal	Mainly used in training and connecting with management agencies	VCA (2024)

administration, traceability, digital payment and finance, training, and connection. However, the level of application is not high.

The system of mechanisms and policies for DT in cooperative management in Vietnam (**Table 4)** has formed a relatively complete

Table 4. Summary of policies related to digital transformation in cooperative management in Vietnam

Group	Text	Main contents related to cooperative management
Legal Orientation & Framework	Resolution No. 20-NQ/TW dated June 16, 2022 of the XIII Party Central Committee on continuing to innovate, develop, and improve collective economic efficiency in the new period. Resolution No. 09/NQ-CP dated February 2, 2023 of the Government on the Action Program to implement Resolution No. 20-NQ/TW dated June 16, 2022 of the Central Executive Committee.	Innovation of the economy; assign implementation tasks, including modernizing cooperative management.
Specialized Law	The Law on Cooperatives 2023, approved by the 15th National Assembly during its 6th Session (November 2023), took effect on July 1, 2024.	Strengthening the organizational and management framework; paving the way for transactions and electronic records in the cooperative.
Directing a separate DT for cooperatives	Directive No. 19/CT-TTg dated December 14, 2024 of the Prime Minister on continuing to promote the implementation of Resolution No. 20-NQ/TW, developing the collective economy and cooperatives in the current situation.	Promoting cooperative DT of cooperative data, e-invoices, e-commerce, traceability stamps, and training.
Assistance Programs	Decision No. 1804/QD-TTg dated 13/11/2020 of the Prime Minister approving the Program to support the development of the collective economy and cooperatives in the period of 2021-2025.	Training, consulting, IT application, and trade promotion for cooperatives.
Management model/standard	Decision No. 167/QD-TTg dated February 3, 2021 of the Prime Minister approving the Plan for the development of the collective economy and cooperatives for the period of 2021-2025.	Replicate new cooperatives efficiently—standardize processes for digitalization.
National Digital Platform	Decision No. 749/QD-TTg dated June 3, 2020 of the Prime Minister approving the "National Digital Transformation Program to 2025, orientation to 2030".	Objectives and targets on digital platforms, digital skills, architects, and social workers.
Digital Transactions	Decision No. 411/QD-TTg dated March 31, 2022 of the Prime Minister approving the "National Strategy for the development of the digital economy and digital society to 2025, with orientation to 2030".	Legal validity for digital signatures, electronic contracts, and digital records of cooperatives.
Data–identifiers	The Law on Electronic Transactions in 2023, approved by the XV National Assembly, took effect on July 1, 2024, replacing the Law on Electronic Transactions in 2005. Decision No. 06/QD-TTg dated January 6, 2022 of the Prime Minister approving the Project "Developing the application of population data, electronic identification, and authentication for national digital transformation in the period of 2022-2025, with a vision to 2030". (Commonly referred to as *Scheme 06*).	Electronic identification/authentication, VNeID, QR—background for digital retrieval and procedures.
Invoices – digital accounting	Circular No. 78/2021/TT-BTC dated September 17, 2021 of the Ministry of Finance guiding the implementation of a number of articles of the Law on Tax Administration and Decree No. 123/2020/ND-CP on invoices and documents (applying e-invoices). Decision No. 206/QD-BTC dated February 24, 2022 of the Ministry of Finance promulgating the Ministry of Finance's Digital Transformation Plan to 2025, with a vision to 2030.	Mandatory nationwide e-invoices—standardizing cooperative financial data.
E-commerce & Digital Promotion	Decision No. 645/QD-TTg dated May 15, 2020 of the Prime Minister approving the National E-commerce Development Master Plan for the period of 2021-2025. Decision No. 1968/QD-TTg dated 22/11/2021 of the Prime Minister approving the Master Plan for e-commerce development for the period of 2021-2025 (supplementing/adjusting Decision 645/QD-TTg).	E-commerce plan for the period of 2021-2025; training ≥100,000 enterprises/cooperatives/households on digital promotion/e-commerce.
Financial support	Decree No. 45/2021/ND-CP dated March 31, 2021 of the Government on the implementation of administrative procedures in the electronic environment. Circular No. 52/2022/TT-BTC dated August 30, 2022 of the Ministry of Finance regulating information data standards in the financial sector to deploy information technology applications.	Cooperative Development Support Fund (central/local): lending, guaranteeing, and supporting interest rates for digitalization projects.

foundation, but there are still gaps that hinder expansion and deepening. In terms of strengths, the Government has had its own direction on DT in the cooperative economic sector (*Directive 19/CT-TTg)* – creating an "axis" of tasks for ministries, sectors, and localities, and emphasizing training, e-commerce, e-invoices, traceability stamps, and cooperative databases. The legal framework for digital transactions was completed with the Law on Electronic Transactions 2023 (effective July 1, 2024), ensuring the legal value of digital signatures and contracts/electronic records; and *Circular 78/2021/TT-BTC* concerning mandatory electronic invoices – directly raising the standards of transparency and the digitization of accounting in cooperatives. In addition, resources from current programs can be integrated: *Decision 1804* (supporting the cooperative economy in the period of 2021-2025), *Decision 167* (replicating the new cooperative model), and *Decision 645* (e-commerce master plan during the period of 2021-2025) to finance training, consulting, digital promotion, and infrastructure for the digitalization of management.

However, there are still gaps in policies such as: (i) there is no specialized central budget program only for "cooperative management corporations", so localities are mainly integrated, leading to the dispersion of resources; (ii) there is a lack of a national-level shared digital platform (integrated accounting-operation-retrieval), which causes each province and project to choose its own solutions, increasing costs and risks of incompatibility; and (iii) there is no uniform standard of cooperative management data or a set of indicators to measure the level of DT in cooperative management nationwide, so the evaluation of effectiveness is still fragmented and depends on the practice of each locality. These limitations indicate the need for a unified scheme/framework on platforms, data, and evaluation indicators, accompanied by a targeted financial mechanism, to move from "project mainstreaming" to specialized policies for DT management cooperatives.

In the ASEAN context, Vietnam's digital transformation of agricultural cooperatives has made notable progress but still lags behind regional peers in institutional readiness and infrastructure integration. Thailand, for instance, has launched advanced agriculture 4.0 platforms—such as the AI- and IoT-based *HandySense B-Farm*—to support smart farming and farmer connectivity (AIBP, 2025). Meanwhile, Indonesia has accelerated its digital agribusiness agenda through initiatives like its "Smart Village" programs and mobile-app ecosystems connecting farmers directly to markets (Mangurai *et al*., 2021). In contrast, empirical evidence from Vietnam highlights significant fragmentation: many cooperatives still lack digital infrastructure, skilled personnel, and coherent policy implementation (RSIS, 2023). While Vietnam's national strategies emphasize digital agriculture, the policy–practice gap persists, especially among smaller cooperatives. Hence, a regional comparison underscores both the opportunities for policy learning and the urgency for Vietnam to strengthen its cooperative-level digital capacity and institutional coordination.

Challenges in implementing digital transformation in agricultural cooperative management in Vietnam

Institutions and policies*:* Currently, although the Government has issued a National Strategy on DT and has integrated digital agriculture goals into national programs such as OCOP and New Rural Areas, there is still a lack of a specialized policy framework for cooperatives. Cooperatives do not have clear regulations on data standards, security, electronic authentication, digital signatures, or traceability specifically applied to collective economic models. In addition, policies to support technological innovation, software, or financial incentives for cooperatives in DT are still scattered, lacking consistency, and do not reach the right target. The management of financial and performance reports of cooperatives is still loose as there is no mechanism to require cooperatives to submit full performance and financial reports as there is for enterprises. This does not encourage cooperatives to update their technology and improve their management capacity to meet the State management requirements.

Society – culture: Most cooperative members are middle-aged or elderly farmers with low educational attainment and limited digital skills. The fear of change and of failure when adopting new technologies is also a major barrier. Some cooperatives still maintain an administrative–subsidized management model and lack the motivation for innovation. The culture of information sharing, financial transparency, and data democratization, which are the foundations of digital transformation, has not yet been truly fostered. In addition, many cooperatives remain weak in developing digital transformation plans for governance or they set inappropriate goals, and even when plans are formulated, they are not closely aligned with reality (VCA, 2025).

Technology infrastructure*:* Barriers to technology infrastructure create difficulties in synchronously implementing DT programs. Only about 60% of rural areas in Vietnam have stable internet connections (Ministry of Information and Communications, 2023). Meanwhile, most agricultural cooperatives develop in rural areas of Vietnam. This causes major obstacles to the application of DT technologies. Therefore, in 2023, only about 8.4% of agricultural cooperatives nationally applied DT (PSARD 2023).

Technological resources: Most cooperatives do not have a platform for accumulating digital assets, and databases such as member records, production logs, and accounting finances have not been digitized synchronously. The level of DT of agricultural cooperatives in Vietnam is still very limited. Specifically, in 2023, only 15% of cooperatives and farms used digital production management systems, while the majority still relied on traditional methods (PSARD, 2023). Underestimating intangible assets leads to in-depth and unsustainable technology implementation (Vinogradova & Galimova, 2021).

Economic – financial: Most agricultural cooperatives in Vietnam are small in scale, with low revenue and limited capacity for capital accumulation, while the investment costs for software, hardware, staff training, and maintaining digital platforms are relatively high. The report of the Vietnam Digital Agriculture Association (2024) also indicated that 70% of agricultural cooperatives face financial barriers to investing in digital transformation. Specifically, 93.2% of cooperatives have capital of less than VND 5 billion—with 43.2% having capital below VND 1 billion and 50% ranging from VND 1 to 5 billion (VCA, 2025). Thus, financial constraints create major obstacles for investment in digital technology and in developing digital human resources in Vietnam.

Cooperative management capacity: Many cooperatives do not have specialized personnel for DT, and their boards of directors do not have digital skills or have not been trained in data-based decision making. In addition, the lack of data analysis, risk control, and change management departments makes cooperatives prone to failure or abandonment during the implementation process. Additionally, the technical level of Vietnamese farmers is still low, as only about 20% of farmers are trained in digital technology, while the majority are still familiar with traditional production methods (PSARD, 2023). This makes the implementation of technological solutions difficult, especially for cooperative members who have many limitations in accessing information and modern technology.

Some solutions for Vietnam to improve its cooperative management capacity in the context of agriculture 4.0

Framework for approaching solutions to support the digital transformation of agricultural cooperative management in Vietnam

At the center lies the ultimate goal: the digitalization of four core processes—member management, finance, production, and consumption—to generate a "reliable data stream" that supports decision-making. Surrounding this are the three external blocks representing the enabling conditions for DT in the management of agricultural cooperatives **(Figure 3)**.

Technology (T) – "technological capability appropriate to cooperatives": This refers to connectivity infrastructure, devices, and modular software. The policy implication is to select technologies aligned with the cooperative's scale and process complexity, prioritizing a basic package (accounting, digital signature, e-invoice, and member registry) before moving toward digital

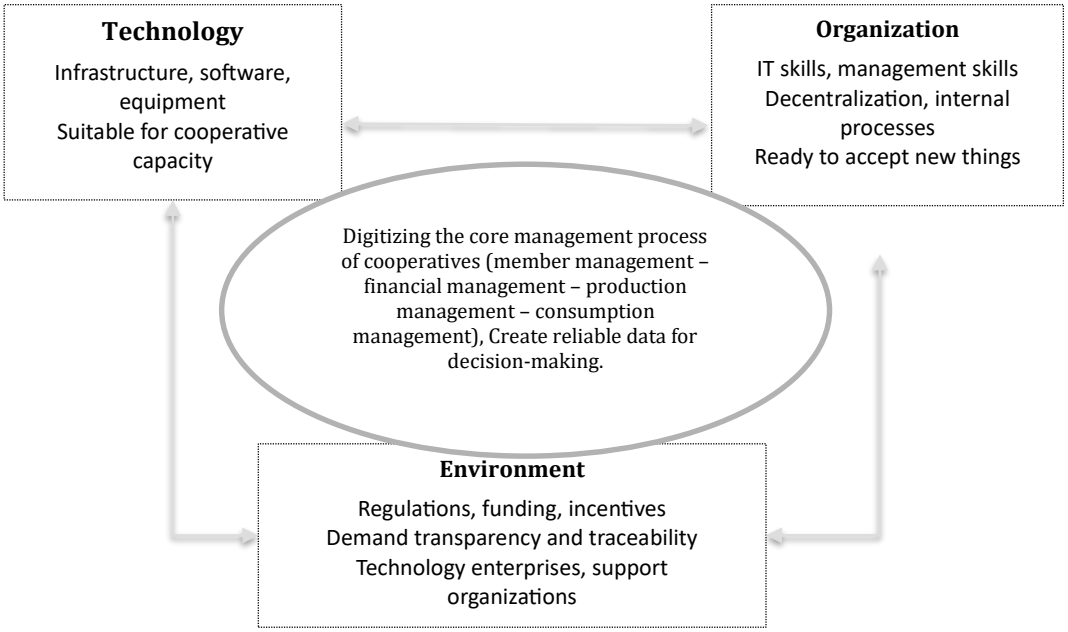

Figure 3. Approach diagram for digital transformation in cooperative management in Vietnam

production logs, QR-based traceability, lightweight ERP, and digital mapping/IoT. Technology is the source of standardized data but only becomes effective when linked with process re-design.

Organization (O) – "organizational capability for change readiness": This covers the information technology and management skills of staff; delegation, internal processes, and data discipline; and attitudes toward innovation. The two-way relationship T↔O emphasizes alignment and adaptability: the simpler and more standardized the technology, the lower the learning curve; conversely, more mature organizations will demand higher-level technologies (integration, analytics).

Environment (E) – "institutional–market environment": This includes the legal framework (e-transactions, e-invoices), financial resources and incentives, market requirements for transparency/traceability, and the ecosystem of technology enterprises/support providers. The interaction E↔T ensures common standards and shared platforms, while E↔O creates both motivation (compliance, rewards–penalties) and capacity (training, advisory services).

Solutions to support the digital transformation of agricultural cooperative management in Vietnam

(i) Technological solutions

It is necessary to build an ecosystem to support the DT of cooperatives along the chain: from telecommunications infrastructure, open software platforms, and financial tools (technology credit, equipment rental and purchase) to technical consulting and periodic digital capacity assessments for agricultural cooperatives.

In the context of agricultural DT, cooperatives can implement digital strategies at appropriate levels to their development level and internal capacity **(Table 5)**. For cooperatives at the basic level, starting with simple digital tools such as building a fanpage on social networks to promote products, using spreadsheet software (Excel) to manage member data, or applying basic accounting software will help them get used to the digital environment. Basic DT activities will not require large resources and are suitable for the scale and characteristics of agricultural cooperatives. For cooperatives that have developed production and product consumption and have a stable operating platform, it is necessary to promote the application of e-commerce solutions to expand the consumption market, deploy electronic production diaries to increase transparency, and apply a traceability system using QR codes to meet the requirements of the market and management agencies. For startup cooperatives with strong resources and a high management capacity, they can aim to integrate advanced

Table 5. Building a roadmap for digital transformation in agricultural cooperative management in Vietnam

Stage	Main content	Applied technology	Prerequisites
Phase 1	Digitize basic data and raise awareness	Accounting software, electronic journal, advanced Excel	Digital skills training organization
Phase 2	Applying production monitoring and control technology	IoT sensors, irrigation controllers, smart greenhouses	Terminals, internet connection, technical knowledge
Phase 3	Data analysis and decision support	AI, data analytics, DSS, predictive modeling	Cooperative staff has the ability to analyze and integrate data.
Phase 4	Connecting markets and digitizing supply chains	Blockchain, e-commerce, CRM, traceability	Third-party collaboration, digital commerce platform, logistics
Phase 5	Comprehensive system integration and automation	ERP, growing area simulation, harvesting and packaging automation system	Integrated infrastructure system, synchronized management software, highly skilled technical staff

technologies such as artificial intelligence (AI) for crop forecasting, blockchain to ensure supply chain transparency, and enterprise resource planning (ERP) systems to comprehensively manage everything from production to consumption. This layered approach helps cooperatives gradually adapt to the digitalization process, provide suitable solutions for specific conditions, and limit risks when deployed on a large scale. Digital transformation in cooperatives needs to be implemented according to a planning process suitable to the capacity, resources, and readiness level of the organization. Below is a roadmap of five stages to implement DT, with each stage corresponding to a step of development in the level of digitalization in the management of agricultural cooperatives (**Table 5**).

Phase 1 (Digitizing basic data and raising awareness): The cooperative starts by digitizing member data, financial records, and production logs, and by deploying internal accounting software, electronic logs, or simple management platforms (e.g. advanced Excel or internal software). At the same time, the cooperative organizes basic training courses to help members learn skills in using mobile devices, computers, and management software. Although this stage involves minimal technological application, it is critical for establishing foundational capabilities.

Phase 2 (Applying production monitoring and control technology): Cooperatives need to equip terminal devices (computers, smartphones, sensors) with a stable internet connection. At this point, data begin to be recorded in real time, supporting faster and more accurate decision making.

Phase 3 (Data analysis and decision support): The cooperative begins to exploit data through the analytics system or decision support software (DSS). They apply statistical models to forecast productivity, diseases, market prices, etc. Data are synchronized and integrated from many sources. This phase requires higher analytical and operational capacities from cooperative staff.

Phase 4 (Connecting the market and digitizing the supply chain): The cooperative establishes an e-commerce system, traces product origins using blockchain, uses customer relationship management (CRM) software to take care of customers, and evaluates consumer behaviors. This means expanding through platforms such as Postmart or Voso, or building an online sales page, and requires coordination with third parties (logistics units, quality control units, etc.).

Phase 5 (Comprehensive automation and system integration): The cooperative deploys a comprehensive management system (ERP), digitally simulates growing areas, automates harvesting and packaging, and synchronizes their finances, warehouse activities, and sales.

(ii) Organizational solutions

It is necessary to focus on digital skills training and improving change management competency within cooperatives. The competency framework was built to

comprehensively reflect the requirements for cooperative administrators in the context of DT and modern agricultural development (**Table 6**). In general, management competencies do not stop at the ability to operate an organization in the traditional way, but have expanded to digital competencies, multi-stakeholder interaction skills, and innovative thinking. In particular, this group of technological energies, including technical knowledge and the ability to operate digital systems, should be considered to have a very high priority, in line with the rapid development trend of smart agriculture. Soft skills such as communication, leadership, coordination, and decision-making in a digital data environment also play an important role in connecting cooperatives with their product supply chain partners.

The highlight of this proposed competency framework is the balance between the requirements of "*digitalization* " and "*human organization* ". The cooperative management capacity requires the combination of systems thinking and learning organizational leadership skills, as well as placing an emphasis on ethics and social responsibility, which make up the core nature of the collective economy of Vietnamese cooperatives today. In addition, the framework is also highly practical as it can be applied to specific goals such as staff assessment, training program design, or the classification of cooperatives according to digitalization capacity.

However, to realize these capacities, there needs to be a systematic investment in training and retraining for the cooperative management staff, and at the same time, cooperatives need to build capacity assessment tools according to quantitative and qualitative criteria suitable for each region and each characteristic of the cooperative's development model. The application of the capacity framework needs to be continuously updated flexibly according to each development stage, the cooperative's DT strategy, and technological developments, as well as changes in the market and sustainable agricultural development policies.

(iii) Solutions on mechanisms and policies

Proposing policies to support digital transformation in cooperative management is mentioned in **Table 7.** A regionally- and sectorally-differentiated policy approach may enhance the scalability of DT by fostering institutional learning. Emphasizing models of 'leading cooperatives' as demonstrative hubs can facilitate the dissemination of digital competencies and shared knowledge across cooperative networks. In Vietnam, when there is a successful model and its superiority is proven, other agricultural cooperatives will actively learn and voluntarily replicate the model. Because the cost of digitalizing agricultural cooperative management will be quite large, digitalization should not take place alone but must be associated with target programs such as OCOP, new rural areas, and crop restructuring to adapt to climate change in localities.

Conclusions

Digital transformation in cooperative management was analyzed along three points: the TOE, which aligns with a management-specific stack (membership, finance, production, consumption), a five-stage DT roadmap that ties technology choices to managerial capabilities, and a value-chain impact. In the context of DT, cooperative management in Vietnam is still at a low stage, with many difficulties in terms of policies, culture, resources, and technology. This study proposed an approach framework to support DT in agricultural cooperative management in Vietnam, including the DT process in basic management activities such as member management, financial management, production management, and consumption management. The support solutions focus on three groups of solutions related to technology, organization, and the policy environment. Some of the recommended policy implications include developing a system of policies to require the standardization of data, statistics, and reports on cooperative activities, and providing financial support for typical digital transformation models and cooperative transformation models.

This study was a synthesis of the theory and practice of DT in the management of agricultural cooperatives in Vietnam. The limitations of the study are that it was unable to explore the causes and consequences of the DT process in cooperative management in-depth or perform

Table 6. Proposed cooperative management capacity framework in the context of agriculture 4.0 in Vietnam

Competency group	Specific content	Priority level
1. Professional and digital knowledge	- Understand smart agriculture technology (IoT, AI, blockchain, DSS) - Operate accounting software, production management, traceability	Very high
2. Leadership and organizational management capacity	- Plan, organize, monitor, and evaluate the effectiveness of cooperative activities - Allocate resources wisely, make decisions based on data	Very high
3. Innovation and adaptation skills	- Quickly grasp technological changes, adapt to the digital environment - Flexible thinking, ready to innovate management models	High
4. Multi-party communication and cooperation skills	- Negotiate and persuade stakeholders (businesses, government, farmers) - Organize internal communications and transparent information sharing	High
5. Data management and digital decision making	- Collect, analyze, and interpret data from information systems - Use dashboards, key performance indicators (KPIs), decision-making software (DSS)	High
6. Risk management and legal compliance	- Identify, assess, and control risks - Master the regulations on tax, environment, food safety, and traceability	Medium
7. Capacity for training and team development	- Guide cooperative members to access new technology - Build a culture of learning and continuous improvement within the organization	Medium
8. Business and market thinking	- Analyze market demand and consumer behavior - Ability to build digital marketing strategies, product positioning on e-commerce platforms	High
9. Ethics and social responsibility	- Transparency and fairness in the distribution of benefits - Promote sustainable production, protect the rights of members and the community	High

Table 7. Proposing policies to support digital transformation in cooperative management

Policy group	Content
Data Standardization Policy	Developing a system of policies to require the standardization of data, statistics, and reports on cooperative activities
Financial Policy	Financial support for typical digital transformation models and cooperative transformation models
Training and consulting	Policies to support digital transformation training and consulting; Developing minimum digital capacity standards of cooperative administrators
Digital market development	Public procurement prioritizes cooperative products with QR/traceability; Conditions for participating in the OCOP program, chain linkage with digitalization requirements

quantitative analysis of the costs and benefits of DT in the management of agricultural cooperatives in Vietnam. Some research directions that can be suggested to have a more complete overview of the topic include surveys to assess the current situation and capacity of DT in the management of agricultural cooperatives as well as factors affecting the irrigation of the DT capacity in the management of agricultural cooperatives, and in-depth analyses of typical cases of costs and benefits in the DT of agricultural cooperative management.

References

AIBP (2025). Thailand Unveils AI-, IoT-based Smart Agriculture Platform. Retrieved from https://www.aibp.sg/latest-in-asean/2402-news-thailand-agriculture?utm_source=

chatgpt.com on May 26, 2025.

Araújo S. O., Ricardo . P., Barata J., Lidon F. & Ramalho J. C. (2021). Characterizing the Agriculture 4.0 Landscape—Emerging Trends, Challenges and Opportunities. Agronomy. 11(4): 667.

Arvanitis K. G. & Symeonaki E. G. (2020). Agriculture 4.0: The role of innovative smart technologies towards sustainable farm management. The Open Agriculture Journal. 14(1): 130-135.

Ayamga M., Lawani A., Akaba S. & Birindwa A. (2023). Developing institutions and inter-organizational synergies through digitalization and youth engagement in African agriculture: The case of "Africa Goes Digital". Land. 12(1): 199.

Bahua M. I. (2018). Managerial Competencies in Agriculture. European Research Studies Journal. 21(2): 623-629.

Barney J. (1991). Firm resources and sustained competitive advantage. Journal of management. 17(1): 99-120.

Ciruela-Lorenzo A. M., Del-Aguila-Obra A. R., Padilla-Meléndez A. & Plaza-Angulo J. J. (2020). Digitalization of agri-cooperatives in the smart agriculture context. proposal of a digital diagnosis tool. Sustainability. 12(4): 1325.

Cherepanov V. V. & Popov E. V. (2022). Concept of the digital transformation of an industrial enterprise. Economics and Management. 28(10):1021-1036.

Danielak W. & Niewiadomski P. (2022). Managerial competences in relation to management level-a survey among manufacturers in the sector of agricultural machinery. Scientific Papers of Silesian University of Technology. Organization & Management/Zeszyty Naukowe Politechniki Slaskiej. Seria Organizacji i Zarzadzanie: No. 164. DOI: 10.29119/1641-3466.2022.164.3.

Duong A. (2023). Unveiling the Role of Government Support: Empirical Studies on the Performance of Cooperatives in Vietnam. DOI: 10.1111/apce.70001.

Duong Hoai An, Nguyen Thi Giang, Duong Xuan Lam, Vu Thi Hien, Ha Quang Trung, Nguyen Manh Thang, Bui Thi Thanh Tam (2023). Readiness for digital transformation in cooperatives in Northeast Vietnam. TNU Journal of Science and Technology. 228 (3): 131-137 (in Vietnamese).

Igbokwe I. (2017). The administrative reform experience in Nigeria. JOSR Journal of Humanities and Social Sciences (IOSR-JHSS). 22(6): 10-19.

Institute of Policy and Strategy for Agriculture and Rural Development (PSARD) (2023). Assessment of the current situation and trends of digital transformation in Vietnamese agriculture (in Vietnamese).

Jurburg D. & Cabrera A. (2019). Análisis de las principales competencias necesarias para la implementación de la Industria 4.0 en el sector agroindustrial uruguyo. Memoria Investigaciones en Ingeniería.17: 151-171.

Joshi J. R. (2024). Understanding the Role of Cooperatives in Economic Development. AMC Journal (Dhangadhi). 5(1): 101-117.

Golmohammadı F. (2018). Farmer Cooperatives as an Agricultural Innovation System for Organizing and Changing Rural Land Use from Peasantry to Collective Action among Villagers in Iran. Black Sea Journal of Agriculture . 1(2): 44-59.

Geng W., Liu L., Zhao J., Kang X. & Wang W. (2024). Digital Technologies Adoption and Economic Benefits in Agriculture: A Mixed-Methods Approach. Sustainability. 16(11): 4431. DOI: 10.3390/su16114431.

Kane G. C., Palmer D., Phillips A. N., Kiron D. & Buckley N. (2015). Strategy, Not Technology, Drives Digital Transformation. MIT Sloan Management Review & Deloitte. 27p.

Krisnawati N. (2019). Assessment of factors affecting cooperatives' performance in Indonesia: The case of credit union cooperatives. Journal of entrepreneurship, Business and economics. 7(2): 80-105.

Mangurai S.UN.M., Solikhin A., Octaviani E. A., and Anidah (2021). Progressing Indonesia's Agriculture 4.0: Research and Application Towards ASEAN Digitalization Initiatives in the COVID-19 Pandemic. Policy Brief. Retrieved from https://asean-crn.org/wp-content/uploads/2021/12/2021_Policy-Brief-Progressing-Indonesia-Agriculture-Research-Application-ASEAN-Digitalization-Covid19.pdf ASEAN-CRN on May 26, 2025.

Ministry of Agriculture and Rural Development (2024). Promote digital transformation in cooperatives. Retrieved from https://www.mard.gov.vn/ on September 12, 2025. (in Vietnamese).

Ministry of Information and Communications (2023). Summary report on work in 2023, directions and tasks in 2024 (in Vietnamese).

Montesclaros J.M.L & Teng P.S. (2023). Digital technology adoption and potential in southeast asian agriculture. Asian Journal of Agriculture and Development. 20(2): 7-30.

National Assembly of the Socialist Republic of Vietnam (2012). Law on Cooperatives 2012. National Political Publishing House Truth (in Vietnamese).

Ninh Binh Provincial Cooperative Alliance (2024). Solutions to promote digital transformation in the field of collective economy, cooperatives in Ninh Binh province. Retrieved from https://lmhtxninhbinh.org.vn/ on September 12th 2025 (in Vietnamese).

Nguyen Huu Nhuan, Duong Nam Ha, Tran The Cuong, Ninh Xuan Trung, Do Huy Hung & Pham Hoang Anh (2022). Digital transformation in international cooperatives and lessons for Vietnam. Journal of Economics and Development. 305(2): 58-68. (in Vietnamese).

Poppe K., Vrolijk H. & Bosloper I. (2023). Integration of Farm Financial Accounting and Farm Management Information Systems for Better Sustainability Reporting. Electronics . 12(6): 1485.

Phan Trong An (2022). Experience in developing agricultural cooperatives in Japan and lessons for Vietnam. Retrieved from:

http://iasvn.org/upload/files/786NM881WC1_an_phantrong.pdf on March 15, 2024 (in Vietnamese).

Qin T., Wang L., Zhou Y., Guo L., Jiang G. & Zhang L. (2022). Digital technology-and-services-driven sustainable transformation of agriculture: Cases of China and the EU. Agriculture. 12(2): 297.

Rajchelt-Zublewicz M., Piwoni-Krzeszowska E. & Matyja M. (2019). Tangible and intangible resources and the financial performance of Polish social cooperatives. Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu. 63(5): 173-187.

RSIS (2023). Empowering Digitalisation in ASEAN Agriculture. Policy Report. Retrieved from https://www.rsis.edu.sg/wp-content/uploads/2023/07/PR230714_Empowering-Digitalisation-in-ASEAN-Agriculture.pdf @RSIS_NTU on May 26, 2025.

Sarker M. N. I., Islam M. S., Ali M. A., Islam M. S., Salam M. A. & Mahmud S. H. (2019). Promoting digital agriculture through big data for sustainable farm management. International Journal of Innovation Applied Studies. 25(4): 1235-1240.

Schoemaker P. J., Heaton S. & Teece D. (2018). Innovation, dynamic capabilities, and leadership. California management review. 61(1): 15-42.

Shakir K. A., Ramli A., Pulka B. M. & Ghazali F. H. (2020). The link between human capital and cooperatives performance. Journal of Entrepreneurship Education. 23(1): 1-11.

Shirwa A. M., Ahmed Y. & Ali R. (2025). A cooperative governance framework for sustainable digital transformation in construction: The role of digital enablement and digital strategy. Journal of Co-operative Organization and Management. 13(1): 227-239.

Tornatzky L. G. & Fleischer M. (1990). The Processes of Technological Innovation. Lexington, MA: Lexington Books.

VCA (2024). There is still a lot of room for the collective economic sector to develop if the State has appropriate support policies. Retrieved from: https://vca.org.vn/du-dia-phat-trien-khu-vuc-lanh-te-tap-the-con-rat-lon-neu-nha-nuoc-co-chinh-sach-ho-tro-phu-hop-a31656.html on May 26, 2025 (in Vietnamese).

VCA (2025). Assessment of the relative gaps in Digital Transformation and the Lack of Digital Transformation Skills in Cooperatives in Vietnam (March 2025). 13p. Retrieved from: https://vca.org.vn/upload/KEND/Report%20Summary%20ENG.docx on September 12, 2025 (in Vietnamese).

Vietnam Digital Agriculture Association (2024). Application of digital technology in Vietnam's agricultural value chain (in Vietnamese).

Vinogradova E. & Galimova A. (2021). Management of changes in companies of the agro-industrial complex: implementation of high technologies. E3S Web of Conferences. 262: 01040.

Vu Thi Hai, Phi Thi Diem Hong & Nguyen Van Phuong (2022). The current status of accounting work at agricultural cooperatives in An Giang province. Vietnam Agricultural Science Journal. 20(1): 89-97 (in Vietnamese).

Vukelić N. & Rodić V. (2014). Farmers'management capacities as a success factor in agriculture: a review. Економика пољопривреде. 61(3): 805-814.

Vietnam Cooperative Alliance (2025). Cooperatives break through capacity, affirm their position from digital transformation. Retrieved from: https://vca.org.vn/htx-but-pha-nang-luc-khang-dinh-vi-the-tu-chuyen-doi-so-a33378.html on July 2, 2024 (in Vietnamese).

Wan J., Lin S. & Wu Q. (2023). The Concept and Connotation of Enterprise Digital Transformation. Wuhan International Conference on E-business. Springer. 315-324.

Westerman G., Bonnet D. & McAfee A. (2014). Leading Digital: Turning Technology into Business Transformation. Harvard Business Review Press. 24p.

Westerman, G. and McAfee, A. (2012) The Digital Advantage: How Digital Leaders Outperform Their Peers in Every Industry. The MIT Center for Digital Business. Retrieved from http://ide.mit.edu/sites/default/files/publications/TheDigitalAdvantage.pdf on December 22, 2025.

Yu X., Liu W., Qing L. & Zhang D. (2023). Improving farm cooperatives' performance and sustainability: A study of agricultural managers' competencies based on the grounded theory and the fsQCA methods. Sustainability. 15(2): 1263.

Zheng, Y., Li, H., & Wu, J. (2024). Does government policy matter in the digital transformation of farmers' cooperatives? —A tripartite evolutionary game analysis. Frontiers in Sustainable Food Systems. 8: 1398319.

Zimmermann A., Schmidt R., Jugel D. & Möhring M. (2015). Evolving enterprise architectures for digital transformations. Digital Enterprise Computing (DEC 2015). Bonn: Gesellschaft für Informatik: 183-194.