



# Application of the O2O Model to Strengthen Agricultural Supply Chain Linkages in Cooperatives in An Giang Province

Nguyen Van Thanh<sup>1\*</sup>, Mai Thi Ngoc Phuong<sup>2</sup>

<sup>1\*</sup>,<sup>2</sup> Ba Ria – Vung Tau University, Vung Tau Ward, Ho Chi Minh City, Vietnam

\*[thanhnv01@bvu.edu.vn](mailto:thanhnv01@bvu.edu.vn)

## ABSTRACT

This study evaluates the current status of supply chain linkage in agricultural cooperatives in An Giang province and analyzes the potential application of the Online-to-Offline business model to enhance the effectiveness of supply chain linkages. Based on surveys and data collection from cooperatives, farmers, distribution enterprises, and supporting service providers, the research analyzes the levels of vertical and horizontal linkages within the local agricultural supply chain. Quantitative analysis methods are employed to assess the impacts of key factors in the Online-to-Offline model, including traceability, logistics efficiency, and customer interaction, on supply chain linkage performance. The findings reveal that several cooperatives have begun adopting digital platforms for order management, online payment, and product traceability, thereby improving transparency and market connectivity. The study confirms the potential for scaling up the Online-to-Offline model in the agricultural sector and proposes policy recommendations to support cooperatives in digital transformation, strengthen supply chain linkages, and build a sustainable digital ecosystem in Viet Nam.

*Keywords: supply chain linkage; agricultural cooperatives; Online-to-Offline; traceability; digital transformation.*

## 1. Introduction

In the context of globalization and rapid digital transformation, Vietnamese agriculture is under increasing pressure to transition toward a modern, sustainable, and market-oriented development model. A decisive factor in this transition is the degree of integration within agricultural supply chains, encompassing production, procurement, distribution, and consumption. Nevertheless, existing studies consistently reveal persistent weaknesses in Vietnam's agricultural supply chains,

© The Author(s) 2026

X. V. Vo and T. N. T. Phan (eds.), *Proceedings of the International Conference on Sustainable Economics and Finance in the Digital Business Transformation (INCOSEF 2025)*, Advances in Economics, Business and Management Research 380,

[https://doi.org/10.2991/978-94-6239-624-1\\_32](https://doi.org/10.2991/978-94-6239-624-1_32)

particularly within cooperatives (COOPs). Linkages among farmers, cooperatives, enterprises, and consumers remain fragile; information transparency is limited; logistics systems are inefficient; and cooperatives have yet to fully perform their expected role as the core of value chain-based production. These shortcomings stem largely from constraints in managerial capacity, technological adoption, and market access (Nguyen & Tran, 2020; Le, 2021).

These issues are especially evident in An Giang Province, a strategic hub for rice and aquaculture production. Weak supply chain integration has led to fragmented production, excessive reliance on intermediaries, and inadequate transparency in quality control and product traceability. As a result, both farmers' economic efficiency and the province's export competitiveness are adversely affected. Although many cooperatives have established contract farming arrangements with enterprises, persistent obstacles related to data sharing, logistics coordination, and market stability continue to undermine their effectiveness. If these bottlenecks remain unresolved, An Giang's agricultural sector risks losing competitiveness amid increasingly stringent international standards for quality and traceability.

Within this context, the Online-to-Offline (O2O) model—widely applied in e-commerce—emerges as a promising approach to restructuring agricultural supply chains. By integrating online platforms with offline distribution and consumption activities, O2O expands market access while enhancing transparency, traceability, and logistics efficiency (Chen et al., 2021). Investigating the application of the O2O model in An Giang's agricultural cooperatives is therefore both timely and necessary, offering potential solutions to existing structural constraints and contributing to Vietnam's broader digital agriculture agenda.

A critical research gap lies in the limited attention paid by domestic studies to the systematic integration of the O2O model into cooperative operations. Most prior research focuses either on traditional supply chains or on e-commerce in general, without accounting for local socio-economic conditions, technological infrastructure, and consumer behavior that differentiate Vietnam from countries such as China or Singapore. This study addresses this gap by applying the O2O model within a localized cooperative context and grounding the analysis in empirical evidence from representative cooperatives in An Giang.

Accordingly, the study seeks to answer how O2O adoption can enhance supply chain integration among agricultural cooperatives in An Giang, thereby contributing both practical insights and a contextualized theoretical framework for sustainable digital agricultural development in Vietnam.

## 2. Research Methodology

This study, entitled “*Applying the Online-to-Offline (O2O) Model to Enhance Agricultural Supply Chain Linkages in Cooperatives in An Giang Province,*” is grounded in an integrated theoretical framework that combines the supply chain relationship model of Lambert et al. (1998) with the multi-channel O2O distribution framework developed by Zhang et al. (2018). The Lambert model emphasizes collaborative relationships, information sharing, and coordinated resource utilization among supply chain actors, while the O2O framework highlights the strategic integration of online and offline channels to improve market access, transparency, quality control, and consumer experience. In this research, the O2O model is conceptualized as an operational mechanism whereby marketing, transactions, and customer interactions are initiated through digital platforms and completed through physical production, logistics, and distribution processes.

At the cooperative level, online channels are used to promote products, enhance transparency in production processes, implement traceability systems, and receive customer orders. Offline channels, by contrast, are responsible for harvesting, processing, packaging, transportation, distribution, and after-sales services. This integration enables cooperatives to reduce reliance on intermediaries, improve information transparency, and expand market access, particularly for export-oriented agricultural products. Reports from the An Giang Department of Agriculture and Rural Development (2023–2024) indicate that rice and vegetable products applying traceability systems integrated with O2O mechanisms have begun accessing Japanese and European markets, providing initial empirical evidence of the model’s feasibility.

The study was conducted in An Giang Province, a major agricultural production center in Vietnam’s Mekong Delta characterized by diversified cropping systems and a growing number of cooperatives undergoing digital transformation. The research sample comprised 25 agricultural cooperatives located in Chau Thanh, Cho Moi, Thoi Son, Tri Ton districts, and Long Xuyen City, ensuring representativeness in terms of production scale and sectoral diversity. An Giang was selected not only because of its leading role in rice, vegetable, and fruit production, but also due to persistent challenges such as high logistics costs, fragmented production, and weak market linkages—conditions typical of digital transformation constraints in the Mekong Delta.

Quantitative data were collected through a structured questionnaire survey. Of 150 questionnaires distributed, 134 valid responses were obtained, yielding a response rate of 89.3%. Respondents included cooperative members and management board representatives. A controlled stratified

sampling strategy was applied in collaboration with the An Giang Cooperative Alliance, focusing on cooperatives that operated stably, maintained transparent production records, had initial experience with digital technology adoption, and expressed willingness to participate. Cooperatives were stratified by primary production type (rice, vegetables, fruit crops) and by size (small, medium, and large). Sample selection within each stratum followed a controlled convenience principle to balance methodological rigor and fieldwork feasibility.

To complement the quantitative analysis, qualitative data were collected through 15 semi-structured interviews with cooperative managers, procurement and distribution enterprises, and agricultural experts. Qualitative data were analyzed using NVivo 12 following a thematic content analysis approach. Four key themes emerged: drivers of digital transformation, institutional and human resource constraints, coordination among supply chain actors, and perceived impacts of O2O implementation on supply chain efficiency. Secondary data from official provincial reports and academic literature were also used to enhance data triangulation and reliability.

Overall, by integrating supply chain theory with the O2O model and adopting a mixed-methods approach, the study establishes a rigorous and context-sensitive framework for analyzing and strengthening agricultural supply chain linkages among cooperatives in An Giang Province.

### **3. Research Results**

#### **3.1. Current State of Agricultural Supply Chain Linkages among Cooperatives in An Giang**

##### *3.1.1. Vertical Linkages among Cooperatives, Farmers, and Distributors*

Survey findings in Table 1 reveal that vertical linkages among key actors in the agricultural supply chain in An Giang Province remain only moderately developed, despite several encouraging signs. On the downstream side, 19 out of 25 cooperatives (76%) have established contract farming or output-purchasing agreements with at least one distribution enterprise, indicating an improvement in market access and sales stability. At the production level, 64% of surveyed farmers (86 of 134 respondents) reported supplying more than 70% of their total output to cooperatives, reflecting a relatively strong and stable linkage between farmers and cooperative organizations.

However, deeper forms of coordination, particularly in information sharing and operational integration, remain limited. Only 14 of the 25 cooperatives (56%) actively share data on inventory levels, harvesting schedules, and expected output through digital platforms. This suggests that while contractual arrangements are relatively common, information transparency and timeliness

are insufficient to support efficient supply chain operations. Interviews with cooperative managers indicate that these limitations are mainly due to inadequate digital skills and the lack of standardized data-sharing systems. Furthermore, only 7 cooperatives (28%) have formalized Service Level Agreements (SLAs) with logistics providers, exposing supply chains to risks such as delivery delays, fluctuating transportation costs, and inconsistent distribution performance.

Another important finding from both the survey and in-depth interviews is the underdevelopment of direct sales channels from cooperatives to end consumers. Only 15 cooperatives (60%) participate in online sales via websites, e-commerce platforms, or social media, and most of these initiatives remain at an experimental stage. Cooperatives generally lack integrated systems for order processing, digital payment, logistics coordination, and customer relationship management. Consequently, access to final consumption markets remains constrained, limiting opportunities for market expansion and weakening overall vertical integration.

To quantify the level of vertical linkage, the study constructed a composite index based on five observed variables: (i) contract farming agreements, (ii) farmer–cooperative supply ratios, (iii) data-sharing practices, (iv) logistics coordination, and (v) the establishment of SLAs. These indicators were measured using a five-point Likert scale (1 = very low; 5 = very high). The overall mean score reached 3.4 out of 5, with contract agreements scoring highest (4.2), followed by farmer–cooperative supply linkage (3.8). In contrast, data sharing (3.2), logistics coordination (3.0), and SLAs (2.9) lagged behind, highlighting logistics management and information transparency as the most critical bottlenecks.

Further analysis using multivariate linear regression shows that O2O-related factors significantly strengthen vertical linkages. The dependent variable—the O2O-based supply chain linkage index—was explained by three independent factors derived from Exploratory Factor Analysis: product traceability, logistics efficiency, and online interaction intensity. The model demonstrates strong explanatory power ( $R^2 = 0.61$ ), with all coefficients positive and statistically significant ( $p < 0.05$ ). These results confirm that O2O adoption enhances vertical integration by improving transparency, optimizing logistics, and enabling cooperatives to connect more directly with end consumers.

*Table 1. Observed Variables in the O2O Impact Model on Supply Chain Linkages (N = 134; 25 cooperatives).*

No.	Observed Variables (Independent Variables)	Variable Definition	Measurement Unit	Number of Cooperatives Applying (out of 25)	Number of Valid Responses (out of 134)	Percentage (%)
1	Online Order Management	The ability to receive, process, and respond to customer orders through digital platforms	Likert scale (1–5)	17	91	68
2	Online Payment	The extent of adoption of electronic payment tools to reduce cash transactions and enhance transparency	Likert scale (1–5)	17	91	68
3	Product Traceability	The ability to ensure transparency regarding product origin, production processes, and certification	Likert scale (1–5)	18	97	72
4	Online Sales Channels	The extent of market expansion	Likert scale (1–5)	15	81	60

		through e-commerce platforms and social media				
--	--	---	--	--	--	--

Source: Quantitative survey results, 2024–2025

3.1.2. Horizontal Linkages and Supporting Services

Survey results indicate that 11 out of 25 cooperatives (44%) participate in cooperative unions or inter-regional cooperative alliances, thereby expanding operational scale and enhancing competitiveness. However, only 5 out of 25 cooperatives (19%) have formal agreements for shared use of physical infrastructure, such as cold storage facilities or drying equipment. The primary reasons identified include the absence of effective resource-sharing mechanisms and a lack of joint investment capital. These constraints have resulted in fragmented investment patterns, limited aggregation capacity, and reduced bargaining power when negotiating with large-scale distributors.

3.1.3. Information Quality and Benefit-Sharing Mechanisms

*In-depth interviews reveal that 16 out of 25 cooperatives (63%) have implemented incentive and penalty mechanisms linked to output volume and product quality. Nevertheless, 9 out of 25 cooperatives (37%) continue to apply uniform profit-sharing schemes, which tend to weaken members' motivation to improve productivity and quality. Although 18 out of 25 cooperatives (72%) have adopted product traceability practices, the absence of an integrated digital system limits cross-verification of information, thereby undermining transparency across the supply chain.*

### 3.2. Level of O2O Model Adoption among Agricultural Cooperatives in An Giang

#### 3.2.1. Results of Exploratory Factor Analysis (EFA) and the Level of O2O Adoption

Exploratory Factor Analysis (EFA) conducted on 134 valid survey responses identified four principal factor groups: (i) online transaction management, (ii) product traceability, (iii) logistics efficiency, and; (iv) customer interaction (KMO = 0.79; Bartlett's Test of Sphericity,  $p < 0.001$ ).

The results indicate varying levels of O2O adoption across different dimensions. Specifically, online order management has been adopted by 68% of cooperatives, with an average score of 3.8 out of 5; online payment systems are applied by 68%, with a mean score of 3.7 out of 5; product traceability shows the highest adoption rate at 72%, with an average score of 4.0 out of 5; and online sales channels are used by 60% of cooperatives, with a mean score of 3.5 out of 5. These indicators collectively reflect improvements in transaction management efficiency, information transparency, logistics support, and market expansion capacity.

Notably, the survey reveals that 15 out of 25 cooperatives have begun selling products directly to end consumers through online channels, including websites, e-commerce platforms, and social media. These cooperatives have implemented basic processes for order management, electronic payment, and delivery tracking. Although these activities are still in an early stage and limited in scale, they demonstrate substantial potential for expansion and for enhancing supply chain linkage efficiency, while also enabling consumers to access cooperative products more directly.

#### 3.2.2. Quantitative Impact of O2O on Supply Chain Linkages

In the analytical model, the dependent variable is the level of O2O-based supply chain linkage among cooperatives, enterprises, and customers, measured using a five-point Likert scale. The independent variables consist of three factors extracted from the EFA: (i) product traceability capability,; (ii) logistics efficiency, and; (iii) online customer interaction.

Results from the multivariate linear regression analysis indicate that the model exhibits a relatively strong goodness of fit ( $R^2 = 0.61$ ;  $p < 0.05$ ), suggesting that the three O2O-related factors explain more than 60% of the variance in supply chain linkage intensity. Among these factors, product traceability ( $\beta = 0.45$ ) exerts the strongest influence, confirming that information transparency and traceability constitute a foundational element in building trust within the supply chain. Online

customer interaction ( $\beta = 0.41$ ) also demonstrates a significant effect, highlighting the importance of digital communication, feedback mechanisms, and online customer support in maintaining market connections and facilitating direct sales. Logistics efficiency ( $\beta = 0.38$ ) reflects the critical role of optimized transportation, warehousing, and delivery systems in ensuring stable physical flows, particularly in fulfilling orders from cooperatives to end consumers.

These quantitative findings indicate that O2O implementation not only enhances data management and logistics performance but also enables cooperatives to connect directly with final consumers, thereby creating opportunities for market expansion, revenue growth, and improved supply chain transparency. Primary survey data and in-depth interviews further suggest that cooperatives adopting digital platforms for order management, payment, and delivery have improved response speed, reduced intermediary costs, and enhanced customer experience, while laying the groundwork for expanding online sales channels.

### *3.2.3. Enablers and Challenges*

**Enablers.** Survey results show that 68% of cooperatives (17 out of 25) have adopted online order management and electronic payment systems, contributing to cost reduction and increased transparency. Among the 134 respondents, 59% of farmers reported that online sales channels enable faster access to customers. A cooperative manager in Cho Moi district noted that online sales contributed to a 15% increase in revenue. Furthermore, 72% of respondents agreed that product traceability enhances credibility, facilitates connections with export-oriented enterprises, and supports international market expansion. Reports from the An Giang Department of Agriculture and Rural Development (2024) similarly emphasize information transparency as a “passport” for agricultural products to enter global markets.

**Challenges.** Despite these advantages, 56% of cooperatives (14 out of 25) reported limitations in technological infrastructure, particularly in internet connectivity and management software. Among the surveyed households, 61% (82 respondents) indicated limited familiarity with digital applications and continued reliance on face-to-face transactions and cash payments. As one cooperative leader in Phu Tan district observed, “Older farmers can barely use smartphones; despite repeated training, the effectiveness remains low.” Additionally, only 28% of cooperatives

(7 out of 25) have established Service Level Agreements (SLAs) with logistics providers, resulting in delivery delays and unforeseen cost increases. Insufficient financial resources and a lack of digitally skilled human capital were also cited by 60% of cooperatives (15 out of 25) as major barriers to effective O2O implementation.

#### 4. Discussion

Quantitative results from the multivariate regression model indicate that the O2O model exerts a positive and statistically significant effect on strengthening agri-food supply chain linkages among agricultural cooperatives (ACs) in An Giang Province. The dependent variable is the level of O2O-based supply chain integration (cooperatives–enterprises–customers), measured on a five-point Likert scale. Independent variables include traceability, distribution/logistics efficiency, and online interaction. The estimation results ( $R^2 = 0.61$ ;  $p < 0.05$ ) show that all three factors have positive effects, with traceability exerting the strongest influence ( $\beta = 0.45$ ), followed by online interaction ( $\beta = 0.41$ ) and logistics efficiency ( $\beta = 0.38$ ).

These findings confirm the research hypothesis and provide new empirical evidence in the context of the Mekong Delta—a region endowed with agricultural advantages but constrained by limited digital infrastructure. The results extend earlier studies by Nguyen et al. (2021) and Tran et al. (2020), while aligning with Pham et al. (2019) in emphasizing the role of information transparency in reinforcing supply chain trust. Similarly, studies by Tambo and Wünscher (2017) in Africa and Li et al. (2020) in China demonstrate that transparency and trust are core determinants of O2O effectiveness.

However, the model also reveals several challenges: (i) fragmented technological infrastructure in rural areas, (ii) limited digital capabilities among cooperative managers and farmers, and (iii) entrenched traditional transaction practices that hinder O2O adoption. These constraints are consistent with the FAO (2022) report on digital transformation barriers in Southeast Asia and findings by Rao and Dev (2019) in India.

Overall, the results support the strategic orientation of An Giang's Digital Transformation Plan (2021–2025) and suggest policy implications for building an agricultural digital ecosystem through

coordinated engagement among cooperatives, logistics enterprises, e-commerce platforms, and regulatory agencies. The study demonstrates that O2O not only enhances agri-food supply chain integration in An Giang but also offers a basis for international comparison, contributing to the modernization of Vietnam's rural economy.

## 5. Conclusion

This study achieves its objectives by confirming the positive and statistically significant impact of the O2O model on enhancing agri-food supply chain linkages among agricultural cooperatives in An Giang Province. Three key determinants are identified: traceability, distribution efficiency, and the level of online interaction. These findings add empirical evidence for the Mekong Delta, where agricultural strengths coexist with digital infrastructure constraints.

Academically, the study clarifies the role of O2O in strengthening trust, enhancing transparency, and fostering coordination among supply chain actors. Comparisons with international experiences highlight the novelty and scientific relevance of applying the O2O model to Vietnam's agricultural context. Practically and policy-wise, the localization of O2O implementation in An Giang should account for its multi-ethnic composition (Kinh, Hoa, and Cham communities) and diverse production practices. Flexible designs aligned with culturally appropriate digital capacity-building are essential. While the study's scope limits full reflection of offline activities, the data remain sufficiently robust to capture prevailing linkage trends. Future research should expand the survey area and assess the long-term socio-economic, sustainability, and consumer behavior impacts of O2O in Vietnamese agriculture.

## REFERENCES

- An Giang Union of Science and Technology Associations. (2023). *Report on the application of science and technology and digital transformation in cooperatives*. An Giang Province, Vietnam.
- Cao, T., & Xie, H. (n.d.). *A literature review of supply chain development: Evidence from the agricultural industry*. BCP Business & Management, 20.

Food and Agriculture Organization. (2021). *Digital agriculture report: Rural e-commerce development – Experience from China*. FAO.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *The International Journal of Logistics Management*, 9(2), 1–20. <https://doi.org/10.1108/09574099810805807>

Li, J., Fang, Y., & Lim, K. H. (2020). Online-to-offline commerce: Review and research agenda. *Journal of Electronic Commerce Research*, 21(1), 1–20.

Luu, V. D., & Do, K. C. (2024). Digital transformation in agriculture: Theoretical issues and policy recommendations for Thai Binh Province. *Vietnam and the World: Journal of Economic Studies*, 554(7).

Nguyen, A. H. (2021). Development of short agri-food supply chains in Vietnam in the new context. *World Economic and Political Issues*, No. 7(303), 2021.

Nguyen, D. T. (2025). Impact of value chain linkage on sustainable agricultural economic development in the context of industrialization and modernization in Vietnam. *Asian Economic and Financial Review*, 15(9), 1406–1418. <https://doi.org/10.55493/5002.v15i9.5489>

Nguyen, T. T. N. (2022). Digital agriculture in Viet Nam: Conditions and prospects for development. *Agricultural Economics (AGRIS Online Papers in Economics and Informatics)*, 14(3), 35–44. <https://doi.org/10.7160/aol.2022.140304>

People's Committee of An Giang Province. (2021). *An Giang Province digital transformation program for the period 2021–2025* (Decision No. 553/CTr-UBND).

People's Committee of An Giang Province. (2022). *Plan to support small and medium-sized enterprises in digital transformation toward 2025*. An Giang Province, Vietnam.

Zhang, M., Zhao, X., Voss, C., & Zhu, G. (2016). Innovating through services, co-creation and supplier integration: Cases from China. *International Journal of Production Economics*, 171(2), 289–300. <https://doi.org/10.1016/j.ijpe.2015.09.026>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

