

# Barriers to Sustainable Agricultural Logistics in Emerging Economies: Evidence from SMEs in Vietnam

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## Abstract

**Background:** Sustainable agricultural logistics is increasingly important for enhancing supply chain resilience and competitiveness in emerging economies. However, prior studies have mainly examined sustainable agriculture or general logistics barriers, while limited attention has been paid to how Vietnamese SMEs experience barriers to sustainable agricultural logistics in practice. **Aim:** This study aims to identify the key barriers to sustainable agricultural logistics from the perspective of Vietnamese SMEs operating in agricultural logistics. **Methods:** A qualitative exploratory design was selected because the topic remains under-researched and requires an in-depth understanding of SMEs' practical experiences, perceptions, and context-specific constraints. Semi-structured interviews were conducted with 15 SME owners, managers, and logistics personnel in Can Tho, Dong Thap, Dong Nai, and Ho Chi Minh City. The data were analyzed using descriptive statistics and thematic analysis. **Results:** The findings reveal four dominant themes shaping SMEs' adoption of sustainable agricultural logistics: market-driven pressure, resource and technology constraints, information and market-access limitations, and institutional support gaps. SMEs tended to adopt sustainability-oriented practices mainly in response to customer requirements and cost-efficiency concerns. However, their implementation capacity was constrained by limited access to market information, insufficient capital and technological resources, unstable raw material supply, and weak policy effectiveness. **Conclusion:** The study contributes to sustainable logistics literature by showing that SMEs' barriers are not isolated constraints but interrelated market, resource, technological, and institutional challenges within an emerging economy context. Practically, the findings suggest the need for more targeted financial incentives, digital transformation support, human resource development, market access improvement, and logistics infrastructure investment to better align policy support with SMEs' operational needs in Vietnam.

**Keywords:** barriers; emerging economies; SMEs; sustainable agricultural logistics; Vietnam

## 1. Introduction

Agricultural logistics plays a crucial role in enhancing the added value of products while contributing to sustainable development in emerging economies such as Vietnam, where agriculture still accounts for a large proportion (Loi et al., 2024). However, building a sustainable logistics system in this sector remains highly challenging, particularly for small and medium-sized enterprises (SMEs) – the majority force in the supply chain but often constrained by capital, technology, and managerial capacity. Vietnam's agricultural sector is currently facing major challenges in the process of international integration, ranging from technical barriers and anti-dumping measures in exports, increasingly stringent quality requirements in demanding markets, to the severe impacts of climate change, which make agricultural production vulnerable and threaten food security (Son, 2019).

In 2024, Vietnam's GDP was estimated to increase by 7.09% compared to 2023, a growth rate that was only lower than those of 2018, 2019, and 2022 during the 2011–2024 period. Within the growth structure, the agriculture, forestry, and fisheries sector recorded a 3.27% increase, contributing 5.37% to the overall added value. Despite the impacts of natural disasters and floods, the sector still achieved positive results thanks to



higher yields of various agricultural products, stable livestock production, and steady growth in aquaculture. Specifically, the added value of agriculture increased by 2.94%, contributing 0.26 percentage points to overall growth; forestry rose by 5.03% but with a small proportion, contributing only 0.03 percentage points; while fisheries grew by 4.03%, contributing 0.10 percentage points (NSO, 2024). The first half of 2025 witnessed the strongest GDP growth of the 2011–2025 period, rising 7.52% compared to the same period in the previous year. The agriculture, forestry, and fisheries sectors expanded by 3.84%, accounting for 5.59% of the economy's overall added value growth. The agricultural sector, which supports exports and meets domestic consumption demand, maintained steady growth across forestry, fisheries, and agriculture. In the first half of 2025, the added value of agriculture increased by 3.51% compared to the same period of the previous year, contributing 0.29 percentage points to overall added value growth. The forestry sector rose by 7.42%, but contributed only 0.04 percentage points, while fisheries increased by 4.21%, contributing 0.10 percentage points (NSO, 2025).

Agricultural logistics plays a crucial role in ensuring the efficient operation of the agricultural supply chain, from production to consumption. According to Higgins et al. (2015), it is the process of transporting and managing the supply chain of agricultural products from farms to processing or export, closely associated with infrastructure and policies. Theeraviriya et al. (2020) emphasized agricultural logistics as a tool to solve the location–routing problem (LRP), aiming to minimize fuel costs and improve price fairness for farmers. Chuyen and Rajagopal (2025) expanded this concept into a complex network that connects physical elements, information flows, and container logistics hubs. Rajabzadeh and Fatorachian (2023) further added that the goal of agricultural logistics is to ensure quality, traceability, performance optimization, and waste reduction.

Sustainable agricultural logistics is regarded as a modern approach that simultaneously integrates economic, environmental, and social objectives in managing the agricultural supply chain. According to Brinken et al. (2025), this field focuses on optimizing the entire logistics process from production, harvesting, and transportation to storage, with an emphasis on reducing emissions, enhancing efficiency, and applying advanced technologies such as AI, sensors, and optimization algorithms. Tsolakis et al. (2023) broadened this concept into data-driven agricultural logistics, highlighting the role of IoT and autonomous vehicles in resource management, particularly water and energy, while also supporting the achievement of the United Nations' Sustainable Development Goals (SDGs). Similarly, Zhou et al. (2024) and Wu and Haasis (2018) emphasized the importance of collaboration and digital technologies to ensure a balance between economic efficiency, environmental protection, and improved social welfare. More recently, Zheng and Zhou (2023) added that smart blockchain can enhance transparency, traceability, and overcome inherent limitations in traditional agricultural logistics, thereby fostering the sustainable development of the entire sector.

Sustainable agricultural logistics is characterized by the integration of digital technologies, blockchain, and data analytics to optimize the supply chain from production, processing, and storage to distribution and consumption. Research indicates that digital platforms play a central role in directly connecting farmers with consumers, while promoting transparency, reducing information asymmetry, and facilitating collaborative logistics (Zhou et al., 2024). In addition, the application of smart blockchain ensures traceability, food safety, and consumer trust, while automating control and payment processes within the logistics chain (Zheng & Zhou, 2023). Furthermore, solutions such as IoT, AGVs, and data analytics are deployed to improve resource efficiency, reduce

logistics costs, and increase agricultural productivity, thereby fostering green and sustainable development (Tsoulakis et al., 2023). From another perspective, sustainable agricultural logistics not only targets economic benefits but also delivers environmental and social value. Economically, this model significantly reduces logistics costs, minimizes transport losses, and increases farmers' profits (Zhou et al., 2024). Environmentally, the adoption of advanced technologies helps reduce carbon emissions, save energy and water, and promote more efficient farming practices (Tsoulakis et al., 2023). Socially, sustainable logistics enhances farmers' welfare, creates additional employment opportunities, and improves the quality of products supplied to consumers (Zhu, 2024). Thus, the combination of modern technologies, supply chain collaboration, and sustainability orientation has shaped a comprehensive agricultural logistics system that simultaneously addresses economic, environmental, and social objectives.

Although previous studies have examined barriers to sustainable agriculture and logistics, their focus remains different from the specific concern of this study. Raut and Gardas (2018) analyzed sustainable logistics barriers in fruit and vegetable transportation in India, while Junior et al. (2022) and Cao and Solangi (2023) focused mainly on broader barriers to sustainable agriculture adoption. These studies provide useful insights, but they have not sufficiently examined how SMEs in an emerging economy experience sustainable agricultural logistics barriers at the operational level, particularly in relation to information access, market connectivity, resource limitations, technology adoption, and policy effectiveness. This gap is important in Vietnam, where SMEs are central actors in agricultural logistics but often operate with limited capital, fragmented supply chain linkages, and uneven institutional support.

This study aims to identify and explain the key barriers to sustainable agricultural logistics from the practical perspective of Vietnamese SMEs. Specifically, it examines how market-related, resource-based, technological, supply-chain, and institutional constraints shape SMEs' ability to adopt sustainable logistics practices. Theoretically, this study contributes to sustainable logistics literature by shifting attention from general sustainability barriers to logistics-specific constraints in agricultural supply chains and by showing how these barriers interact in an emerging economy context. Practically, the findings provide evidence for designing more targeted policies and support mechanisms to improve sustainable agricultural logistics among SMEs in Vietnam.

## **2. Methods**

**Research Design:** The study was conducted using a qualitative exploratory approach, aiming to identify and analyze in depth the barriers to sustainable agricultural logistics in Vietnam. This approach is appropriate given the limited scope of prior research, particularly concerning the role and practical experiences of small and medium-sized enterprises (SMEs) in the agricultural supply chain. This design was chosen because the study seeks to capture context-specific experiences, perceptions, and operational constraints of SMEs rather than to test predetermined hypotheses.

**Data Collection Techniques:** Primary data were collected through semi-structured interviews with 15 participants, who were managers or logistics personnel of SMEs operating in agricultural logistics in key regions, including Can Tho, Dong Thap, Dong Nai, and Ho Chi Minh City. The interview guide was developed based on the research objectives and prior studies on sustainable agriculture, agricultural logistics, and SME barriers. It covered four main areas: SMEs' awareness of sustainable logistics, sustainability-oriented practices, barriers to implementation, and perceptions of policy and market support. A

purposive sampling method was employed to ensure diversity in product categories (such as rice, fruit, and vegetables), operational scales, and levels of participation in the supply chain. In addition, secondary data were obtained from industry reports, policy documents, and previous studies to support the analysis. The sample size was considered adequate for exploratory qualitative research because repeated responses began to emerge across interviews, and no substantially new barrier categories were identified in the final stage of data collection.

**Data Analysis:** The collected data were analyzed using thematic analysis following the framework of Braun and Clarke (2006), which includes familiarization with the data, initial coding, theme development, reviewing and naming themes, and interpretation of results. The coding process was conducted around three main groups of barriers: (i) Technology, (ii) Organization, and (iii) Environment. To enhance the credibility of the analysis, the initial codes and emerging themes were reviewed by the authors and compared with interview notes and secondary documents. Any differences in interpretation were discussed until agreement was reached. SPSS was used only to summarize coded interview responses through basic descriptive statistics, such as frequencies and percentages. These descriptive results were not intended for statistical generalization but served to support and contextualize the thematic findings.

Ethical considerations were addressed throughout the research process. Participants were informed about the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time. Informed consent was obtained before each interview. To ensure confidentiality, personal and enterprise identifiers were anonymized, and the data were used only for academic purposes.

### **3. Results and Discussion**

#### ***3.1 Descriptive Analysis***

The statistical results (Table 1) show that the majority of interview participants were business owners (53.3%), followed by logistics managers (26.7%), while specialists and production managers accounted for 13.3% and 6.7%, respectively. This structure accurately reflects the characteristics of small and medium-sized enterprises (SMEs) in Vietnam's agricultural sector, where business owners and logistics managers play a crucial role in strategic planning and supply chain operations. At the same time, the participation of production managers and specialists, though smaller in proportion, still provides practical perspectives, contributing to the diversity and comprehensiveness of the research data.

The results indicate that enterprises operating for 5 to 10 years accounted for the largest proportion (40.0%), reflecting a stage of stable development with considerable practical experience. Newly established enterprises of less than 5 years represented 26.7%, while long-standing enterprises of more than 20 years accounted for 20.0%, and those operating between 11 and 20 years made up 13.3%. These statistics demonstrate that the interviewed enterprises had a diverse range of operating years, portraying a broad picture of management experience in the agricultural logistics sector. This distribution ensures a multidimensional perspective between emerging enterprises and those with extensive experience.

The statistical results further show that in the interview sample, enterprises with 10 to 50 employees accounted for the highest proportion at 40.0%, followed by enterprises with fewer than 10 employees at 33.4%. Larger enterprises, including those with 51 to

200 employees and those with more than 200 employees, each represented 13.3%. This indicates that the survey sample primarily focused on small and medium-sized enterprises, consistent with the research objectives, while still including the presence of larger enterprises, thereby providing a more comparative and multidimensional perspective.

**Table 1.** Survey sample characteristics

| Indicator                          | Frequency | Percentage (%) |
|------------------------------------|-----------|----------------|
| <b>Job Position</b>                |           |                |
| Business Owner                     | 8         | 53.3           |
| Logistics Manager                  | 4         | 26.7           |
| Production Manager                 | 1         | 6.7            |
| Specialist                         | 2         | 13.3           |
| <b>Business Operating Duration</b> |           |                |
| Under 5 years                      | 4         | 26.7           |
| From 5 to 10 years                 | 6         | 40.0           |
| From 11 to 20 years                | 2         | 13.3           |
| Over 20 years                      | 3         | 20.0           |
| <b>Enterprise Scale</b>            |           |                |
| Under 10 employees                 | 5         | 33.4           |
| From 10 to 50 employees            | 6         | 40.0           |
| From 51 to 200 employees           | 2         | 13.3           |
| Over 200 employees                 | 2         | 13.3           |

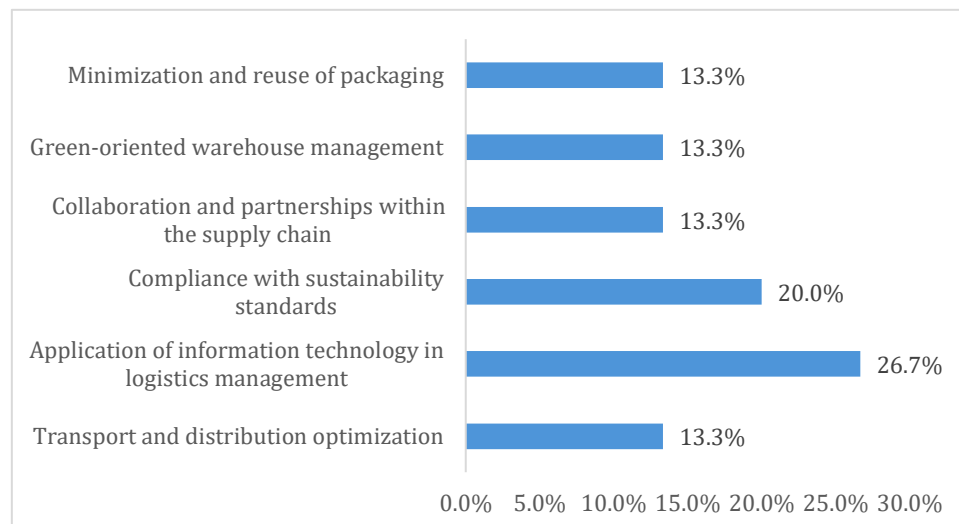
### ***3.2. Enterprises' Awareness of Sustainable Logistics***

The descriptive frequencies in Figure 1 and Figure 2 show that SMEs had begun to adopt several sustainability-oriented logistics practices, particularly information technology application, compliance with sustainability standards, transportation optimization, supply chain collaboration, green warehouse management, and packaging reduction. However, the qualitative findings indicate that these practices were still selective rather than fully integrated into a long-term sustainability strategy. Most participants associated sustainable logistics with immediate business benefits, especially meeting customer requirements, reducing costs, and maintaining market relationships. This suggests that SMEs' adoption of sustainable logistics was largely market-driven and cost-driven, rather than internally institutionalized as a strategic sustainability commitment.

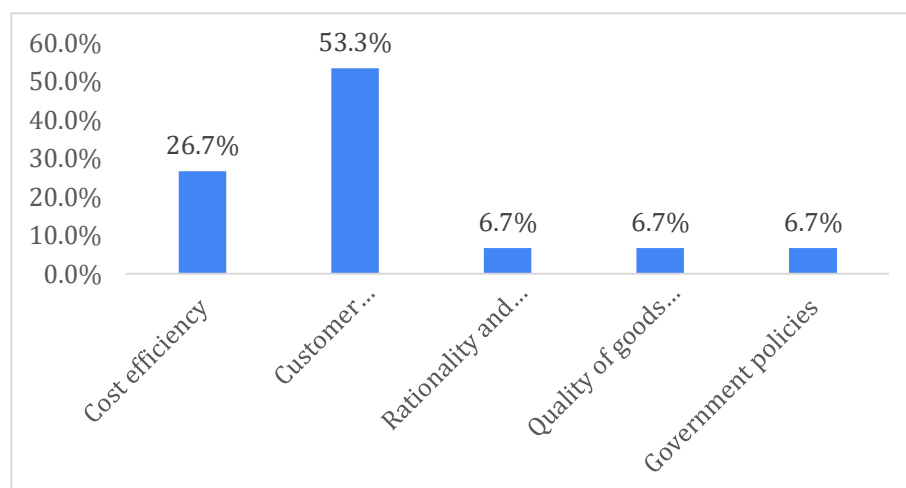
### ***3.3. Barriers to Implementing Sustainable Logistics***

The findings reveal that information and market-access limitations were the most prominent barriers to sustainable agricultural logistics. As reflected in Figure 3 and Figure 4, participants frequently mentioned difficulties in accessing reliable market information, stable buyers, clear quality standards, and predictable demand. These barriers were closely connected with resource and technology constraints, including limited capital, inadequate digital capability, insufficient cold-chain facilities, and a shortage of skilled

personnel. From a qualitative perspective, these barriers should not be viewed as isolated problems. Limited information reduces market certainty, weak market access reduces investment motivation, and resource constraints limit SMEs' ability to adopt traceability, cold storage, digital logistics, and green transportation solutions.



**Figure 1.** Business activities implemented towards sustainability goals in logistics

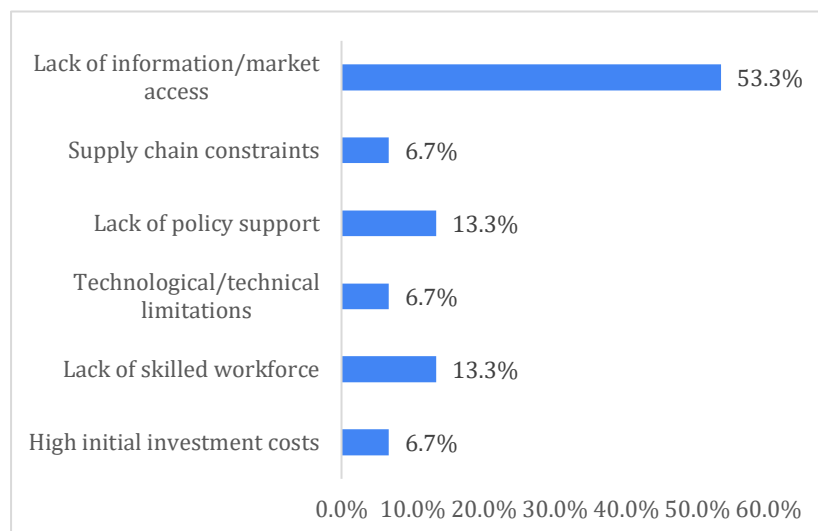


**Figure 2.** The main drivers for businesses to implement sustainable logistics activities

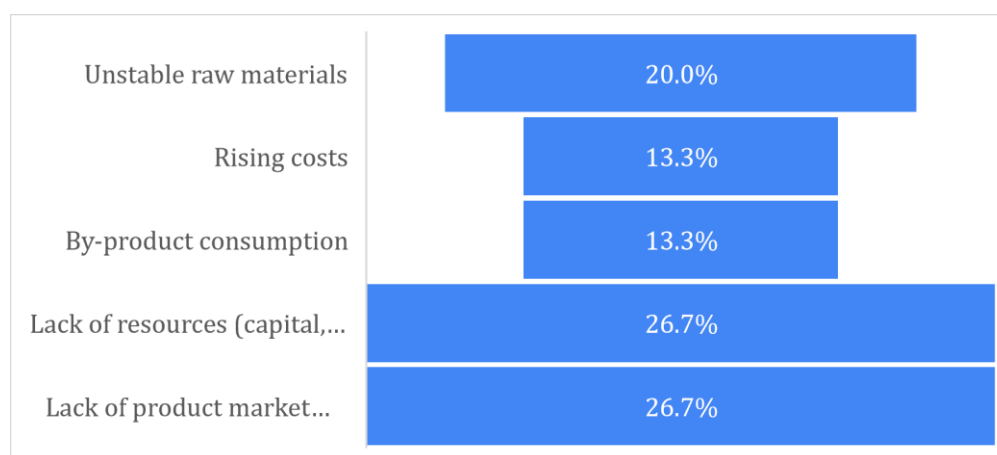
### 3.4. The Role of Policies and the External Environment

Figure 5 and Figure 6 provide descriptive support for the qualitative finding that SMEs perceived a gap between policy objectives and operational needs. Participants did not necessarily reject the importance of government support, but they emphasized that existing support mechanisms were often difficult to access, insufficiently specific, or not directly connected to logistics-related problems such as cold-chain infrastructure, transport costs, digital transformation, market linkage, and administrative procedures.

This finding suggests that policy support for sustainable agricultural logistics should move beyond general sustainability promotion and focus more directly on SME capacity building, logistics infrastructure, market information systems, and accessible financial and technical assistance.



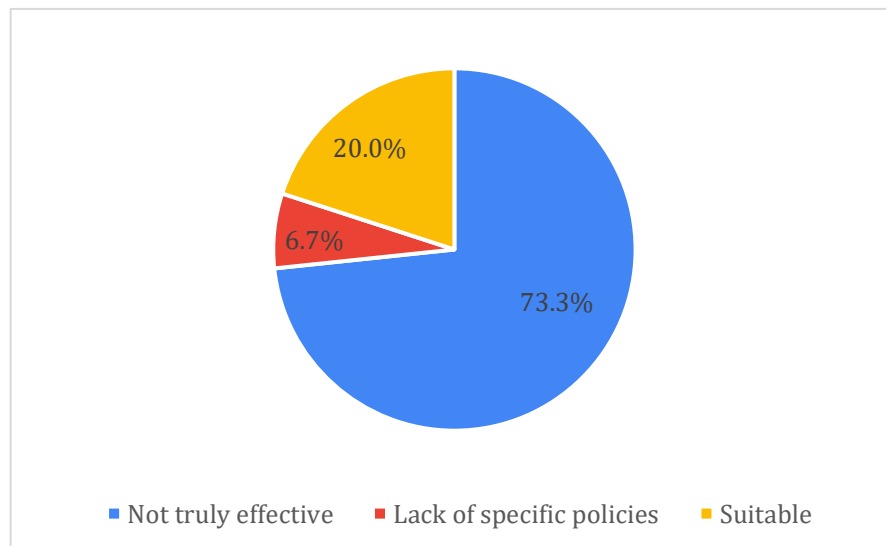
**Figure 3.** Major barriers to implementing sustainable logistics



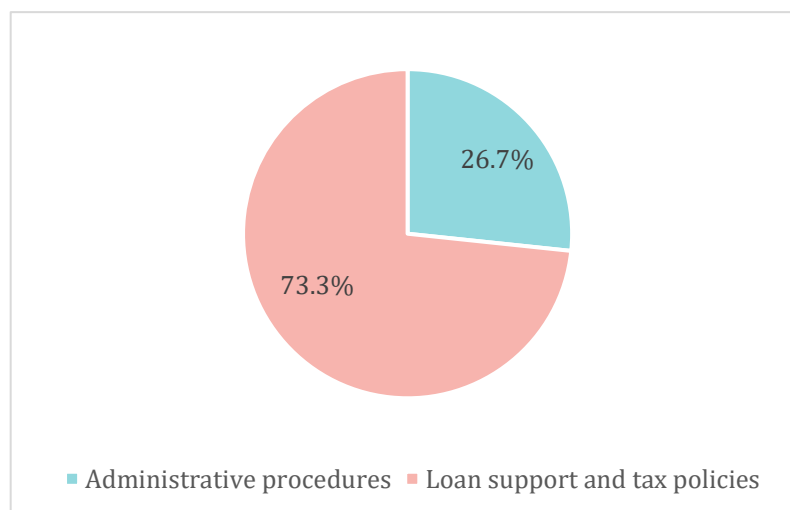
**Figure 4.** Factors hindering businesses in building a sustainable agricultural supply chain

This finding is consistent with previous studies showing that sustainable logistics and agricultural supply chains are strongly influenced by external pressures and operational constraints. Raut and Gardas (2018) emphasized that logistics barriers in fruit and vegetable supply chains are closely associated with post-harvest losses and transportation inefficiencies. However, while Junior et al. (2022) and Cao and Solangi (2023) mainly examined broader barriers to sustainable agriculture, this study provides more specific evidence on logistics-related barriers faced by SMEs in Vietnam. The dominance of information and market-access barriers can be explained by fragmented production, unstable raw material supply, product perishability, dependence on

intermediaries, and limited access to stable buyers. These conditions reduce SMEs' willingness to invest in cold storage, traceability systems, digital logistics, and green transportation. The findings also support Tsolakis et al. (2023), Zhou et al. (2024), and Zheng and Zhou (2023), but further show that digital and traceability solutions require accessible financial, technical, and institutional support.



**Figure 5.** Enterprises' assessment of current government support policies for agricultural logistics



**Figure 6.** Changes in the policy or market environment that help businesses overcome barriers

From a sustainability perspective, the findings show that SMEs' logistics decisions are shaped by the tension between economic feasibility, environmental expectations, and social or institutional requirements. Although sustainable logistics is expected to reduce losses, improve traceability, and support greener supply chains, SMEs are unlikely to adopt these practices when market demand is uncertain and investment capacity is limited. From a supply-chain perspective, the dominance of information and market-

access barriers reflects weak coordination among farmers, SMEs, buyers, logistics providers, and policy actors. This extends sustainable logistics literature by showing that, in emerging economy contexts, barriers are not only technical or financial but also relational and informational. Theoretically, the study contributes by linking SME-level constraints with broader supply-chain sustainability challenges, showing how market uncertainty, information asymmetry, resource limitations, and institutional gaps jointly restrict the transition toward sustainable agricultural logistics.

#### **4. Limitations and Future Directions**

This study has several limitations that should be considered when interpreting its findings. First, the exploratory qualitative design and purposive sample of 15 participants enabled in-depth examination of SMEs' practical experiences, but the results are not intended to be statistically generalized to all agricultural logistics enterprises in Vietnam. In addition, participants were drawn from Can Tho, Dong Thap, Dong Nai, and Ho Chi Minh City. Although these locations are important agricultural production and logistics areas, they may not fully represent differences in infrastructure, market access, institutional support, and logistics conditions across other regions. Second, the study relied mainly on participants' perceptions collected at a single point in time, which may be affected by individual experiences, organizational roles, and prevailing market or policy conditions. The descriptive frequencies were used only to support the qualitative interpretation and should therefore not be considered estimates of the prevalence or relative importance of barriers among the wider SME population. These methodological and contextual boundaries should be taken into account when applying the findings beyond the study setting.

Future research can extend this study in several directions. Larger quantitative or mixed-method studies could be conducted across different regions of Vietnam to test the relative importance of the identified barriers and improve the generalizability of the findings. Researchers could also develop and validate measurement scales for market and information constraints, financial and technological limitations, supply-chain coordination problems, and institutional support gaps, and examine their effects on sustainable logistics adoption, logistics performance, supply-chain resilience, and environmental performance. Comparative studies across specific commodity chains, such as rice, fruits and vegetables, aquaculture, and processed agricultural products, would also be valuable because logistics requirements differ in terms of perishability, seasonality, cold-chain dependence, and export standards. In addition, future studies should consider firm size, digital capability, export orientation, and supply-chain position as possible explanatory or moderating factors. Longitudinal research could further examine how improvements in digitalization, traceability, cold-chain infrastructure, financial incentives, market linkages, and policy implementation influence SMEs' sustainable logistics practices over time, while alternative theoretical perspectives may help explain how internal capabilities and external pressures jointly shape sustainability transitions.

#### **5. Conclusion**

This study identified the key barriers to sustainable agricultural logistics from the perspective of SMEs in Vietnam. The findings show that although SMEs have begun to adopt sustainability-oriented logistics practices, their implementation remains selective

and largely driven by customer requirements, cost efficiency, and market pressure. The most important barriers are not limited to individual financial or technical constraints but are interrelated challenges involving limited market information, weak market access, inadequate capital and technology, unstable raw material supply, insufficient logistics infrastructure, and ineffective policy support. Theoretically, the study contributes to sustainable logistics literature by showing how market uncertainty, information asymmetry, resource limitations, and institutional gaps jointly shape SMEs' ability to adopt sustainable agricultural logistics practices in the Vietnamese context.

Based on these findings, more targeted support is needed to improve sustainable agricultural logistics among SMEs in Vietnam. Policy interventions should prioritize accessible financial incentives, preferential loans, tax support, simplified administrative procedures, and investment in logistics infrastructure such as cold storage, transport connectivity, and market information systems. In addition, SMEs need practical support for digital transformation, traceability systems, human resource training, and supply-chain collaboration among farmers, cooperatives, logistics providers, buyers, and government agencies. These recommendations should be implemented with attention to the specific conditions of Vietnamese agricultural logistics SMEs rather than through broad or general sustainability policies.

### **Declaration of Generative AI and AI-Assisted Technologies in the Writing Process**

The authors declare that ChatGPT (OpenAI) was used only as an auxiliary tool during manuscript preparation, mainly for language polishing, wording refinement, and translation support. All outputs generated with AI assistance were critically evaluated, verified, and substantially modified by the authors. The authors remain fully accountable for the accuracy, originality, integrity, and academic content of the manuscript.

### **Authorship Contribution Statement**

**Tran Trung Chuyen**, as the first and corresponding author, contributed to conceptualization, methodology, investigation, data collection, data curation, formal analysis, and writing—original draft preparation. **Premkumar Rajagopal** contributed to supervision, validation, methodological review, and writing—review and editing. Both authors reviewed and approved the final version of the manuscript.

### **Declaration of Competing Interest**

There are no conflicts of interest related to the matter at hand.

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