

RISK MANAGEMENT AND GREEN LOGISTICS IN VIETNAM

Pham Van Quynh

Foreign Trade University, HCMC Branch

Email: phamvanquynh.hcmc@ftu.edu.vn

Received: 16 March 2026; Revised: 17 April 2026; Accepted: 2 May 2026

ABSTRACT

In recent years, Vietnam has witnessed remarkable economic growth, establishing itself as an attractive destination for foreign investors. Driven by globalization and expanding trade relations, effective logistics management has become indispensable for both domestic and foreign businesses. Currently, Vietnam's logistics operations still face various risks, including natural disasters, infrastructure challenges, regulatory uncertainties, and human factors, as well as challenges related to sustainable development and green logistics. Given these considerations, effective management of logistics risks and the development of green logistics are imperative to ensure supply chain resilience and the sustainable success of businesses. This study provides a comprehensive analysis of the existing literature on risk management in logistics and green logistics. This research delves into key supply chain risk concepts, logistics risk management principles, different types of logistics risks, as well as opportunities, challenges, and proposed solutions to enhance the use of the digital economy for supply chain risk management and promote green logistics in Vietnam.

Keywords: Supply chain, risk management, digital economy, green logistics, Vietnam.

1. INTRODUCTION

Vietnam, a developing and increasingly integrated economy, is not exempt from the global supply chain and plays a crucial role in the production and distribution of many goods worldwide. Agility, a logistics and transportation service provider, ranks Vietnam 10th among developing logistics markets. However, Vietnam also faces many challenges, such as how to provide professional logistics services, increase competitiveness, and meet international standards as shown in [1]. Minimization of risks in the supply chain is a major issue that many businesses are researching and contemplating. As a result of the impact of the continuously expanding global supply chain network, logistics processes are more susceptible to risks and disruptions as demonstrated by Xanthopoulos et al. [2]. As a matter of fact, logistics is a complex process, making supply chains more vulnerable to risks amidst the ever-evolving economy and market fluctuations. Supply chain risks can stem from various factors, such as issues in transportation, inventory, and purchasing, or external factors like natural disasters. Risk management is crucial in logistics because any disruption or delay in the supply chain can significantly impact business operations, including increased costs, lost revenue, damaged goods, and reputational deterioration. Therefore, effective risk management in logistics offers numerous benefits, including efficient time utilization, prevention of resource waste, financial protection, and stability.

The term “green logistics,” along with similar terms such as “sustainable logistics” and “green sustainable logistics,” was first introduced in the 1980s. Since then, many organizations, officials, and researchers have discussed various concepts and terms related to

green logistics. According to Wu and Dunn [3], green logistics is a system in which energy is consumed efficiently, reducing environmental harm while improving labor efficiency and competitiveness. Green logistics is a system of logistics activities created to simultaneously meet human needs and preferences and align with sustainable development trends.

In Vietnam, the *Vietnam Logistics Report 2022* [4] defined green logistics as: “Green logistics is logistics activity aimed at sustainable, environmentally friendly goals, minimizing harmful impacts on the environment and consumers.” Thus, in essence, green logistics focuses on efforts and measures aimed at minimizing the negative impacts of logistics operations, striving for a sustainable balance between economic, social, and environmental goals, as detailed by Sbihi and Eglese Sbihi [5].



Figure 1. Green logistics development framework [5]

Over the past five years, research attention has largely focused on the COVID-19 pandemic, the Russia–Ukraine conflict, combined with heightened concern among citizens, businesses, and governments about climate change, significantly influenced markets and encouraged trends toward gradual deglobalization. Other global developments that emerged or accelerated during this period include new sourcing strategies, the rapid growth of online shopping and home delivery, rising digital literacy, and an expanding need for digitization across sectors such as services, logistics, and manufacturing. Solari et al. [6] stated that collectively, these factors have caused major disruptions in green logistics and supply chain management worldwide.

This study aims to identify the most critical risks and propose solutions to enhance the use of the digital economy for supply chain risk management and promote green logistics in Vietnam.

2. METHODOLOGY

This study combines the use of secondary data with in-depth interviews conducted with seven prominent logistics companies, including industry leaders such as Transimex and U&I. This multifaceted approach aims to comprehensively investigate and analyze key aspects of the logistics industry.

Secondary Data Analysis: The study begins with an extensive review and analysis of secondary data. This involves systematically reviewing existing literature, reports, academic articles, industry publications, and statistical data related to the logistics sector. The goal is to gain a comprehensive understanding of the current state of the logistics industry, emerging trends, challenges, and best practices. Secondary data analysis provides a foundational knowledge base for building further research activities, as described by Vartanian [7].

In-depth interviews: An in-depth interview is a qualitative method designed to obtain comprehensive insights through extended, one-on-one conversations with a limited number of participants. Unlike other qualitative techniques, this approach requires researchers to devote substantial time to each interviewee, adopting a conversational style that emphasizes open-ended questioning. Such questions foster exploration and discovery, enabling the collection of nuanced information about individuals' perspectives, experiences, emotions, and interpretations of a given issue. This method is widely applied in the social sciences, particularly in media psychology, where it facilitates deeper examination of complex topics and often complements multi-method research designs. Nevertheless, when employed as a standalone technique in media studies, its findings are constrained by limited generalizability, as noted by Rutledge and Hogg [8].

Semi-structured, in-depth interviews were conducted with key stakeholders, decision-makers, and experts from selected logistics companies. The interview process was designed to delve into key aspects of logistics management, including operational strategy, risk mitigation practices, technological advancements, sustainability initiatives, and industry-specific challenges, as discussed by Eppich et al. [9].

As a matter of limited resources for research, this study conducted interviews with seven logistics companies in Vietnam. The interviews were guided by a set of predefined open-ended questions but also allowed for flexibility in exploring emerging topics and insights.

3. MAIN FINDINGS

Following a comprehensive analysis of secondary data and in-depth interviews with seven prominent Vietnamese logistics firms conducted at the end of 2024, several critical operational risks emerged. These primarily include deficiencies in inventory control, transportation bottlenecks, human resource vulnerabilities, and customer service gaps. Additionally, the field research uncovered localized opportunities and structural challenges regarding the implementation of green logistics operations in Vietnam.

During the interviews, participating firms expressed significant concerns regarding the broader macroeconomic environment. Key areas of anxiety included intensifying industry competitiveness, shifting compliance attitudes among service users, domestic infrastructure gaps, and long-term profit sustainability. Conversely, all sampled firms recognized that green logistics plays a pivotal role in fostering customer loyalty, enhancing corporate social responsibility (CSR) reputations, and driving talent recruitment. Notable insights from the field include:

- "A company concentrating on green logistics is more attractive to young professionals."
- "Companies that offer environmentally friendly insights and transparency obtain new customers and earn long-term loyalty among existing ones."
- "Without corporate responsibility, we may lose our competitiveness."
- "When it comes to cooperation with intra-industrial firms, we do pay attention to their attitude towards green logistics."

3.1. Inventory risk

According to Gritsenko et al. [10], inventory risk is a type of risk in logistics arising from the possibility of having too much or too little inventory. Serious costly consequences of incorrect inventory management are stockouts, overstocking, and obsolete inventory.

Supply chain disruptions: There is a risk of this occurring with seasonal items or those purchased from overseas. Supply chain disruptions can also occur when a company's

purchasing activities are not completed on schedule. A company's financial performance can suffer long-term consequences due to disruptions in the supply chain as shown by Tang [11].

Inaccurate forecasting: Forecasting demand and sales is a crucial component in determining the necessary inventory levels and the timing of ordering raw materials and storage. Inaccurate forecasting can lead to oversupply or undersupply, resulting in lower-than-expected revenue. Besides increasing warehousing costs, excessive inventory can cause products to become obsolete and lose value.

Theft: Theft of inventory can significantly impact a company's productivity and profitability. If the company doesn't invest in security systems, this can happen frequently and have a significant impact.

Risk of excessive inventory: Two different types of goods, known as basic goods and trending goods, always coexist in the market. When a new product is introduced, it is sure to receive positive customer feedback, and demand for that product will increase for a period until saturation. The product will become obsolete and lose value when the market is saturated. Additionally, external factors such as epidemics and natural disasters can affect the goods. Perhaps the best example of this is the post-COVID-19 era, when many businesses were stockpiling old-style goods due to decreased product consumption.

3.2. Transportation risks

It is impossible to eliminate unnecessary dangers and obstacles that negatively impact delivery schedules when transporting goods over long distances, whether by sea, rail, or road. Therefore, the crucial question many organizations are asking today is: What risks are associated with delivery?

Approximately 19,000 to 20,000 vehicles enter and exit Catlai port daily. During peak hours, container trucks are often delayed for several hours due to traffic congestion caused by inadequate transportation infrastructure [12]. This leads to higher fuel consumption and slower goods transportation before reaching the port. This results in products manufactured in Phumy town (Baria -Vungtau) having to be transported to Binhduong for container loading and then transported from Binhduong, with businesses incurring additional lifting and handling fees to bring them to the port for export. The above points demonstrate that poor transportation risk management leads to many negative consequences, such as delayed deliveries and high shipping costs.

Currently, road transport is the most flexible and convenient mode of transport. However, this method also carries many risks. Goods transported from North to South (and vice versa) can only travel via National Highway 1A, which is always overloaded due to the large number of vehicles on this route, causing traffic congestion and leading to delayed deliveries. This also causes significant losses for businesses dealing with seasonal products. This is one of the issues that particularly worries companies in Vietnam because delayed deliveries greatly affect the company's reputation.

In addition, transportation risks can also stem from employee aging, the diversity of vehicles [13]. These issues could affect the safety of workers and incur significant costs for the companies and can also lead to negative rumors about the companies due to a lack of professionalism and safety concerns.

3.3. Human resource risks

Human resources are a crucial component of the logistics industry, and their role is very significant in ensuring the successful execution of logistics operations. However, there are risks associated with human resources in the logistics sector that need to be effectively managed for successful operation. Some common risks related to human resources in logistics include:

Labor shortage: A lack of skilled and experienced labor in the logistics industry can affect the smooth operation of logistics processes. In Vietnam, except for the mining industry and the state sector, the country faces a serious shortage of highly skilled labor according to the IMF [14].

Fraud and theft: The risk of fraud and theft by employees is always present in the logistics industry, where employees have access to sensitive information and assets. This includes the theft of physical assets such as goods and equipment, as well as data manipulation to carry out fraudulent financial transactions. Fraudulent activities can lead to financial losses, damage to the company's reputation, and legal consequences.

Health and Safety: The logistics industry is often associated with high levels of physical activity and exposure to hazardous substances, leading to health and safety risks. For example, businesses ensure the safety of frontline workers by providing them with protective equipment such as masks and alcohol, as well as by conducting daily disinfection checks.

Cybersecurity: The logistics industry is also vulnerable to cyberattacks, which can lead to data and asset loss. Technology is increasingly integrated into logistics operations. Cyberattacks can range from phishing and ransomware attacks to data breaches and hacks. The consequences of a cyberattack can be very serious, including the theft of confidential information, damage to the company's reputation, and disruption of business operations.

3.4. Risks in customer service management

In logistics, customer service management is a crucial aspect of the supply chain involving handling customer inquiries, complaints, and feedback related to products or services provided by the logistics company. The main risks associated with customer service management include:

Dissatisfied customers: Ineffective customer service can lead to dissatisfied customers, who may switch to competitors or even write negative online reviews, which can damage the company's reputation and diminish its credibility.

Loss of revenue: Companies may lose revenue if customers choose not to purchase products or services in the future due to poor customer service. Modern clients expect timely delivery, accurate information, and professional communication throughout their interactions with logistics companies. If these expectations are not met, they may seek services from competitors or move their business operations elsewhere.

Increased operating costs: The company may incur additional costs related to handling customer complaints, refunds, and exchanges, which can impact the company's profitability. An example of how poor customer service can increase operating costs is through returns and exchanges. If a logistics company delivers incorrect or damaged shipments to customers, this will lead to increased costs associated with returns, refunds, and exchanges. For example, the company may need to resend the shipment to the customer at no extra cost, cover the cost of shipping the returned package back to the warehouse, and bear the costs associated with warehousing and repackaging the returned item.

Damaged Reputation: A company with a poor reputation for customer service may face challenges in attracting new customers or retaining existing ones, which can impact the company's long-term growth potential. For example, a logistics company might consistently fail to deliver on time, provide accurate tracking information, and respond promptly to customer complaints. Customers receiving poor service are likely to share their experiences with others, leading to negative reviews and a tarnish on the reputation of the company. As a result, potential customers may hesitate to use the company's services, and existing customers may choose to do business elsewhere.

Non-Compliance with Regulations: Poor customer service practices can lead to non-compliance with regulations and laws, which can result in legal action against the company and significant financial penalties. Suppose a logistics company fails to ensure that products being shipped are properly labeled and meet all applicable regulatory and safety requirements. The company might transport hazardous materials without the necessary documentation or labeling, violating federal and state regulations. If a customer is injured by hazardous materials, or if a leak or spill causes property or environmental damage, this could lead to legal action against the logistics company. In addition to damaging the company's reputation, non-compliance with regulations can result in significant fines, penalties, and legal costs. The cost of such legal action can be substantial and may impact on the company's financial stability and long-term growth potential.

3.5. Opportunities and Challenges of Green Logistics in Vietnam

To effectively transition towards sustainable supply chains, it is essential to evaluate the dual forces of market-driven catalysts and systemic barriers within the Vietnamese landscape.

3.5.1. Opportunities for Green Development

Government Regulations and Support Policies: As one of the countries most severely affected by climate change, Vietnam is deeply aware of the seriousness and urgency of environmental protection activities, especially in reducing greenhouse gas emissions. In fulfilling its commitments under COP26, the Vietnamese Government has intensified efforts to develop and implement measures to reduce CO₂ emissions. Overall, the Communist Party and the Government of Vietnam have demonstrated genuine concern and top priority for sustainable development activities, including promoting green logistics. This commitment is clearly demonstrated through the issuance of numerous legal documents and policies aimed at creating a favorable legal framework.

Business Awareness: According to a survey conducted by the Vietnam Logistics Report 2022 editorial board, as shown in, a significant proportion of Vietnamese businesses, including those providing and using logistics services, have shown considerable interest in green and sustainable logistics practices. Over 73.2% of surveyed companies stated they have incorporated green logistics services into their business strategies. This is concrete and clear evidence of businesses' awareness of the role of green logistics in sustainable development [4].

Consumer Awareness: In recent years, consumer awareness in Vietnam has undergone positive changes. Consumers are increasingly aware of and prefer goods and products supplied using green logistics services. Since customers are the ultimate goal of any product supply chain, this changing consumer attitude towards green logistics serves as a strong impetus for businesses to participate in green logistics activities. According to the survey, over 30% of customers agree with the use of environmentally friendly vehicles, fuels, and materials, while more than 10% are willing to pay more for green logistics services.

3.5.2. Structural Challenges

Limited Financial and Human Resources: Both financial and human resources pose challenges to the development of green logistics services. The financial capacity of businesses is a prominent internal factor with the greatest impact on the development of green logistics, scoring an average of 4.24/5, according to the survey data in [4]. As of 2022, 98% of businesses operating in Vietnam are small and medium-sized enterprises, so financial limitations are entirely understandable. To participate in green logistics activities, businesses must ensure investment capital for purchasing new technology equipment and restructuring existing operations. Financial constraints directly hinder the implementation of green logistics. Furthermore, Vietnam is severely lacking in high-quality logistics professionals. According to forecasts by the Vietnam Logistics Research and Development Institute, by 2030, the country's logistics industry will need an additional 2.2 million personnel, including approximately 200,000 high-quality logistics personnel with professional qualifications and certifications, proficient in relevant skills, and fluent in foreign languages [1].

Logistics Infrastructure: From an external perspective, Vietnam's logistics infrastructure is considered the most challenging factor for developing green logistics. Specifically, despite investment in logistics infrastructure, many problems persist, such as the poor quality of roads, ports, and terminals, as well as suboptimal planning and construction of the transportation network, leading to limited efficiency in logistics operations. The problem of overloaded transportation systems causing congestion on many routes and ports remains common, especially during peak hours. Regarding information technology systems serving logistics, the level of IT application in businesses is still low, and the system lacks synchronization, leading to delays in processing and implementing logistics activities.

Institutional and Policy Limitations: The Vietnamese government and Party leaders have made many efforts to introduce regulations and policies supporting green logistics activities. However, the application and implementation of these regulations in practice face many difficulties due to overlapping functions and responsibilities among relevant agencies. Furthermore, focusing only on promoting one type of logistics activity while neglecting other types of logistics infrastructure will lead to a lack of synchronization in the application and implementation of green logistics. This is especially true for regulations on recycling, repair, and waste recovery. Recycling and the development of environmentally friendly packaging are underway, but the promotion of the use of limited renewable resources remains limited.

4. SOLUTIONS TO RISK MANAGEMENT IN GREEN LOGISTICS IN VIETNAM

4.1 Risk management solutions

Firstly, inventory management risks: To avoid supply chain disruptions, companies must diversify their suppliers and have alternative sources in case of shortages. Additionally, it's crucial to establish transparent and stable relationships with suppliers and have contingency plans in place to deal with unexpected disruptions. Furthermore, to minimize the risk of inaccurate forecasting, companies can utilize market research and analytics tools to gather data on consumer behavior and market trends. They can also collaborate closely with customers and suppliers to stay updated on changes in demand and production. Moreover, implementing appropriate security measures such as surveillance cameras, security personnel, and inventory control systems can help mitigate the risk of theft. Training employees in best inventory management practices is also essential to prevent internal theft. Furthermore, companies should regularly review their inventory levels and adjust them based on market trends and sales forecasts. Implementing a flexible pricing strategy can also help move inventory quickly and minimize losses due to obsolescence. Additionally, companies can consider investing in

technologies such as automation and robotics to improve inventory management processes and reduce operating costs.

Secondly, transportation risks: The government can invest in improving infrastructure, such as expanding highways, building new roads, and constructing modern ports to alleviate congestion and other traffic-related problems. Additionally, companies can utilize technological solutions, such as GPS tracking software and route optimization, to improve their transportation processes and reduce the likelihood of delays and accidents. Furthermore, organizations can provide regular training and development opportunities for their employees to ensure they understand best practices in safety and can make informed decisions at work. Additionally, businesses can prioritize risk management in transportation by conducting regular risk assessments, implementing appropriate measures to mitigate risks, and monitoring their effectiveness. Moreover, companies can work with their partners, including logistics providers, carriers, and transport contractors, to create more efficient and effective transportation processes to reduce the risk of delays and accidents. Overall, mitigating transportation risks requires a multi-faceted approach, including both government and organizational action. By investing in infrastructure, technology, employee training, risk management, and partner collaboration, companies in Vietnam can mitigate the impact of transportation-related risks on their operations and reputation.

Thirdly, human resource risks: Businesses should invest in training and development programs to cultivate a skilled and experienced workforce in the logistics industry. This includes providing apprenticeships, internships, and ongoing education to attract and retain top talent. To prevent theft during recruitment, companies should conduct background checks on new employees and implement robust management and security protocols to prevent fraudulent activities. This includes installing security cameras, maintaining access control, and conducting random checks. Taking good care of employees can improve employee engagement and motivation, thereby fostering a positive corporate culture. Therefore, companies need to implement health and safety policies that prioritize employee safety and prevent injuries or illnesses. This includes conducting regular safety assessments, providing safety equipment and training, and proactively addressing health and safety concerns. This will foster greater employee loyalty as they feel cared for and respected. To protect security, companies can deploy IT security measures, such as firewalls, antivirus software, and employee training programs, to prevent cyberattacks. This includes conducting regular IT assessments, implementing data backup and recovery procedures, and monitoring user activity to detect potential security breaches. By investing in these measures, companies can mitigate the impact of human resource-related risks on their operations and reputation.

Finally, to mitigate the risks associated with poor customer service management in logistics, companies can take several proactive steps. First and foremost, organizations must provide excellent customer service by ensuring that their customer relationship staff are well-trained, knowledgeable, and equipped to handle inquiries and resolve service failures promptly and professionally. This training should specifically focus on advanced conflict resolution, effective cross-departmental communication, and the proficient use of real-time tracking systems to provide clients with accurate data. Furthermore, establishing a standardized service recovery protocol allows the team to systematically address complaints, manage returns or exchanges efficiently, and minimize operational cost overruns. By implementing these structured frameworks, logistics providers can safeguard their corporate reputation and maintain long-term client retention.

4.2 Solutions to green logistics development

Financial Measures: The government has the potential to establish a dedicated support fund for green logistics businesses, providing financial assistance and interest rate incentives to alleviate the financial burden. Furthermore, businesses can actively seek strategic partnerships and investments from international organizations or domestic partners capable of providing both financial support and technology transfer.

Human Resource Development: Prioritize strengthening training and human resource development programs in the logistics industry, emphasizing green skills and new technologies. Establish collaborative initiatives between businesses and universities to ensure a well-trained workforce that meets market demands.

Strengthening Logistics Infrastructure: Upgrade transportation infrastructure, allocating investment towards upgrading port, rail, and road infrastructure to minimize congestion and improve overall efficiency. Develop a comprehensive transportation planning strategy to optimize the transportation network and reduce travel time.

Information Technology Integration: The government can implement policies to encourage the application of information technology in logistics operations, leveraging tax benefits and investment incentives. It should encourage the synchronization of information technology systems within the logistics industry to streamline processes and reduce waiting times.

Regulations and Policies: Ensure the effective regulation and application of policies related to green logistics. Strengthen coordination among regulatory agencies to minimize conflicts and enhance policy enforcement.

Recycling and Sustainability Initiatives: Implement policies that promote recycling, repair, and waste recovery, especially in the logistics sector. Collaborate with businesses and organizations to develop recycling solutions and utilize renewable resources.

4.3 Applying the digital economy to risk management

According to Gritsenko et al. [10], utilizing the digital economy (Logistics 4.0, IoT, AI, Blockchain) reduces logistics risks by optimizing processes, increasing transparency, and enabling accurate forecasting. Digital technology enables real-time tracking, route optimization, warehouse automation, and inventory risk management, thereby reducing costs, increasing productivity, and minimizing errors, improving customer service and developing an important new era for building ideal and competitive supply chains.

Real-time Tracking (IoT): Sensors and RFID tags provide end-to-end visibility of goods, reducing the risk of lost shipments, theft, and inventory inaccuracies.

Condition Monitoring (IoT): IoT sensors monitor temperature, humidity, and shock for sensitive cargo (e.g., pharmaceuticals, food), reducing spoilage risks and quality failures.

Tamper-Proof Records (Blockchain): Provides an immutable, shared ledger for all stakeholders, reducing fraud, document disputes, and counterfeit risks. Blockchain ensures greater transparency and security in supply chains by providing an immutable ledger of all transactions and activities. This increases trust between stakeholders, reduces fraud, and enhances the traceability of goods.

The digital economy can reduce logistics risks in several ways:

- Increased transparency and real-time tracking: Using IoT and AI helps track the location and status of shipments 24/7, enabling quick identification and resolution of supply chain disruptions.

- Route and transportation optimization: Big data and AI algorithms help calculate the most efficient routes, minimizing the risk of delayed deliveries due to congestion.
- Warehouse and operational automation (RPA): Minimizes human error in manual processes, packaging, and inventory management, helping to ensure the quantity and quality of goods.
- Accurate forecasting and planning: The digital economy allows businesses to analyze historical data to forecast demand and prepare contingency plans for potential shipping time risks.
- Data transparency using Blockchain: Ensures data is not altered, increasing reliability in logistics transactions and paperwork.

5. CONCLUSIONS

In the field of green logistics, integrating environmentally sustainable practices into the supply chain is attracting significant attention from businesses and government agencies in Vietnam. The emphasis on green logistics aligns with global efforts to reduce the environmental impact of supply chain operations. As the world increasingly recognizes the importance of sustainable business practices, integrating green logistics not only minimizes environmental risks but also enhances company reputation and attracts environmentally conscious consumers.

The dual focus on effective risk management and the adoption of green logistics practices helps Vietnam's logistics industry achieve a sustainable and resilient future. By proactively addressing inherent risks and adopting environmentally friendly approaches, businesses not only strengthen their position but also contribute to the overall progress of the Vietnamese logistics landscape. This integrated strategy is crucial for addressing the complexities of the global logistics market and ensuring long-term success in a constantly evolving economic landscape.

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