Factors Affecting Green Logistics Development In Vietnam

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Abstract: The study aims to identify the factors influencing green logistics development in Vietnam. The empirical data were collected through 437 questionnaires surveyed by logistics enterprises in Vietnam. Using exploratory factor analysis, confirmatory factor analysis, and structural equation modeling (SEM), the study found that the most influential factor on green logistics development is state policy, while the least impact comes from employees' awareness and knowledge. The results suggest effective solutions to enhance green logistics development in Vietnam in the future.
Keywords: green logistics, develop, Vietnam

INTRODUCTION

The rapid growth of the economy and climate change harm people's living environment. Statistics from the European Environment Commission show that the logistics industry accounts for 5.5 percent of global emissions from transportation. Therefore, stakeholders are putting pressure on logistics companies to take responsibility for the negative environmental impacts of their business operations.

Green logistics is a vital solution to address pollution issues. It involves reducing the environmental damage caused by the logistics industry and utilizing resources throughout the logistics cycle for sustainable development. Green logistics is part of both symbiotic economies with the environment and adaptive economic growth, playing a crucial role in each country's green economic development strategy (Qu et al., 2017). Its goal is to implement new technologies, use clean fuels to cut emissions, and reduce noise. Green logistics helps businesses maintain long-term economic efficiency, minimize ecological impact, make breakthroughs in global environmental protection, and lay the groundwork for sustainable growth.

In Vietnam, the logistics industry contributes significantly to environmental pollution due to the use of fossil fuels. Green transportation, using environmentally friendly biofuels and reducing unnecessary stages in the supply chain, will support the logistics industry in developing sustainably and protecting the environment. Export and import activities are growing, and domestic trade is expanding, making the development of green logistics necessary and beneficial for enterprises. Although Vietnam has approximately 4,000 logistics companies, most are small to medium-sized. Therefore, the application of green technology still faces many challenges.

The study aims to identify the factors that directly influence green logistics development in Vietnam. The results suggest effective solutions to advance green logistics toward sustainable growth in the future.

LITERATURE REVIEW

2.1.1. Logistics

The Council of Logistics Management (1988) defines "Logistics is the process of planning, implementing, and controlling a cost-effective way of circulating, reserving materials, and managing in-process inventory of manufactured products in the same line of the corresponding information from the first point to the last point of consumption to meet the customer's requirements."

Doan (2010) argues that "Logistics is the process of optimizing the location, storage, and transfer of cycle resources from the first point, which is the provider, through the manufacturer, wholesaler, and retailer, to final consumers, via a series of economic activities."

Although there are different views on logistics, within the study, logistics is defined by the Commercial Law of Vietnam (2005). "Logistics is a commercial activity in which traders organize one or more stages, including receiving goods, transporting, storing, customs clearance, making other documents, consulting customers, packing, marking, delivery, or other services related to the goods as agreed with the customer for remuneration."

2.1.2. Green logistics

Green logistics exhibits the traits of a logistics system that uses modern technologies and methods to reduce environmental harm during operations, while still increasing resource use within the system (Rogers & Tibben-Lembke, 1998; Yanbo & Songxian, 2008).

Green logistics involves activities related to managing the two-way flow of goods and information from the starting point to the endpoint in the supply chain to improve efficiency and reduce environmental damage while still fully meeting human needs. Green logistics aims to transport and deliver goods, raw materials, and other physical resources at the lowest cost while providing the highest quality and minimizing the negative environmental impact throughout the entire process (Carter & Rogers, 2008).

Green logistics also refers to supply chain management activities and implemented plans aimed at reducing the environmental and energy impacts of goods distribution, focusing on handling materials, waste management, packaging, and transportation (Rodrigue et al., 2012).

Therefore, green logistics is not a new idea. Its aim is to integrate environmental protection into the company's overall goals and balance the supply chain to deliver core values to customers. Green logistics creates harmony among economic, social, and environmental benefits.

2.2. Hypothesis

Combination of the PEST model and the studies by Schmied (2010) and Le (2015). Seven factors influence the development of green logistics in Vietnam, as follows:

2.2.1. Political

Political factors are typical of each country, including institutions, policies, and laws that strongly affect all fields and industries. If a business operates in a country, it must comply with the laws and policies issued. Therefore, politics have the greatest impact on the development of green logistics. Political stability, diplomatic relations, and government policies that promote economic growth, tax incentives, environmental protection laws, and corporate law can lead enterprises to shift from using outdated technologies to adopting modern solutions. This shift supports green development, environmental protection, and social responsibility. It will give the logistics industry a competitive advantage. Based on the above arguments, the proposed research hypothesis is as follows:

H1: Political has a positive affect on green logistics development.

2.2.2. Macroeconomics

The macroeconomy includes gross domestic product (GDP), inflation, interest rates, changes in exchange rates, and the fluctuations of essential goods that impact green logistics development. Logistics companies need to monitor the macroeconomic conditions that directly influence the economy and future growth to make informed investment decisions, innovate technology, and adopt the greening model in their operations. Based on these points, the proposed research hypothesis is as follows:

H2: Macroeconomics has a positive affect on green logistics development.

2.2.3. Social and cultural

Social and cultural values are fundamental to each country. Culture consists of the values that shape a society and form the basis for its existence and development. Therefore, social and cultural factors significantly influence how logistics enterprises are perceived in terms of sustainable development. They help protect socio-cultural, cultural, and spiritual values, as well as people's lifestyles. Additionally, the merging of different cultures fosters new perceptions within society about caring for the environment. This, in turn, can lead to changes in consumer psychology and lifestyles, and promote a trend toward green development in the economic and logistics sectors. Based on these arguments, the proposed research hypothesis is as follows:

H3: Social and cultural have a positive affect on green logistics development.

2.2.4. Science and technology

Science and technology play an active role in forecasting, preventing, renovating, and restoring environmental pollution, as well as conserving natural resources. The era of technological revolution makes it urgent to replace old technologies with environmentally friendly ones to create products and services that meet environmental protection standards and satisfy customers. Logistics businesses incorporating modern science and technology—such as increased use of the internet, artificial intelligence, and customer data—will reduce costs and eliminate redundant stages in the supply chain and environmental protection efforts. Information and communication technology (ICT) will diminish the geographical barriers of media and be applied in managing the circulation of goods and information within enterprises. Based on the above, the proposed research hypothesis is as follows:

H4: Science and technology have a positive affect on green logistics development.

2.2.5. International integration

During the process of international integration, trade barriers are removed, allowing domestic logistics enterprises to join the global supply chain and compete with foreign competitors in the local market. This presents both challenges and opportunities for logistics businesses to gain new management experiences and adopt modern technologies to meet customer demands, both domestically and internationally. Additionally, it enhances competitiveness by improving service quality, expanding network operations, and fully developing resources. However, the competitiveness of Vietnam's logistics enterprises remains low, as they mainly focus on stages like transportation, delivery, and customs procedures. Moreover, human resources lack expertise, and technology is weak; transportation systems and supporting infrastructure for logistics activities have not kept pace with growth. Consequently, logistics enterprises face many challenges in applying green logistics to stand out in international integration. Based on the above arguments, the proposed research hypothesis is as follows:

H5: International integration has a positive affect on green logistics development.

2.2.6. The enterprise

The enterprise consistently strives to increase revenue and decrease costs. As a result, logistics companies are directly involved in transporting vehicles that use biofuels, implementing multimodal delivery, and consolidating freight. High transportation costs and limited revenue opportunities hinder logistics businesses from adopting green solutions. However, enterprises recognize the benefits of green logistics, such as vehicles using eco-friendly technology that are less costly to operate and provide environmental benefits to the community and society, compared to older cars that run on fossil fuels and fail to meet emission standards. Therefore, companies are less interested in trucks that are more expensive than the profits they generate. Additionally, green transportation in urban areas reduces emissions and noise pollution. Based on these arguments, the proposed research hypothesis is as follows:

H6: The enterprise has a positive affect on green logistics development

2.2.7. Customers

Customers want to offer products and services using methods that are less harmful to the environment. Customer influence will drive logistics companies to adopt green solutions to meet customer demands. The company will use perishable packaging materials and home delivery to reduce vehicle traffic, congestion, and emissions. Based on these points, the proposed research hypothesis is as follows:

H7: Customers have a positive affect on green logistics development.

METHODOLOGY

3.1. Qualitative research

By summarizing documents and synthesizing previous studies, the authors designed a preliminary scale that includes seven factors: political, macroeconomic, social and cultural, science and technology, international integration, enterprise, and customer influence on green logistics development.

The study engaged 12 managers from logistics companies to gather opinions, identify, and develop factors influencing the development of green logistics. It carefully evaluated the observed variables within each factor to match the context. Additionally, the study conducted in-depth interviews with five logistics experts to pinpoint and resolve issues encountered during discussions and refine the research model.

The results indicate that there are significant disagreements on certain factors influencing green logistics development. Of 12 managers who participated in discussions, 10 and 5 experts stated that two factors, "social and cultural" and "enterprise," should be adjusted. The "social and cultural" factor is too broad in meaning, making it unsuitable for green logistics. Everyone has a vague feeling and questions whether this factor truly influences the development of green logistics. Through discussions and in-depth interviews, they concluded that the "social and cultural" factor should be removed. The "enterprise" factor is considered incomplete in capturing the whole meaning of the content. It is necessary to replace it with factors that reflect enterprise awareness of green logistics development. They include "perception of enterprise owners" and "perception and knowledge of employees." Additionally, both experts and managers emphasize that green logistics depend heavily on transport infrastructure for growth. Therefore, they agreed that the "Transport infrastructure" factor should be added. Furthermore, the "Political" factor should be renamed to "State policy" to reflect better the laws and policies guiding green logistics development. Simultaneously, the wording should be simplified to make the scale easy to understand and

answer, while accurately maintaining the core meaning based on the theoretical framework and the knowledge of survey participants.
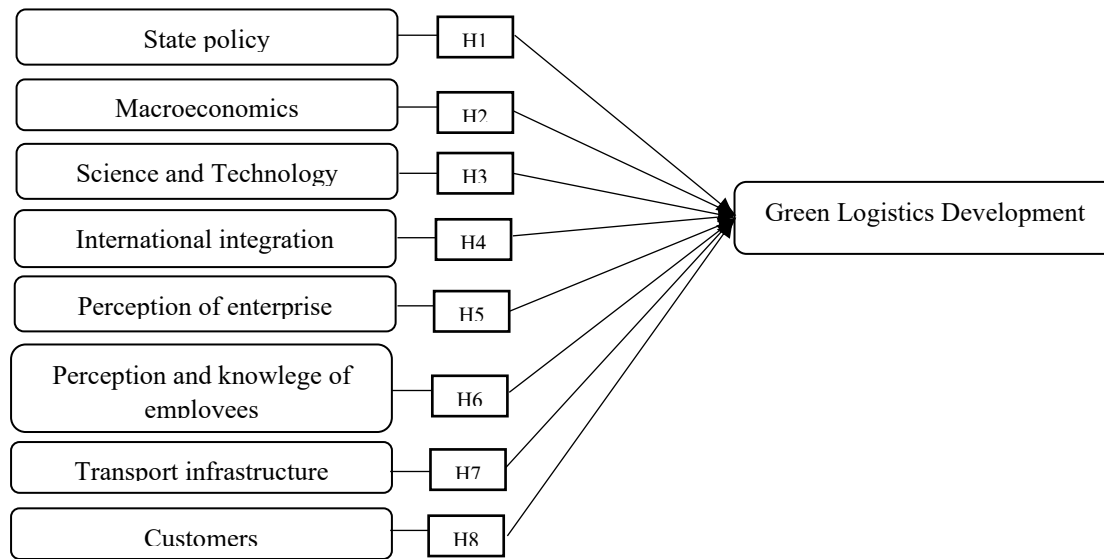
Figure 1. Adjusted framework model

Source: The author

Table 1: Scale of factors in the study framework

Abbr.	Variables	Source
State policy		
Pol1	The stability of the political plays a significant role in green logistics development.	Discovery in qualitative research
Pol2	State policies create motivation and influence green logistics development.	
Pol3	Building a legal basis and supporting documents for the green logistics development.	
Pol4	Transparency and implementation of an electronic customs system.	
Pol5	Simplify documents and administrative procedures in the process of exporting and importing goods.	
Pol6	Increase tax incentives for logistics enterprises applying green technology in goods supply.	
Pol7	Organize seminars and training courses for logistics businesses to expand their knowledge and benefits if they develop green logistics.	
Pol8	Green logistics development belongs to the national strategy on green growth.	
Macroeconomics		
Mac1	The inflation rate and GDP have an impact on the development of green logistics.	Discovery in qualitative research
Mac2	Changes in tax rates and new regulations on green logistics notify logistics enterprises.	
Mac3	Changes in the process of exporting and importing goods affect the development of green logistics.	
Mac4	Green logistics plays an essential role in socio-economic development.	
Mac5	Enterprises need a large capital scale in green logistics development.	
Mac6	The price of clean raw materials and input services are interested.	
Science and Technology		
ST1	Enterprises use science and technology to affect prices and service quality.	Discovery in qualitative research
ST2	Enterprises use information technology to track the status of goods.	
ST3	Enterprises use science and technology, so customers can grasp the process of transporting goods.	

Abbr.	Variables	Source
ST4	Enterprises use science and technology, work done quickly and efficiently.	
ST5	Enterprises use science and technology to save costs and environmental protection.	
ST6	Enterprises use science and technology to increase their internal capacity to meet the needs of customers.	
International integration		
Int1	Investment trends from abroad have an impact on green logistics development.	Discovery in qualitative research
Int2	Participation in international trade agreements has a positive impact on green logistics development.	
Int3	International integration increases competitiveness in the logistics industry.	
Int4	International integration promotes green logistics development.	
Int5	International integration supports the logistics industry to access and use environmentally friendly technologies.	
Int6	International integration supports logistics enterprises to find and access new customer sources.	
Perception of enterprise owners		
Ent1	Enterprise owners are always interested in environmental protection and responsibility to the community.	Discovery in qualitative research
Ent2	Enterprise owners always focus on applying green technologies in business activities.	
Ent3	Enterprise owners always want to create environmentally friendly products and services.	
Ent4	Enterprise owners improve knowledge, promote understanding of environmental protection for employees.	
Ent5	Enterprise owners always have a development orientation associated with environmental protection.	
Perception and knowlege of employees		
Emp1	Employees know about their responsibilities and obligations towards the environment and green logistics development.	Discovery in qualitative research
Emp2	Employees are always fully equipped with knowledge and training on environmental protection.	
Emp3	Employees have a sense of efficient and energy-saving use of equipment and machines to perform work.	
Emp4	Employees have the knowledge and ability to use green technologies to apply at work.	
Emp5	Employees have knowledge and awareness for environmental protection.	
Transport infrastructure		
Tra1	Infrastructure for freight is not synchronized.	Discovery in qualitative research
Tra2	The road system connecting to seaports and airports has not invested strongly.	
Tra3	Transport infrastructure has not kept pace with the growth of the logistics industry.	
Tra4	Many main circulation routes through the city cause traffic congestion affecting logistics activities.	
Tra5	Logistics centers are lacking with small scale.	
Tra6	The location of the ports is not convenient for the transportation of goods.	
Customers		
Cus1	The demand of customers to use safe products and services that meet environmental protection criteria.	Discovery in qualitative research
Cus2	Customers want to use environmentally friendly means of transport.	
Cus3	The green logistics service process meets the standards set by customers.	
Cus4	Customers want to choose a logistics enterprise with environmental protection factors.	

Abbr.	Variables	Source
Cus5	Customers want to experience the green logistics service that brings.	
Green Logistics Development		
Dev1	Green logistics development level.	Discovery in qualitative research
Dev2	Green logistics activity level.	
Dev3	Green logistics contributes to changing the logistics industry.	

Source: The author

3.2. Quantitative research

The research design in quantitative research is the descriptive research design, using observed variables on a 5-level Likert scale (from 1- absolutely disagree to 5- absolutely agree). The study employs a convenient sampling method for logistics enterprises in Vietnam. The total number of logistics enterprises in Vietnam is 4000 (Ministry of Industry and Trade, 2019). Therefore, the sample size will be calculated using Slovin's (1984) formula.

$n = N/(1 + e^2N) = 4000/(1 + 0.05^2 * 4000) = 363$

With:

- n: standard sample size
- N: overall scale
- e: errors allowed (0.05)

Additionally, to reduce the risk of a low response rate, the authors will use a sample size of 475 observations. Survey locations include five cities: Hanoi, Hai Phong, Da Nang, Ho Chi Minh City, and Can Tho, because these cities have the fastest growth rates and the greatest potential for logistics development in the country (Vietnam Logistics Report, 2019). The authors divided the questionnaires evenly among the five cities, with 95 enterprises per city. This equal distribution aims to provide a fair assessment of opportunities for green logistics development across those cities. A total of 437 valid questionnaires were collected. The survey period from January 1st, 2021, to April 30th, 2021. Survey questionnaires were distributed both directly and via email or phone calls to logistics enterprises.

Table 2: Sample characteristics

Characteristics	Items	Number	Percent (%)
Type of enterprise	State enterprises	12	2.7
	Private enterprise	391	89.5
	Enterprises with 100% foreign capital	34	7.8
Number of employees	Under ten employees	47	10.8
	From 11 to 50 employees	108	24.7
	From 51 to 100 employees	123	28.1
	More than 100 employees	159	36.4
Operating time	Under five years	115	26.3
	From 5 years to 10 years	185	42.3
	More than ten years	137	31.4

Source: Analysis results from SPSS 26

Among the 437 logistics enterprises participating in the survey, private firms made up 89.5%. Most companies have between 51 and 100 employees (64.5%) and have been operating for five to over ten years, accounting for 73.7% of the total. The characteristics of the survey sample accurately reflect the current situation in the logistics industry in Vietnam. The enterprises are small, with a limited number of employees, and their operating periods are shorter than those in other countries.

FINDINGS AND DISCUSSION

The results show that the lowest Cronbach's Alpha coefficient is 0.784, and the highest is 0.884. Compared with the standard 0.6, all observed variables of the scale are satisfactory. Corrected item-total correlation is greater than 0.3. The Cronbach's alpha coefficient of the variable types for all 50 observed variables is smaller than the sum of Cronbach's Alpha coefficient, so no variables are excluded (Nunnally

& Bernstein, 1994). All scales meet the criteria for reliability and discriminant validity. Therefore, the scale is considered good and meets the reliability requirements for exploratory factor analysis.

The study uses the Principal Axis Factoring extraction method along with Promax rotation. The analysis of the overall scale includes all observed variables of the framework model. The results show a coefficient KMO = 0.811; the Bartlett Test is statistically significant with Sig. = 0.000 (<0.05), and nine factors were extracted with an Eigenvalue of 1.324; Sums of Squared Loadings = 80.231% (greater than 50%). These nine factors explained 80.231% of the variability in the data (Hair et al., 1998).

The results of the CFA indicate that the weights of the observed variables are all standard (≥ 0.5). Therefore, the scales achieve the convergent validity (Anderson & Gerbing, 1988). The results also show that the model has 1527 degrees of freedom, with a test value of CMIN (Chi-square) = 421.156 and a P-value of 0.000; CMIN/df (Chi-square per degree of freedom) = 2.543, which is less than 3 (Carmines & McIver, 1981). The GFI is 0.902; TLI is 0.912; and CFI is 0.915, all greater than 0.9 (Tabachnick & Fidell, 2007). The RMSEA value is 0.046, which is less than 0.08 (Hu & Bentler, 1999). Therefore, the research model aligns well with the data. Additionally, there is no correlation between the measurement errors, indicating that the observed variables are unidimensional. The correlation coefficients among the research concepts are all different from 1, showing that the components have discriminant validity. The analysis results also confirm that the scales meet the requirements of reliability (Steenkamp & Van Trijp, 1991).
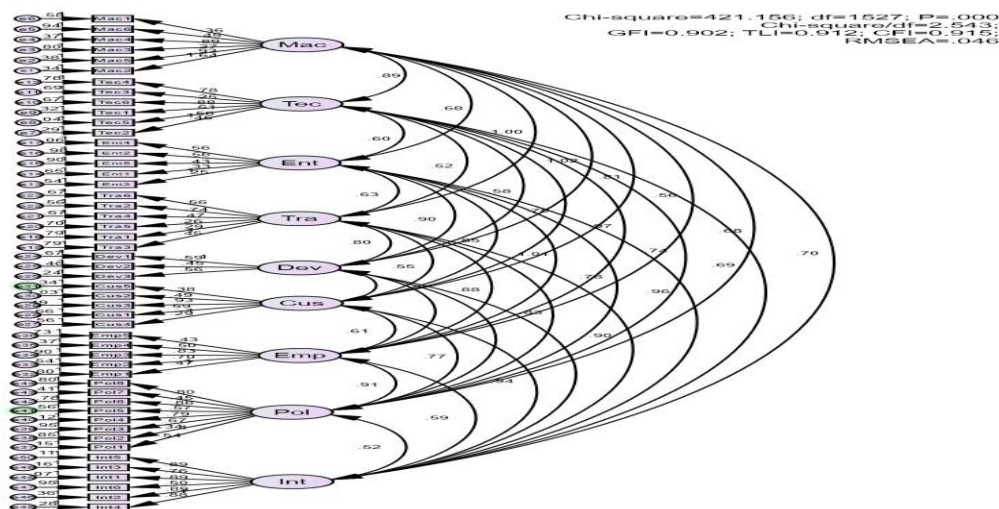
Figure 2. The results of the confirmatory factor analysis of the overall model scale
Source: Analysis results from AMOS 20

Based on the outcomes of the confirmatory factor analysis of the overall model scale, the results of the structural equation modeling align with the research data. It is indicated by the CMIN/df (Chi-square/df) = 2.647 < 3 (Carmines & McIver, 1981) and the GFI = 0.907, TLI = 0.918, CFI = 0.922, all greater than 0.9; and an RMSEA = 0.048, which is less than 0.08 (Hu & Bentler, 1999).

Simultaneously, based on the analysis results, the P-value for the impact relationships between the factors is less than 0.05. Therefore, the relationship between personality traits, job satisfaction, and organizational commitment is statistically significant in the structural equation modeling (SEM). Consequently, hypotheses H1, H2, H3, H4, H5, H6, H7, H8 are accepted.

Table 3: The results of Regression Weights

Correlation			Estimate	S.E	C.R	P
Dev	←	Mac	0.412	0.074	3.725	0.000
Dev	←	Tec	0.476	0.062	3.651	0.000
Dev	←	Ent	0.393	0.069	0.704	0.000
Dev	←	Tra	0.453	0.082	2.261	0.000
Dev	←	Cus	0.384	0.188	2.171	0.000
Dev	←	Emp	0.375	0.093	3.394	0.000
Dev	←	Pol	0.481	0.197	2.363	0.000
Dev	←	Int	0.404	0.126	1.347	0.000

Source: Analysis results from AMOS 20

Empirical research indicates that eight factors have a positive influence on green logistics development in Vietnam. Among them, government policies have the most significant impact. Intervention by the government is essential for developing countries, whereas developed nations often have suitable measures and guidelines for environmental management, typically delegated to public organizations. Attention to environmental protection plays a crucial role in promoting green logistics, which aligns with Vietnam's situation. As Vietnam faces numerous natural disasters that harm the environment, and pollution levels are increasing, focusing on environmental protection is a vital factor in supporting the development of green logistics and addressing vulnerabilities.

Furthermore, science and technology factors and infrastructure for green logistics also play a vital role in the development of green logistics in Vietnam. This aligns with the reality of transport infrastructure, communication infrastructure, and the application of science and technology in the green logistics field in Vietnam. Logistics enterprises are mainly small and medium-sized businesses. Therefore, the application of green technology in providing logistics services is limited to one or a few simple stages within the logistics service supply chain. Other factors include macroeconomics, international integration, perceptions of enterprise owners, customers, as well as the awareness and knowledge of employees, all of which significantly impact the development of green logistics.

CONCLUSION AND IMPLICATION

The study aims to analyze the factors influencing green logistics development in Vietnam. It examines data collected through surveys of logistics enterprises. Confirmatory factor analysis and structural equation modeling were used to determine the relationships between the scales in the research model. The results show that the State's policies have the most significant impact on green logistics development in Vietnam.

State policies play a crucial role for logistics companies. Therefore, it is important to improve the legal framework. The government needs to implement favorable policies and support mechanisms to motivate and encourage logistics companies to develop green logistics.

Promote the adoption of science and technology in developing green logistics. Investing in information technology is essential and a prerequisite for green logistics growth. Logistics companies should collaborate to enhance their capacity and invest in green technology systems to boost business performance. Implement GPS technology for transportation management and positioning. Additionally, strengthen the development of cold chain technology in warehouse management to address technical and equipment challenges related to heat, cold preservation, and energy efficiency for warehouse systems.

Vehicles have the greatest impact on the environment through emissions, noise, and traffic congestion. Therefore, the State must carefully plan and design the logistics infrastructure to enhance the efficiency and overall performance of the system. Increase investment in transport infrastructure, improve the quality of roads, railways, airways, and sea routes, with an emphasis on developing the seaport system and shipping via transportation modes with high potential for greening and emission reduction in the supply chain.

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