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PHÂN TÍCH HOẠT ĐỘNG LOGISTICS BỀN VỮNG TẠI ĐÀO VIÊN (ĐÀI LOAN) VÀ BÀI HỌC CHO HÀ NỘI (VIỆT NAM)

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Tóm tắt

Nghiên cứu được tiến hành với mục đích tổng hợp và đánh giá việc thực hiện các hoạt động logistics bền vững của hai thành phố Đào Viên (Đài Loan) và Hà Nội (Việt Nam) bằng phương pháp phân tích so sánh định lượng. Khung so sánh dựa trên các chỉ số EcoLogistics do ICLEI phát triển với bốn tiêu chí: tính bền vững về môi trường, công bằng xã hội, tính bền vững về kinh tế và hiệu quả vận hành. Kết quả nghiên cứu đã chỉ ra những điểm mạnh và điểm yếu của hoạt động logistics bền vững tại Hà Nội. Từ đó, dựa trên các chính sách mà Đào Viên đã áp dụng thành công, nhóm nghiên cứu đề xuất các khuyến nghị để thành phố Hà Nội tiếp tục duy trì và phát triển hệ thống logistics hiệu quả và bền vững hơn trong tương lai.

Từ khoá: Hà Nội, Đào Viên, logistics bền vững, EcoLogistics

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SUSTAINABLE LOGISTICS PRACTICES IN TAOYUAN (TAIWAN): LESSONS FOR HANOI (VIETNAM)

Abstract

This study aims to investigate the implementation of sustainable logistics practices of the two cities Taoyuan (Taiwan) and Hanoi (Vietnam) by using the desk research analysis approach. The comparative framework is based on the EcoLogistics Indicators developed by ICLEI with four criteria: environmental sustainability, social equity, economic sustainability and operational efficiency. As a result of research synthesis and analysis, strengths and weaknesses of green logistics activities in Hanoi are revealed to draw comprehensive conclusions and to propose recommendations for this city to perform better in the sector as well as maintain an efficient and sustainable logistic system in the future, based on the policies that Taoyuan had successfully accomplished.

Keywords: Hanoi, Taoyuan, sustainable logistics, EcoLogistics

1. Introduction

In the context of unprecedented urbanization and globalized trade, the logistics sector wields significant influence over the economic, environmental, and social dynamics of cities. While logistical activities contribute positively to socio-economic development, fulfilling demands for mobility, constructing infrastructure, and creating job opportunities, they also pose challenges such as dependency on fossil fuels, adverse effects on health and safety, and environmental pollution (Abbasi & Nilsson, 2016). The surge in logistical activities underscores the urgent need for sustainable practices to mitigate potential adverse effects on both the environment and urban populations.

Taiwan's Taoyuan City stands out as a major logistics hub in the Asia-Pacific region and a global leader in sustainable logistics (ICLEI, 2021). Recognized for innovative policies and programs, Taoyuan has successfully reduced the environmental impact of its logistics sector through initiatives like green transportation, sustainable warehousing, reverse logistics, and eco-friendly packaging. In contrast, Hanoi, Vietnam's capital city, grapples with challenges such as air pollution, greenhouse gas emissions, and traffic congestion, highlighting the varying states of sustainable logistics practices in different urban contexts.

Motivated by these disparities, the research group chose the topic "Sustainable logistics practices in Taoyuan (Taiwan): Lessons for Hanoi (Vietnam)" to compare the current status of sustainable logistics practices in the two cities. The objective is to draw actionable recommendations for Hanoi based on the lessons learned from Taoyuan's experiences, paving the way for a sustainable future in Hanoi's burgeoning logistics sector. The research methodology involves a comprehensive analysis of existing literature on sustainable logistics practices, employing the Ecologistics Indicators framework for a systematic evaluation of sustainability. This

approach encompasses a multidimensional assessment, integrating key performance indicators related to environmental, social, and economic aspects of logistics operations in both Taoyuan and Hanoi.

2. Overview of sustainable logistics performance

2.1. Sustainable logistics: Concept & Characteristics

Srivastava (2017) defined green logistics as one key element of the sustainable supply chain that focuses on the design, execution, and management of logistical activities while considering environmental, social, and economic issues. It adopts a triple-bottom-line strategy to measure how decisions may affect people, the environment, and revenue (Chen & Paulraj, 2017). Varsei, Azadegan and Ivanov (2019) expounded that sustainable logistics methods enable businesses to balance satisfying their logistical requirements and minimising harmful environmental and social effects. Additionally, many tactics and programmes to lessen the negative effects of logistical operations may be proposed in sustainable logistics (Vanalle et al., 2021). It addresses issues including lowering carbon emissions through alternative fuels, energy-efficient modes of transportation, and green packaging techniques.

The sustainable development of urban logistics is becoming more urgent than ever due to the fast development of the e-commerce industry and the impacts of COVID-19. Urban logistics is conceptualised as optimising goods management, storage and delivery. Taniguchi et al. (2001) explored that city logistics was the process of private companies aiming at total optimization of the logistics and transport activities with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy. While it plays a vital role in the urban economy by supporting industries and society, a growing concern of conventional logistics's negative social and environmental effects can be acknowledged. Consequently, a sustainable and efficient logistics freight sector is crucial for promoting urban competitiveness, economic growth and most importantly maintaining the quality of life.

2.2. EcoLogistics Indicators: Overview

The EcoLogistics Indicator (ELI) system is a sustainable logistics performance measurement system designed for policymakers to make interventions and propose decisions to improve the efficiency of the logistics system while considering social, economic, and environmental components as priorities. It is a tool for urban areas to measure their urban logistics performance status quo to identify gaps and opportunities for policy interventions and set appropriate targets that adapt to their vision and goals. Specifically, the system serves as a self-assessment tool to evaluate the status quo of the city’s approach to managing sustainable urban logistics, with a cycle of re-evaluation every two to three years to assess the progress, identify trends, and consider the needs for intervention. This is part of developing a Sustainable Urban Logistics Plan (SULP) or a similar action plan or pathway policy document to intervene and plan for the short-, medium- and long-term strategies.

The indicator system is structured into four dimensions that take into account the need for sustainability:

(1) ***Environmental sustainability*** refers to reduced air and noise pollution, greenhouse gas (GHG) emissions, and energy consumption from freight operations;

(2) ***Social equity*** ensures safety, public participation in city policies, and overall quality of life of the local communities to minimize disturbances to the communities resulting from logistics operations;

(3) ***Economic sustainability*** maintains the economic competitiveness of the city and addresses energy efficiency and overall freight sector efficiency and affordability and

(4) ***Operational efficiency*** is a coefficient of delivery productivity (e.g., average payload), utilization (e.g., fleet), and reliability (e.g., timeliness).

In each dimension, various sub-indicators are delineated, many of which have interrelated relationships.

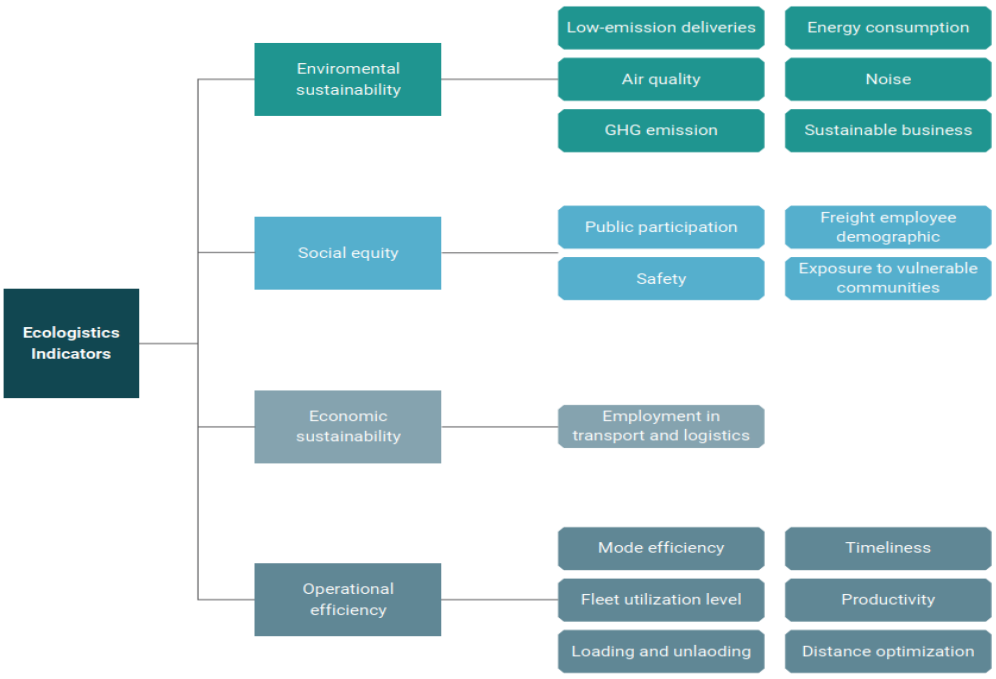

Figure 1. Overview of the EcoLogistics Indicators

Source: Taoyuan EcoLogistics Multi-stakeholder Group (2022)

3. Sustainable logistics practices in Taoyuan & Hanoi: A comparative analysis

3.1. Environmental sustainability

3.1.1. Low-emission deliveries/Zero-emission deliveries

In Taoyuan, a proactive stance against emissions includes a Low Emission and Quiet Zone in the Daxi District, featuring a city-funded consolidation station with light electric freight vehicles next to residential and school areas. Launched in April 2022, this initiative, managed by the Takoham Environmental Sustainability Foundation, supports the implementation of low-carbon, quiet consolidation stations and shared tricycles in Daxi. The foundation facilitates communication among the city government, local retailers, and residents, assisting in informative sessions led by the municipal government. It guides logistics operators and residents in obtaining permits for trucks over 3.5 tonnes to enter the historical city (Gavilan, 2022). The Taoyuan City Ecologistic White Paper (2022) highlights a notable increase in low-emission trucks from 60% in 2019 to 66% in 2020. Furthermore, Taoyuan collaborates with fleet-owning corporations to promote the use of environmentally friendly trucks, aligning with the city's commitment to reducing exhaust and pollution from logistics and transportation.

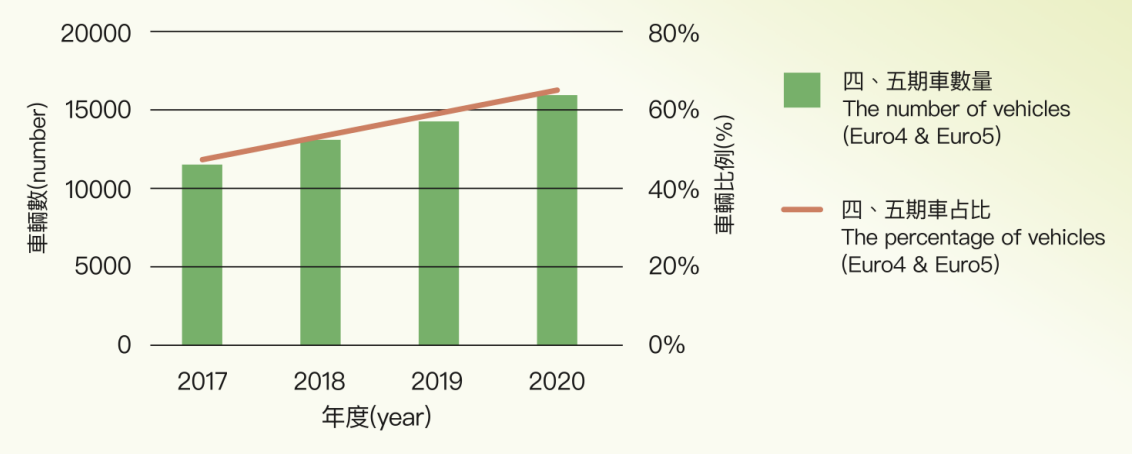

Figure 2. The percentage of low-emission vehicles in Taoyuan (Taiwan)

Source: Taoyuan City EcoLogistics White Paper (2022)

Hiền et al. (2023) found that motorbikes make up nearly 90% of the total vehicle distribution in Hanoi, totaling 6,091,986 units. The city experiences an average hourly traffic volume of 11,125 vehicles, constituting 0.164% of the total. Main urban roads exhibit the highest motorbike density, particularly secondary inner city roads, where motorcycles account for 86.3% of the total traffic. Cars represent 11.2%, and trucks are below 1%. In main internal city roads, motorbike traffic is 81.4%, while car traffic is 16.3%. The study highlights the concentration of heavy and light truck traffic on national and provincial roads, with buses and passenger cars prevalent on national highways and inner-city routes. As illustrated in Figure 3, a summary of vehicle performance results shows that the vehicle composition by age from 0-5 years accounts for 17.2% of the number of motorbikes, the age group of 6-10 years accounts for 40.3%, the age group 11-15 years accounts

for 27.4%, vehicles from 16-20 years old account for 7.2% and vehicles over 20 years old account for 7.9%. The average age of motorbikes is 11.2 years, slightly higher than 8-10 years in GIZ's summary of 2015 studies (Trang et al., 2015).

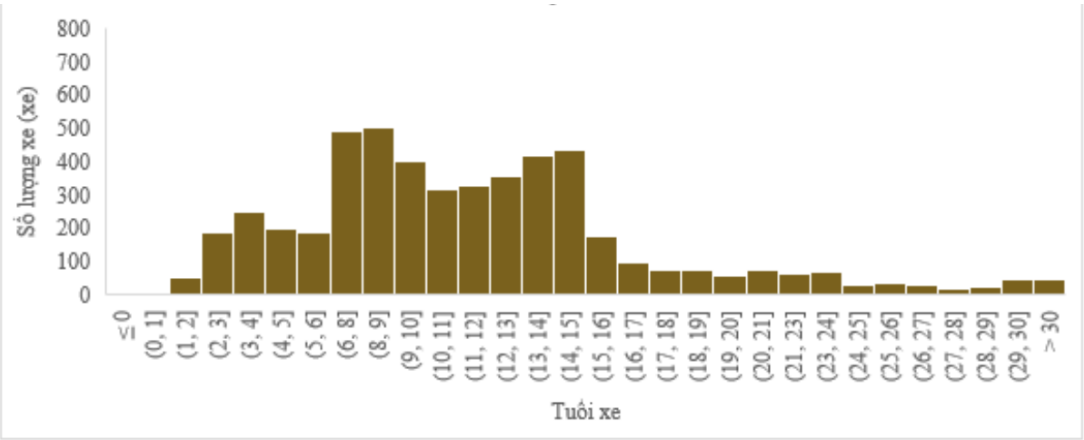

Figure 3. The motorcycle age distribution was surveyed in Hanoi in 2021-2022

Source: Tran et al. (2023)

3.1.2. Air quality

Taoyuan maintains a moderate air quality level, reflected in the Air Quality Index (AQI) ranging from 21 to 70, depending on location and time. While certain areas enjoy satisfactory air quality, the northern part of Taoyuan City is deemed acceptable with a moderate health concern for some susceptible individuals. The primary pollutant in Taoyuan is PM2.5 and PM10 at levels 72 and 26, respectively. Trucks contribute significantly to air pollution, with total suspended particulates (TSP), sulfur oxides (SOx), and nitrogen oxides (NOx) accounting for 37.2%, 35.6%, and 72.6%, respectively. Government initiatives focus on stricter emission standards and support for public transportation, yet challenges persist, including public awareness, funding and enforcement gaps, and regional influences on air pollution.

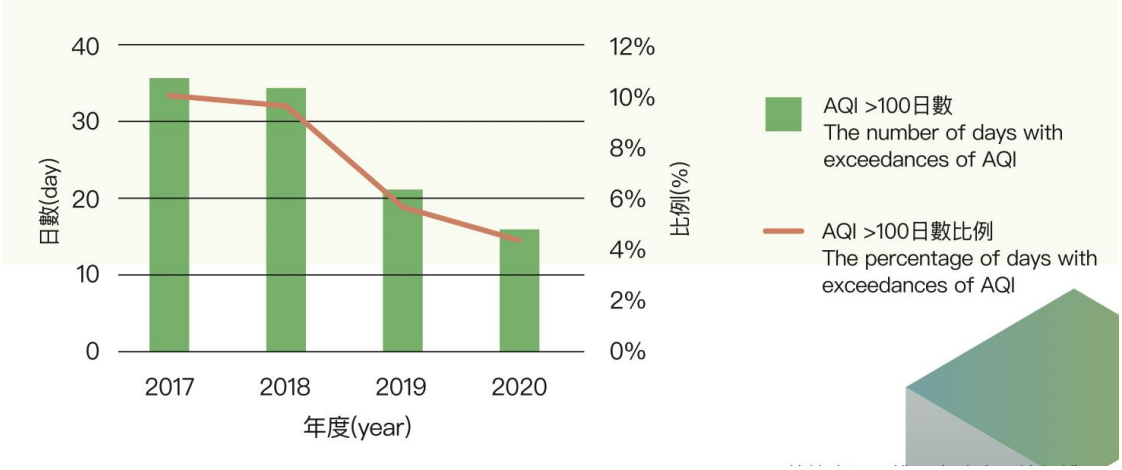

Figure 4. Air quality in Taoyuan (Taiwan)

Source: Taoyuan City EcoLogistics White Paper (2022)

Hanoi's air quality, measured by the AQI, is unhealthy for sensitive groups, ranging from 95 to 149 with a primary pollutant being PM2.5. The concentration of PM2.5 is higher in Hanoi compared to Taoyuan, leading to more severe health impacts such as coughing, difficulty breathing, asthma, and chronic respiratory disease. The sources of PM2.5 in Hanoi include traffic congestion, construction activities, coal-fired power plants, and agricultural burning, exacerbated during the dry season. The weather conditions in Hanoi also affect the air quality, as low temperature, low humidity, and low wind speed can trap pollutants in the air. Weather conditions like low temperature, humidity, and wind speed contribute to trapping pollutants. The Hanoi committee has also taken measures to improve the air quality, such as expanding the metro system, banning old and polluting vehicles, and increasing renewable energy use (An, 2023).

3.1.3. GHG emission

In Taoyuan, the Environmental Protection Administration (EPA) introduced the Greenhouse Gas Reduction Act in 2006, creating a domestic legal framework for GHG emission management. The Act empowered relevant government agencies to formulate emissions reduction plans, with the Taiwan EPA establishing the National GHG Registry in July 2007 for voluntary emissions reporting. Ongoing efforts aim to establish industry-specific rules for project-based reduction credits aligning with international standards. Taoyuan reports greenhouse gas emissions from small and large trucks at 1,383,198 metric tons, contributing to an annual GHG emission of 30.84 million tons of CO2e in 2016. According to Taoyuan's inventory, the energy industry is the leading contributor (71.92%), followed by the transport sector (12.45%) as shown in Figure 5.

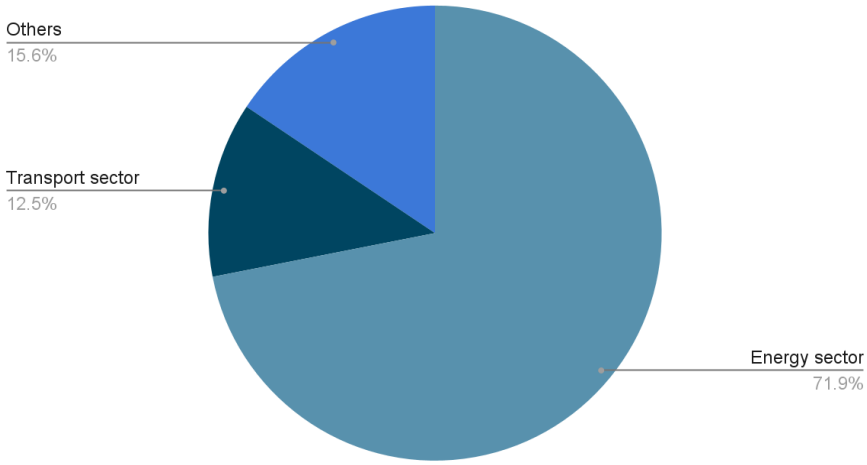

Figure 5. GHG Emission Profile of Taoyuan in 2022

Source: Taoyuan City EcoLogistics White Paper (2022)

The Municipal People's Committee of Hanoi has unveiled an ambitious energy reduction plan, aiming for an 8-10% decrease in total energy consumption from 2020 to 2030, followed by a more significant 14% reduction from 2031 to 2045. Hanoi will achieve these goals by adopting high-efficiency equipment, energy audits, and solutions targeting power usage and emissions in industrial zones, factories, and urban areas. The plan prioritizes a 15% reduction in greenhouse gas emissions by 2030, rising to 20% by 2045, and aims for 2% renewable energy in the total primary energy supply by 2030 and 5% by 2045. Hanoi is actively implementing measures, including developing primary energy sources, fostering sustainable electricity industry growth, and restructuring energy-consuming sectors. The vision includes 700 MW of solar power by 2045, predominantly through rooftop installations. The Hanoi People's Committee plans to renew policies, promote a modern and efficient energy market, and implement environmental protection measures to support these initiatives.

3.1.4. Energy consumption

Taoyuan is actively working to reduce energy consumption and shift towards sustainability. 3% of total electricity consumption in residential, service industry, and institutional sectors came from renewable sources. The Datan Power Plant, Taiwan's leading natural gas-fired combined-cycle facility, expanded with three high-efficiency units. Embracing a circular economy model, Taoyuan promoted resource recovery and energy recycling. Warehouse energy use included material handling, building maintenance, and energy generated by rooftop photovoltaics (Lewczuk et al., 2021).

Hanoi has mobilized over 100 establishments to participate in recognizing the title of establishments using green energy according to the City's criteria, of which 55 establishments have been identified as establishments and construction works using green energy. According to the evaluation, the program's implementation has saved 131.3 kTOE, reaching 1.63% of the level of

energy consumption compared to the demand forecast. Hanoi has also issued a plan to develop renewable energy in 2023 to develop new energy and renewable energy to contribute to meeting the demand for electricity supply, ensuring energy security, reducing greenhouse gas emissions, and protecting the environment. Hanoi City continues to encourage the development of rooftop and surface solar power and pilot-appropriate solar power use models. Research and propose support policies and mechanisms to create breakthroughs in solar power development suitable to the specific conditions of Hanoi Capital (Hà, 2023).

3.1.5. Noise pollution

Noise pollution in Taoyuan, particularly from the Taoyuan International Airport, has been a significant concern. The airport, due to its large volume of passengers, cargo, and flights, contributes substantially to the noise pollution in the area. A study published by Tsao and Lu (2022) provides some insight into the noise levels in Taoyuan, focusing on real estate transactions in the region defined by the Taoyuan International Airport's 60–64 dB day–night average sound level (Ldn) and ≥65 dB Ldn noise contours. It revealed that aviation noise has a significant negative impact on house prices in both noise contour areas of 60–64 dB Ldn and ≥65 dB Ldn. Specifically, the rate of decline in house prices is approximately USD 2356.02/dB and USD 3622.78/dB in the 60–64 dB Ldn and ≥65 dB Ldn contour areas, respectively.

The primary sources of noise pollution in Hanoi are traffic, industrial activities, construction, and karaoke. Hanoi is renowned for its pervasive noise pollution, a cacophony resulting from a blend of vehicular traffic, blaring horns, construction activities, street vendors' calls, and residents engaging in karaoke (Nachemson, 2022). Research results and evaluation by the Institute of Occupational Health and Environment at 12 main roads and intersections in Hanoi show that the average noise during the day is 77.8 to 78.1 dBA, exceeding the permissible standard of 7.8 to 8.1 dBA. At night, noise averages 65.3 - 75.7 dBA, exceeding the standard by 10 - 20 dBA (Nguyễn, 2022).

3.1.6. Sustainable business

Taoyuan is making significant strides in the realm of sustainable business practices. Taoyuan International Airport Corp (TIAC) has been collaborating with airlines to reduce the industry's carbon footprint and construct a sustainable third terminal at Taiwan Taoyuan International Airport. The airport employs over 35,000 individuals from 240 public units and private businesses and has achieved Level 3 optimization of the Airport Carbon Accreditation. This program evaluates airports' efforts to manage and reduce carbon emissions. By implementing highly efficient pumps and LED lighting, the airport has reduced carbon emissions by about 4,000 tonnes

per year. Additionally, the Department of Environmental Protection in Taoyuan is involved in comprehensive planning, environmental impact assessment, research and development, and other comprehensive environmental business.

Hanoi is also making commendable efforts towards sustainable business practices. The Vietnam Business Council for Sustainable Development (VBCSD) is crucial in promoting sustainable business practices in Vietnam. The city focuses on addressing legal bottlenecks in administrative reforms and business community concerns to provide a platform for sustainable and rapid development of businesses. At that time, Hanoi harbored 201,000 enterprises, securing its position as the second-highest nationwide and constituting 23.7% of the overall operational businesses in the country (Tung, 2021). The city persisted in its efforts to streamline administrative processes and alleviate challenges encountered by individuals and businesses, focusing on simplifying procedures related to business and investment, land management, site clearance, construction, and planning.

3.2. Social equity

3.2.1. Public participation

Taoyuan showcases a high level of public awareness and active involvement in ecologistics. As reported in Taoyuan City Ecologistics White Paper 2019, the city has been proactively advancing multi-stakeholder involvement through diverse channels, fostering the creation of a sustainable and livable LOHAS (Lifestyle of health and sustainability) City through collaborations between the public and private sectors. Additionally, the city encourages its citizens to get involved in public hearings, budgeting, and online voting events. Since 2020, Taoyuan has organised several Ecologistics conferences and workshops to integrate perspectives and feedback from various sectors, including industries, government bodies, institutions, and citizens, to promote ecologistics within the city.

Meanwhile, "Ecologistics" is a relatively novel concept in Vietnam, including Hanoi. Therefore, the public awareness of this issue remains limited. The Vietnam Logistics Report (2022) highlights growing interest among Vietnamese businesses for sustainable logistics practices. However, these enterprises' comprehension and capacity for ecologistics transformation within these enterprises are notably constrained. Similarly, there is a promising increase in citizens' awareness of environmental issues in logistics practices. A recent survey in Hanoi, as illustrated in figure 6, shows that nearly 30% of customers are willing to pay extra for green logistics services, and around 25% support eco-friendly packaging and transportation (Vietnam Logistics Report, 2022). This rising awareness signals a solid , and positive shift towards more sustainable logistics practices in Hanoi soon.

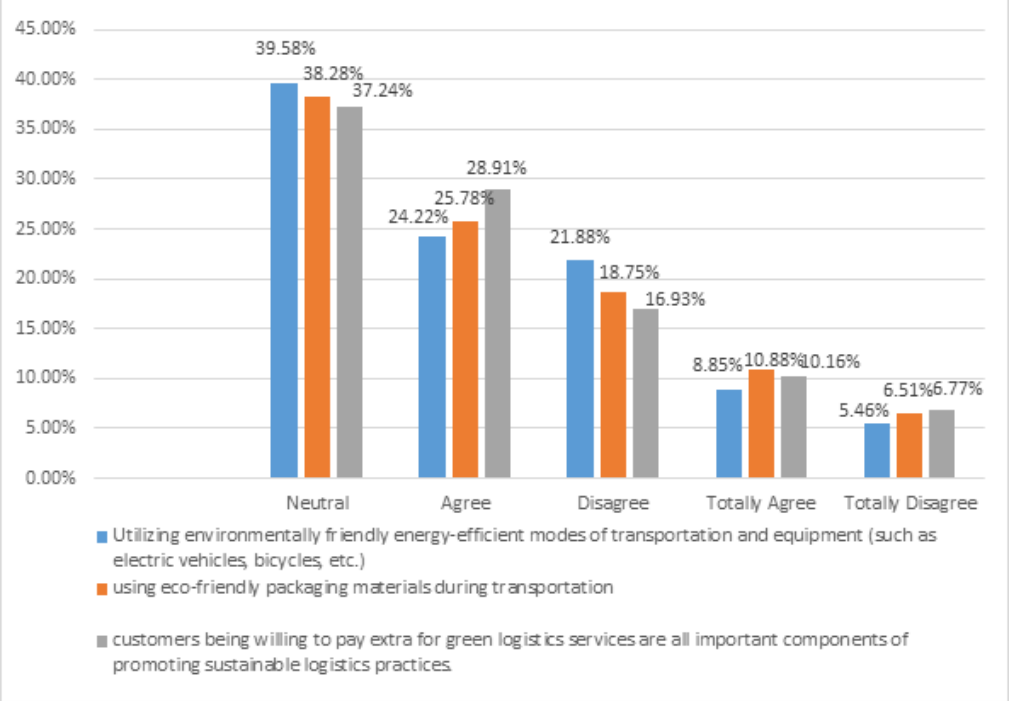

Figure 6. Customers' perspectives on sustainable practices for the last-mile delivery

Source: Findings from the Foreign Trade University and VLI research group, 2022

3.2.2. Safety

Traffic safety is a prominent concern in Taoyuan city, with a comprehensive analysis of statistics shedding light on the current situation. According to the Taoyuan City Police Department, in 2022, freight vehicles are involved in 6.6% of all traffic incidents, and the number of speed violations stands at a concerning number of 23,980 cases. These figures indicate a pressing need for stricter enforcement and road safety initiatives. Moreover, statistics from the Taoyuan City Ecologistics White Paper (2022) reveal that motorcyclists account for the highest number of incidents involving freight vehicles at 79.4% and represent the highest share of freight-related incidents, comprising 57.7%. Meanwhile, truck drivers only cause 3.5% of incidents and suffer no death. Specific statistics are present in the figure 7 below.

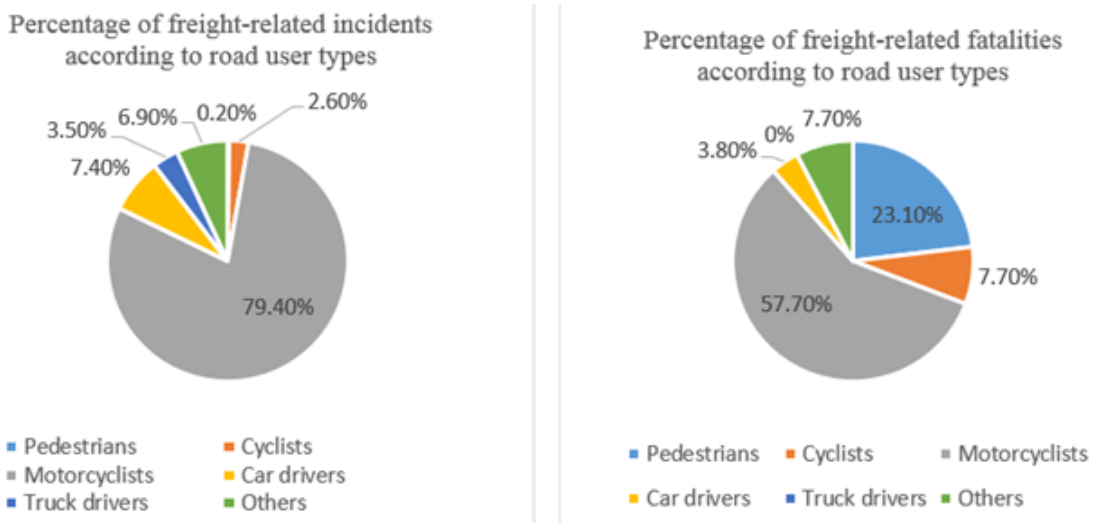

Figure 7. Percentage of freight-related incidents and fatalities according to road user types

Source: Taoyuan City EcoLogistics White Paper (2022)

In Hanoi, traffic safety remains a critical concern, with 24 "black spots" prone to traffic accidents. The year 2022 has witnessed 688 recorded traffic incidents, resulting in the tragic loss of 340 lives and injuries to 475 individuals (Vietnam News, 2022). In the same year, regarding freight transportation, the Hanoi Department of Transportation has addressed 8,026 violations, including overloading, non-compliance with vehicle dimensions, speeding infractions, and improper parking (Hanoi Department of Transport, 2023). The National Traffic Safety Committee reports that in major cities like Hanoi, up to 60% of traffic accidents are caused by motorcycle riders, and 90% of the casualties resulting from these accidents are motorcycle riders (Dạ Khánh, 2023). However, per the Ministry of Public Security's annual statistical report, even though accidents involving freight and passenger vehicles may be much fewer in number, they account for almost 50% of the most severe traffic accidents.

3.2.3. Freight employee demographics

Regarding this criteria, specific data on employment in transport and logistics in both Taoyuan and Hanoi is not readily available from any official institutional reports. However, some fundamental information about the general status quo could be provided. Taoyuan is known as an international transport hub and logistic industry center, home of the 11th busiest airports worldwide by international passenger traffic and the 8th busiest by international freight traffic (ICLEI Sustainable Mobility, 2022). Meanwhile, the logistics industry in Vietnam, including Hanoi, has been among the fastest-expanding sectors in the country, accounting for around 4.5 percent of the total GDP (Mordor Intelligence, 2022). By 2025, the logistics sector is expected to contribute 9-11% of the GRDP with an average growth rate of 17-21% (Statista, 2022b). This suggests a significant workforce involved in transport and logistics, which is a strength in terms of employment opportunities.

3.2.4. Exposure to vulnerable communities

Specific data on the percentage of transport-related pollutants (NOx, PM) emissions that are emitted by urban freight in the transport-related emissions at neighbourhoods with low income population or vulnerable communities in Taoyuan and Hanoi is not readily available from any official institutional reports. However, in general, these two countries have the relatively same pattern with the global condition, as road travel accounts for three-quarters of transport emissions. Most of this comes from passenger vehicles – cars and buses – which contribute 45.1%. The other 29.4% comes from trucks carrying freight (Ritchie, 2020).

3.3. Economic sustainability

Statistics from Taoyuan City Ecologistics White Paper 2022 indicated that the transportation and warehousing sector comprises 14.7% of the workforce, with an average salary of 55,588 yuan per person. With over 1,800 logistics operators, representing nearly 80% of Taiwan's logistics industry, Taoyuan serves as a crucial nexus for the movement of goods and services. Unlike Hanoi, where the majority of the workforce is native, every year, the city of Taoyuan welcomes over 110,000 foreign workers (Taiwan Immigrants' Global News Network, 2021). To ensure the efficiency of the industry, the Department of Labor of Taoyuan City consistently conducts "Migrant Workers Academy" courses throughout 2023. These courses aim to help migrant workers adapt to life and work in Taiwan while enhancing their knowledge and skills (Taiwan Immigrants' Global News Network, 2023).

Hanoi stands out as a crucial hub in the logistics industry, contributing significantly to the national economic landscape. The Logistics Report 2021 highlights that within Hanoi, approximately 25,000 logistics enterprises are registered, with a notable dominance of small-scale ventures. The logistics workforce in Vietnam is witnessing a growth rate of approximately 7.5% annually, reflecting the industry's dynamism and escalating demand for proficient professionals. However, the labour skills remain at a low level with merely 5-7% of the current workforce possessing formal education in this domain (Nhật Dương, 2022). At the growth rate of 7.5%, it is anticipated that the demand for human resources in the logistics industry will soon exceed 850,000 employees in the period 2021-2025 (Nguyễn, 2022).

3.4. Operational efficiency

3.4.1. Mode efficiency

Taoyuan City serves as a significant nexus for logistics and transportation within Taiwan, housing approximately 80% of the nation's logistics firms (Mobility, 2020). A key metric reflecting the city's logistical efficiency is the proportion of freight vehicles. These vehicles, which include trucks, light delivery trucks, and mail cars, are utilized for goods transportation. As illustrated in Figure 8, according to Taoyuan City Ecologistic White Paper 2022, registered freight vehicles constitute 12% of the total registered vehicles, aligning with the global average of 10-15%. Interestingly, despite an absolute increase in the number of trucks, the city has observed a marginal decline in the ratio of trucks to other vehicles in recent years. This suggests an

enhancement in operational efficiency of the city. With respect to the modal split, small trucks, accounting for 78.1% of the total, are the preferred mode for local distribution, while large trucks and mail trucks make up 21.6% and 0.3% respectively. These factors underscore Taoyuan's commitment to sustainable and efficient urban freight operations.

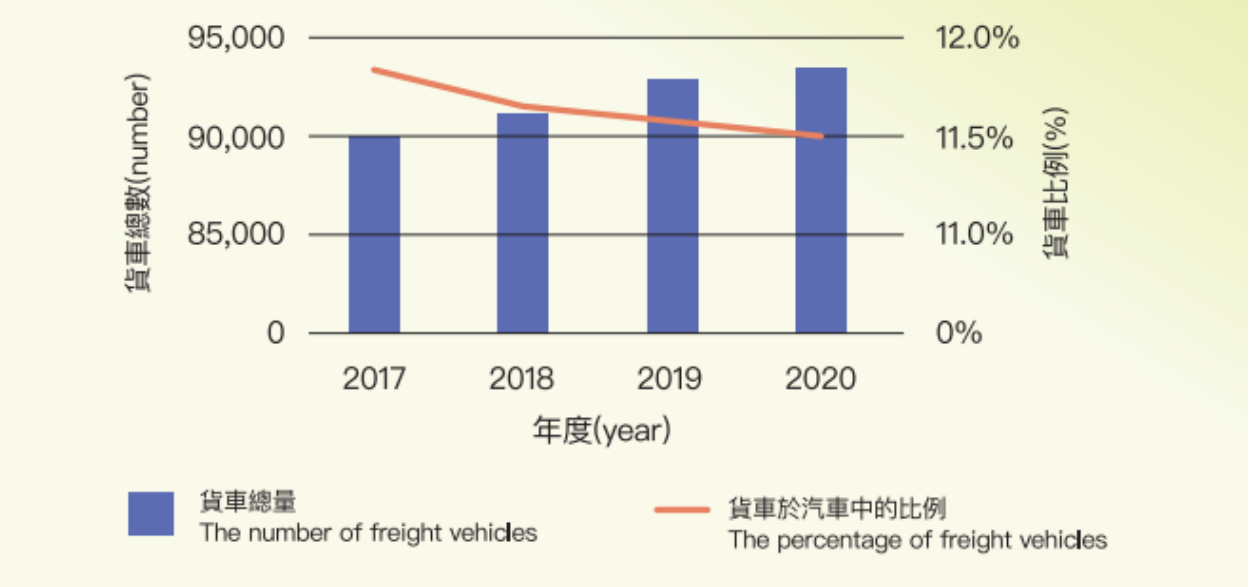

Figure 8. The number and percentage of freight vehicles in Taoyuan (Taiwan)

Source: Taoyuan City Ecologistic White Paper (2022)

Freight transportation within Hanoi City, Vietnam, is primarily facilitated by trucks, with a characteristic emphasis on short-distance journeys, particularly those under 200 kilometers (Kathleen Dematera Contreras et al., 2017). By 2025, Hanoi plans to establish two major logistics centers at the city's northern and southern gateways. These centers will facilitate goods transportation and distribution to other provinces, cities, and industrial parks. They will be strategically linked with major transport hubs, including a logistics center within the Noi Bai International Airport (Hanoi Times, 2021).

3.4.2. Fleet Utilization Level

Warehouse and capacity utilization plays a key role in assessing fleet utilization level. The warehousing market in Taoyuan is robust and growing. High-tech companies, including Quanta, MiTAC, Inotera, Nanya Technology, HTC, CPT, and AU Optronics, have all chosen to build or expand their factories in Taoyuan. Approximately 78% of Taiwan's existing logistics stock is situated in Taoyuan City (Cushman & Wakefield, 2023). The city has embarked on a number of initiatives aimed at enhancing its logistics and transportation systems. For example, the municipal government of Taoyuan has formed a strategic alliance with corporations that own fleets. Furthermore, the city has plans to establish low-emission zones, where the entry of large trucks will be restricted (Knowledge Hub, 2022).

Hanoi City's warehouse systems are currently facing challenges due to outdated infrastructure and equipment, degraded quality, and a reliance on manual labour. Research indicates that the small scale of warehouse utilization is the most significant limitation for warehouse businesses, accounting for 62.3% of the issues. Other challenges include a lack of modernization (59.42%), absence of long-term planning (49.7%), ineffective management (32.29%), and a lack of professionalism in supply (10.3%) (Vietnam Trade and Industry review, 2020).

3.4.3. Loading and Unloading

In Taoyuan City, the government has actively addressed freight vehicle operation challenges, such as by constructing public parking spaces for trucks to facilitate cargo loading and unloading (Taoyuan City Ecologistic White Paper, 2022). In 2019, the city had 143 truck parking spaces, which increased by 22% in 2020 to 174. The distance covered for loading and unloading per vehicle per activity is 143 squares, indicating space efficiency. However, challenges persist, as evidenced by the 60,117 commercial vehicles with parking-related fines per million freight vehicle kilometers, suggesting issues with compliance or inadequate parking facilities (Taoyuan City Ecologistic White Paper, 2022). This underscores the need for continued infrastructure improvement and regulatory enforcement.

Regarding Hanoi, in 2023, Hanoi's People's Committee implemented an action plan to eliminate illegal parking lots, leading to an overflow of trucks onto the streets (Đức, Đồng and Tùng, 2023). Many vacant plots, informally repurposed into parking lots, attract numerous vehicles. However, while hundreds of trucks lack designated transshipment points and park in unauthorized areas, many parking lots remain vacant. This situation underscores the inefficiency in utilizing available spaces.

3.4.4. Timeliness

Taoyuan City, evolving into a business and innovation hub in Taiwan, is improving its transportation systems to connect its citizens and neighbours efficiently (Smith, 2018). However, traffic conditions, particularly during peak hours, pose challenges (Taoyuan Tourism, 2023). The city's Department of Transportation is working to enhance service quality and develop new transportation businesses. Efforts are underway to streamline regulatory procedures and leverage digital technologies for automation, aiming to expedite goods movement and reduce delays. Furthermore, the city has engaged logistics companies in workshops to foster innovation and knowledge sharing, enhancing the logistics sector (Mobility, 2020). These efforts aim to improve freight transportation timeliness significantly.

Hanoi, a transport hub of the Red River Delta, boasts a vast network of waterways, railways, and highways. The city has invested in public transport infrastructure, such as bus rapid transit (BRT) (CityTalk, 2021). Despite heavy traffic conditions, especially downtown, efforts are underway to improve highways and bridges in the Red River Delta Area. The Hanoi People's Committee is focusing on reducing business regulations, delegating administrative procedures, and simplifying internal administrative procedures. These improvements aim to enhance the timeliness

of freight transportation in Hanoi City.

3.4.5. Productivity

Taoyuan City's delivery productivity is remarkable, with an average of 1,538,781 metric tons of goods delivered per kilometer (Taoyuan City Ecologistic White Paper, 2022). This efficiency is due to its well-developed logistics infrastructure, including a robust network of roads, warehouses, and distribution centers. The high delivery productivity indicates the city's logistics sector's capacity to handle large freight volumes, crucial in today's globalized economy. It also suggests strong coordination among various logistics sector stakeholders, from freight forwarders and customs brokers to truck drivers and warehouse operators, ensuring efficient goods transportation.

With regard to Hanoi City, despite the absence of specific data on the average tons of goods delivered per kilometer due to the city's limited data recording capabilities, it is recognized that the city hosts a considerable number of firms operating in the logistics sector. However, these firms, 80% of which are private, only meet 25% of the market demand (Hanoi Times, 2021). This is mainly due to limitations in technology, capital, and human resources.

3.4.6. Distance optimization

In Taoyuan, a variety of services such as Uber Eats and Lalamove have been instrumental in providing efficient food and courier delivery options, thereby contributing to the optimization of delivery organization (Ubereats.com, 2023). Furthermore, according to the Taoyuan City Ecologistic White Paper 2022, trucks constitute 4.5% of the total road vehicles. This underscores the substantial role of trucks in the city's freight transportation system. Consequently, the optimization of truck routes can yield significant enhancements in the overall efficiency of freight transportation.

In contrast, Hanoi presents a complex landscape for the timely and cost-effective distribution of goods. Despite these challenges, companies have engineered intricate systems to optimize logistics networks. However, traffic congestion remains a considerable issue in Hanoi, with the average duration of traffic jams ranging between 45 to 60 minutes per day (Pham and Chung, 2017). Despite concerted efforts by the Hanoi authorities to alleviate traffic congestion, the city's roads continue to be heavily congested. In terms of freight traffic, road vehicles were responsible for the transportation of approximately 26.8% of goods (measured in million tons.km) and about 63.1% of passengers (measured in million passengers.km) in 2019 (Huu and Ngoc, 2021).

4. Lessons for Hanoi (Vietnam) in improving sustainable logistics practices

4.1. Evaluation of the status quo

4.1.1. Strengths

From the above analysis, Hanoi is making significant strides in sustainable logistics practices by transitioning to low-carbon systems, promoting energy efficiency, fostering public participation, and enhancing operational efficiency in logistics, thereby contributing to environmental sustainability and economic growth.

Hanoi is actively applying measures towards sustainable transportation by converting to low-carbon and zero-emission delivery systems. This strategic change of the city not only contributes to reducing the city's overall carbon emissions but is also consistent and parallel with global efforts to fight climate change. In addition, the sustainable commitments of Vietnam in general and Hanoi in particular on energy saving despite the galloping increase in electricity consumption, are a commendable example in promoting efficient energy use. Not only does it inspire sustainable practices in the country, this steadfast commitment also reflects the city's proactive approach to environmental sustainability. Additionally, the city's commendable level of public participation in public space management has promoted inclusivity and empowerment, contributing to the development of a more cohesive and connected society. In addition to the above factors, the rapid growth and strong investment in the logistics industry in Vietnam, especially Hanoi, has created significant employment opportunities, strengthened the city's economic landscape and contributed significantly to the country's GDP.

In addition to the remarkable points in sustainable logistics development at the micro level, Hanoi has made significant progress at the macro level in improving operational efficiency in the field of logistics. The city government is actively supporting local businesses in improving productivity and labor quality, signaling a focal point approach to improving overall productivity. In a context where motorbikes still dominate, the city is actively making efforts to develop public transport, which offers the potential to significantly improve the efficiency and sustainability of this mode in the long term.

4.1.2. Weaknesses

Besides its recognized strengths, Hanoi is grappling with environmental issues, rising crime rates, climate change impacts on vulnerable communities, insufficient logistics sector data, and public transport challenges, necessitating robust strategies for a sustainable logistics framework.

Hanoi faces significant environmental challenges, especially in terms of air quality and greenhouse gas emissions, which require stronger measures to fix the mentioned problems. With the popularity of personal vehicles, noise pollution on the streets is a growing problem, requiring sustainable logistics measures to reduce noise levels and promote a cleaner and more sustainable living environment for citizens.

Hanoi, a city for peace, is witnessing an increase in robberies, assaults, and harassment, endangering residents and tourists. In addition, other types of petty crimes including pickpocketing and theft still constantly affect the friendly and hospitable appearance of the capital. Vulnerable communities, especially children, the elderly, and youth, increasingly face escalating risks from the negative impacts of climate change, underscoring the need for comprehensive strategies in the city's logistics framework.

Another notable weakness that particularly affects the work of assessing the city's sustainable logistics capacity and identifying strategic areas for improvement is the lack of specific data on employment in the logistics and international transportation sector. Further improvements are

needed, including efforts to mainstream improved public transport across local government systems, addressing challenges in fleet utilization in the face of fierce competition from water operators. outside and fix errors in the loading and unloading process. Moreover, the absence of specific data on timeliness and distance optimization in the logistics sector has hindered the assessment of these aspects despite the city's focus on improving productivity.

4.2. Recommendations

To improve sustainable logistics practices in Hanoi, several key strategies can be adopted by the collaboration of multiple parties such as government, businesses, individuals, and research institutions to address environmental challenges, improve public transportation, support the logistics sector, and promote green practices.

For the government and policymakers, it is required to implement stricter environmental regulations and fines for reducing GHG emissions and noise pollution. The investment in public transport infrastructure should be strategically conducted in order to reduce reliance on personal vehicles. Another point is the support from these governmental organizations to foster growth and sustainability of the logistics sector, including employment data collection and fleet utilization.

On a more micro scale, businesses should adopt green logistics initiatives, such as using energy-efficient vehicles or optimizing routes to reduce fuel consumption. They also need to invest in state-of-the-art technologies to improve and optimize supply chain visibility and efficiency. Furthermore, a comprehensive cooperation between micro and macro level to address climate change impacts on vulnerable communities is compulsory in the current status quo.

For individuals, they can contribute to a greener logistics environment by using public transportation, cycle, or walk; support businesses with a priority in sustainable logistics practices; and stay informed about environmental issues and advocate for sustainable practices in each of their communities.

Last but not least, to solve the problem of lacking high-quality database, research and development institutions need to conduct research on the impacts of climate change on logistics and develop innovative solutions. Besides, collaborations with businesses and governments to implement research findings, provide trainings and resources to them would help them adopt sustainable urban logistics practices in a much more improved and stable way.

5. Conclusion

The research paper has conducted a thorough desk-research synthesis and analysis, shedding light on the current status of sustainable logistics practices in Taoyuan, Taiwan, and Hanoi, Vietnam. The research has evaluated the status quo, including strengths and weaknesses of Hanoi, thereby providing recommendations so that Hanoi can effectively capitalize on its existing strengths while mitigating its weaknesses, positioning itself as a leading advocate for sustainable logistics practice management. The research team found that Hanoi has also made great strides in sustainable logistics development, from all levels of government, the participation of local

businesses, and people's awareness. However, Hanoi still has headaches with air quality and greenhouse gas emissions, along with increasing concerns about noise pollution and social security. Solving these problems requires the interdisciplinary participation of the public, private sectors, and individuals.

Despite the comprehensive data collection and analysis, a significant limitation surfaced during the research process. Limited data available could be seen as the first shortcomings. This is possibly due to the fact that although Taoyuan is a pilot city, it can not avoid the shortage of available dataset and Hanoi data recording capabilities is still weak, making the assessment process more challenging. The second limitation is the lack of widespread application of the comparative framework, the EcoLogistics Indicators developed by ICLEI. This hinders the ability to benchmark against a broader spectrum of cities worldwide, limiting the generalizability of the findings.

To address these limitations, future research should prioritize the acquisition of updated and comprehensive data sets. Efforts should be directed towards establishing a more extensive and diverse database, enabling more accurate comparisons and a nuanced understanding of sustainable logistics practices globally. Additionally, expanding the scope to include a broader range of cities will contribute to identifying best practices applicable across various urban contexts. Future studies can delve deeper into the dynamics of sustainable logistics, considering the unique challenges and opportunities presented by different cities worldwide. This approach will contribute to the development of more effective and universally applicable strategies for fostering sustainability in the logistics sector.

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