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PHÂN TÍCH CHIẾN LƯỢC PHI CACBON HÓA CỦA DHL HƯỚNG TỚI LOGISTICS TRUNG HÒA KHÍ HẬU VÀ ĐỀ XUẤT CHO CÁC DOANH NGHIỆP VIỆT NAM

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Tóm tắt:

Sự đóng góp đáng kể của ngành công nghiệp hậu cần vào lượng khí thải nhà kính trong những năm gần đây đã nhấn mạnh tầm quan trọng ngày càng tăng của việc phi cacbon hoá. Theo đó, DHL, công ty logistics hàng đầu thế giới, đang tiên phong trong việc đặt mục tiêu trung hòa carbon vào năm 2050. Trong nghiên cứu này, nhóm tác giả đã thực hiện đánh giá toàn diện các chiến lược phi cacbon hóa của DHL và tác động thực tế của chúng, từ đó đưa ra các đề xuất phù hợp cho các doanh nghiệp Việt Nam trong việc nỗ lực phi cácbon hoá logistics. Nghiên cứu sử dụng phương pháp định tính và dữ liệu thứ cấp từ nhiều nguồn khác nhau, bao gồm các nghiên cứu trước, báo cáo của công ty, bài báo và thông tin từ các tổ chức quốc tế. Dựa trên những thành công của DHL trong việc phi cacbon hóa, nghiên cứu đề xuất các giải pháp phi cacbon hóa cho doanh nghiệp Việt Nam thông qua mô hình chiến lược ASI (Tránh - Thay đổi - Cải thiện).

Từ khóa: Chiến lược phi Cacbon hóa; DHL; Logistics.

ANALYSIS OF DHL'S DECARBONIZATION STRATEGIES TOWARDS CLIMATE-NEUTRAL LOGISTICS AND IMPLICATIONS FOR VIETNAMESE ENTERPRISES

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Abstract

The significant contribution of the logistics industry to greenhouse gas emissions in recent years has underscored the growing importance of decarbonization. DHL, a leading global logistics company, is taking a pioneering role by aiming for carbon neutrality by 2050. In this study, we conducted a thorough evaluation of DHL's decarbonization strategies and their real-world impact in order to offer valuable recommendations for Vietnamese enterprises in their decarbonization efforts. This qualitative research incorporates secondary data from multiple sources from prior research papers, company reports, articles and international organizations. Drawing on DHL's initial success in decarbonization, the study provides implications for Vietnamese enterprises using the ASI (Avoid - Shift - Improve) strategy framework.

Key words: Decarbonization strategies; DHL; Logistics

1. Introduction

Amidst escalating climate crisis, businesses worldwide are facing mounting pressure to adopt sustainable practices and reduce their environmental impact. The logistics industry, a significant contributor to greenhouse gas emissions, is no exception. The decarbonization trend is gaining momentum as businesses recognize the benefits of adopting sustainable practices. As a global leader in logistics, DHL has taken a proactive approach to decarbonizing its operations and achieving climate neutrality.

Current research offers valuable insights into potential decarbonization strategies for logistics, but often overlooks practical implementation, with studies focusing on theoretical frameworks and idealized solutions but neglecting real-world challenges. Addressing this gap, our paper examines DHL's actual progress in achieving climate-neutral logistics through evaluating extensively their decarbonization strategies. By focusing on a real-world case study, the research "*A Comprehensive Analysis of DHL's Decarbonization Strategies towards Climate-Neutral Logistics and Implications for Vietnamese Enterprises*" provides a concrete application of decarbonization strategies in the context of a major logistics company from a case study approach. From there, the study aims to examine how Vietnamese enterprises can learn from DHL's approach, considering unique challenges and opportunities of Vietnam.

2. Theoretical framework

2.1. Overview of Climate-Neutral Logistics

2.1.1. Definition of Climate Neutrality

Growing climate change and environmental concerns are prompting countries and organizations to adopt climate-neutral practices, forsaking environmentally harmful traditional methods. According to UN Climate Change (2021) "climate neutrality refers to the idea of achieving net zero greenhouse gas emissions by balancing those emissions so they are equal (or less than) the emissions that get removed through the planet's natural absorption; in basic terms it means

we reduce our emissions through climate action".

Greenhouse gas emissions encompass not only carbon dioxide but also various harmful emissions from daily activities and production that negatively affect the environment and atmosphere (EPA, 2023). While carbon neutrality focuses solely on balancing carbon dioxide emissions, climate neutrality encompasses a broader and more comprehensive scope, addressing the mitigation of all greenhouse gasses (Maersk, 2023).

2.1.2. Definition of Climate-Neutral Logistics

Logistics plays a vital role in the global economy, encompassing the coordination of tangible goods transportation and various related activities, including Warehousing & Storage, Inventory Management, Packaging, Transportation and Trucking, and Information Logistics (McDaniel, 2022). Considering the definition of "climate neutrality" in combination with "logistics", we could deduce that climate-neutrality in logistics entails balancing greenhouse gas emissions with removals, resulting in a net-zero carbon footprint in all logistics activities from transportation to warehousing to packaging.

2.2. Overview of Decarbonization

2.2.1. Definition of Decarbonization

Decarbonization is the process of reducing or removing carbon dioxide (CO2) and other greenhouse gasses (GHGs) output from the atmosphere (Deloitte, 2023). These endeavors aim to address all types of contaminants contributing to climate change, ranging from methane, nitrous oxide, sulfur hexafluoride, nitrogen trifluoride, perfluorocarbons to hydrofluorocarbons. (IBM, 2023).

2.2.2. Definition of Decarbonization Strategies

According to Denkstatt, a global leading consulting firm in the fields of environmental sustainability, decarbonization strategies is a set of plans and actions designated to accelerate the reduction of carbon dioxide and other greenhouse gas (GHG) emissions. A decarbonization strategy typically defines a firm's overarching decarbonization goal and specific carbon emission reduction targets, which can be further divided into short-term and long-term action plans (Strategy&, 2022).

2.2.3. Four key pillars of Decarbonization

According to America's Zero Carbon Action Plan (ZCAP) and World Bank (2015), businesses' decarbonization pathways employed 04 basic strategies:

(1) Energy efficiency: This aims to reduce the overall energy consumption while maintaining or increasing the level of output, which can be done through process improvement (European Parliament and the Council of the European Union, 2012).

(2) Electrification (and using electricity from non-emitting sources): This involves shifting equipment and assets away from fossil fuels and toward electric power (Maersk, 2023). The most outstanding example of electrifying logistics is the use of Electric Vehicles (EVs).

(3) Fuel switching: Fuel switching involves shifting from high-carbon fuels like propane or gasoline to low- or zero-carbon alternatives. (Charlottesville, 2023)

(4) Carbon Capture: Carbon capture (CC) involves removing CO2 from exhaust gasses, trapping and storing carbon dioxide before its release into the atmosphere (Boot- Handford et al., 2014). This encompasses the injection of captured CO2 deep underground to minimize environmental leakage (Carbon Capture Storage), or its utilization in industrial processes such as making methanol or enhancing oil recovery (Carbon Capture Utilization) (Zhang et al., 2018).

2.3. Decarbonization towards Climate-Neutral Logistics

2.3.1. Necessity of Decarbonizing Logistics

Logistics sector accounts for over one-third of worldwide carbon dioxide (CO2) emissions, making it the largest emitter in many developed nations (Gould, 2023). These emissions are primarily attributed to the use of fossil fuels for transportation and energy - intensive processes. Given that, the decarbonization of the logistics sector is instrumental in the transition to a climate-neutral future (Gould, 2023). Furthermore, amidst growing consumer demand for eco-friendly services, businesses must adapt and decarbonize their logistics operations to remain competitive. Lastly, growing imposition of stringent environmental policies by governments and international organizations demand businesses to take actions.

2.3.2. Challenges of Decarbonizing Logistics

Unavailability of electric alternatives

Logistics typically entails diverse transportation modes, including trucks, ships, planes, and trains, each mode having its own set of challenges when it comes to decarbonization. For example, electrifying trucks might be more feasible than electrifying long-haul aviation. Full electrification is not yet achievable for all types of vehicles and devices due to technology and resource limitations in large-scale production of electric vehicles (EVs) (Alanazi et al., 2023).

Upfront investment and possible implementation downtime

Transitioning to low-carbon logistics involves significant investments in technology infrastructure, supply chain facilities and workforce training (DHL, 2022). This may place a major financial burden for logistics companies and logistics service providers, especially considering potential downtime of implementing new systems and processes.

Potential increase in customer price

As logistics providers invest in decarbonization strategies, the costs associated with deploying decarbonization solutions may be transferred to consumers. This leads to inevitable selling price hikes and may make low-carbon logistics services comparatively less appealing in a competitive market (DHL, 2022).

3. Analysis of DHL's Decarbonization Strategies

3.1. Overview of DHL Group

3.1.1. General information of DHL

DHL is a key division of the Deutsche Post DHL Group, a global leading logistics firm founded in 1969, with its headquarters located in Bonn, Germany. The company offers a wide array of domestic and international express, freight, supply chain solutions, and mail services, to both individual and corporate clients worldwide. DHL's core expertise lies in the management of sea and air mail, with a particular emphasis on international parcel, courier, and express services.

Since entering the Vietnamese market in 1988, DHL has continuously strengthened its presence and maintained a substantial market share. Through its subsidiary entities, including DHL Express, DHL Global Forwarding, and DHL Supply Chain, DHL has consistently provided diverse logistics services to the Vietnamese market. Notably, DHL eCommerce formally ceased operations in the Vietnamese market in November 2021.

3.1.2. Vision – Mission

DHL's vision is to be a "*post office for Germany and a logistics company for the world*" (DHL, 2022). Aligned with this vision, DHL's mission aims to deliver excellence and drive sustainable growth of customers, employees, & investors (DHL, 2022). It also aims to simplify customers' lives through efficient logistics and contribute to making the world a better place by emphasizing on social responsibility.

3.2. Analysis of DHL's Decarbonization Strategies

In the logistics industry's net-zero transition, DHL has been actively implementing innovative methods to reduce its carbon footprint. Their decarbonization strategies extend from having clearly established goals to sustainable building design, pick-up & delivery electrification and utilization of sustainable fuels. Theoretically, these strategies align with three in four decarbonization strategies pillars.

3.2.1. DHL's Decarbonization Goals

Recently, DHL has been intensifying its efforts to decarbonize its operations with the aim to maintain a leading position in the industry with climate-neutral logistics being the core corporate strategy (DHL, 2021). In 2017, DHL has committed to reduce all logistics-related greenhouse gas (GHG) emissions, including those of our suppliers and subcontractors, to zero by 2050 (DHL, 2023). A substantial investment of 7 billion euros over a 10-year period was later made to curb GHG emissions, targeting the advancement of alternative aviation fuels, the expansion of a zero-emission electric vehicle fleet, and the construction of climate-neutral infrastructure (DHL, 2021). Following this goal, four interim milestones by 2025 have been set out to materialize this bold vision:

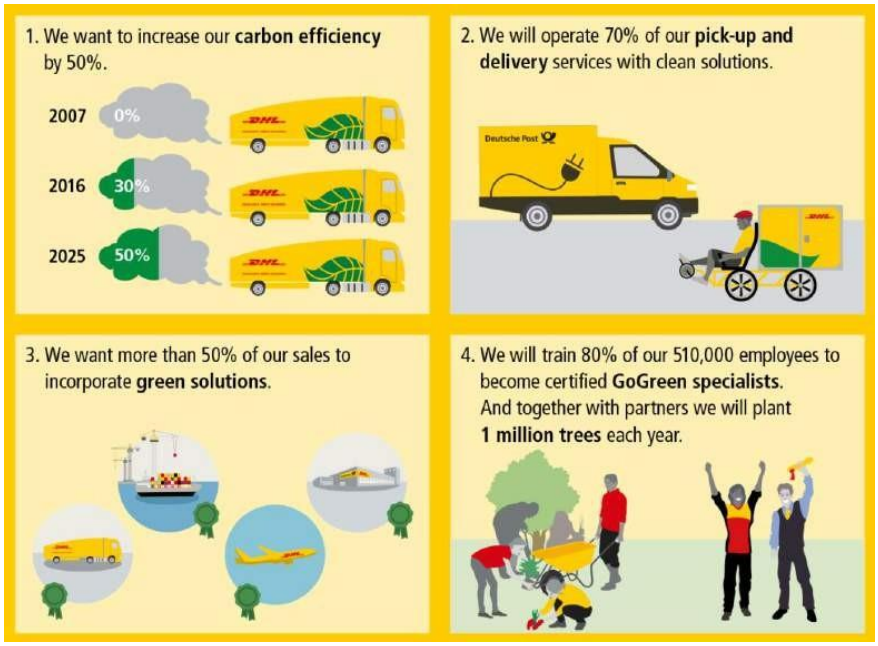


Figure 1: DHL's four interim milestones by 2025 as part of 2050 net-zero mission

Source: DHL (2017)

Furthermore, DHL has set short-term ambitious goals for 2030, including reducing their direct and indirect GHG emissions (Scope 1, 2) by 42%, and cutting logistics-related emissions (Scope 3) by 25%. They also aim to achieve 30% share of sustainable fuels in air, ocean freight, and road transport, and 60% of electric vehicles in pick-up and delivery services. Especially, within 10 years until 2030, all new DHL buildings will be designed climate-neutrally (DHL, 2022).

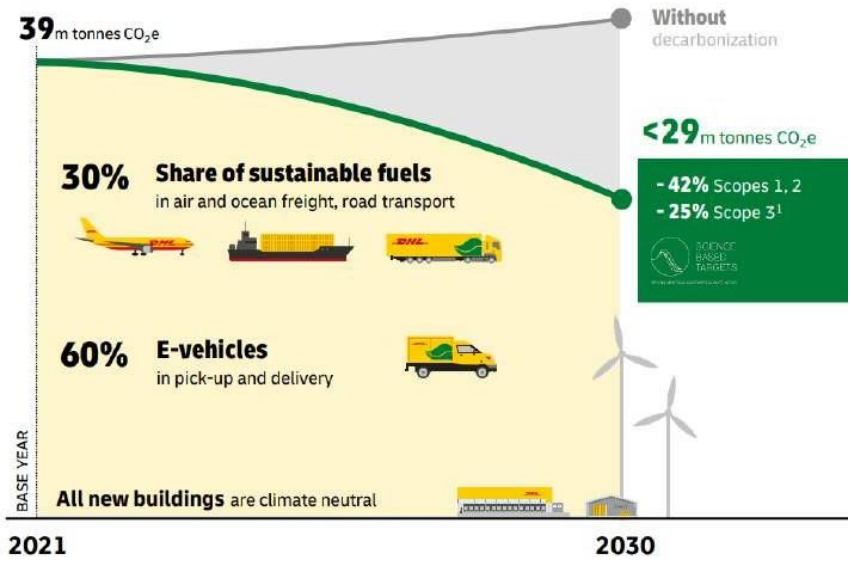


Figure 2: DHL's Decarbonization Measures and Targets by 2030

Source: DHL ESG Presentation (2022)

In conclusion, these ambitious goals for short-term 2030 and long-term 2050 reflect DHL's

steadfast commitment to climate-neutral logistics operations, spanning emissions reduction, sustainable fuel adoption, building design, and environmental leadership.

3.2.2. Climate-neutral building design

As the most globally expansive company, DHL possesses an extensive array of physical assets, including warehouses, sorting centers, hubs, terminals, and office buildings. Hence, their first decarbonization strategy involves harnessing cutting-edge green technologies to transition these assets into climate-neutral structures.

Central to DHL's approach is the extensive utilization of solar energy, featuring the installation of solar panels on warehouse rooftops (DHL, 2023). These panels generate renewable energy that subsequently powers the operational facilities. Complementing this initiative, DHL employs solar-powered external lighting to eliminate reliance on external electricity sources. Furthermore, the company has implemented motion sensor LED lights within its warehouses, strategically generating 38% of the facilities' energy and reducing energy consumption by 20%. (DHL, 2023) These lights are designed to activate only when motion is detected and automatically switch off after a predefined period, thereby promoting energy efficiency and cost savings.

Figure 3: DHL’s carbon-neutral warehouse with solar panels

Source: DHL (2023)

Beyond that, DHL has gone further to offer climate-neutral design service to its customers through DHL Real Estate Solutions (RES). Boasting a team of over 70 experienced real estate experts and designers, DHL RES offers unrivaled consultation on net-zero carbon warehouse design, along with optimized warehouse automated solutions and other on-the- ground operations (DHL, 2023). This has exemplified DHL's dedication to minimizing environmental impact while embracing innovative real estate solutions for a greener future.

3.2.3. Pick-up and delivery electrification

Electric vehicles (EVs) are playing a growing role in transforming global transportation. Hence, “pick-up and delivery electrification” (PUD Electrification) is crucial in their broader decarbonization strategies set, involving road e-fleet expansion and electrification of air fleets.

Expansion of e-fleet

DHL has been accelerating the reduction of carbon dioxide (CO2) emissions through road fleet

electrification. In 2020, 18% of DHL's vehicle fleet comprised EVs for short distance and last mile services. By 2030, it aims to increase worldwide electric delivery vehicles to 60%, equivalent to over 80,000 road e-vehicles (DHL, 2022).

In light of this goal, DHL's efforts have gone beyond replacing diesel-powered vehicles with e-vehicles to make sure that these vehicles meet the highest emissions standards, thereby minimizing non-tailpipe emissions (non-exhaust particulate matter from brake wear, tire wear) and environmental impact of its fleet (Woo et al., 2022). In 2021, DHL incorporated 21,400 electric vehicles (e-vehicles) into their global road fleet. Notably, 25% of these e-vehicles are emissions-free and nearly 70% conform to Euro 5 or 6 emissions standards (DHL, 2021). One year later, DHL reported a remarkable increase to 27,800 e-vehicles in their operations, with 77% (increase of 7%) of them adhering to the highest Euro emissions classifications (DHL, 2022).

DHL's efforts are strengthened by strategic partnerships with EV manufacturers like Ford, Tesla, and Volvo. In 2022, Ford Pro and DHL agreed to expedite global van electrification through a Memorandum of Understanding, whereby Ford Pro will supply DHL with 2,000+ electric vans by 2023 to maintain its leading position in using electric delivery vans worldwide (DHL, 2022). Volvo Trucks also provided DHL with five zero-emission Volvo FM Electric trucks (DHL, 2023). For charging stations, DHL has partnered with Powerflex to install 415 tailored EVSE (Electric Vehicle Supply Equipment), which are strategically positioned overhead for seamless integration with daily delivery operations and drivers' accessibility (Higgins, 2023).

Figure 4: Ford E-Transit and Volvo Electric Trucks utilized by DHL's in transportation

Source: DHL (2022) and Volvo (2023)

Electric-powered air fleet

E-mobility at DHL extends beyond road transport with DHL embracing all-electric aircraft for air freight. DHL's approach features the use of all-electric "Alice" aircrafts from Eviation to gradually replace its diesel-powered cargo planes on short-haul routes (DHL, 2022). The year 2022 marked DHL's first-ever order of all-electric cargo planes with an order of 12 Alice eCargo planes from Eviation. Beside its eco-friendliness, Alice's eco-friendly design, impressive range (max 460 km), payload capacity (maximum 1,130 kg), and rapid charging (under 30 minutes per flight hour) position it as an ideal solution for DHL's global aviation network, ensuring quick turnaround times to meet customer demand (DHL, 2022).

Figure 5: DHL's Alice all-electric cargo plane

Source: DHL (2022)

Along with these sustainable aircrafts, DHL possesses 42% of the aircraft fleet meeting the strict CAEP/8 emissions standard (DHL, 2022). CAEP/8 standard, set by the International Civil Aviation Organization (ICAO), aims to reduce aviation's environmental impact with a nitrogen Oxides (NOx) emission limit of 50g/kN. Adherence to this standard signifies reduced emissions and a proactive approach to air transportation's sustainability.

In short, DHL's commitment to pick-up and delivery electrification represents a pivotal step in their decarbonization strategy. While the upfront costs of sustainable initiatives may be high, reduced fuel costs and lower maintenance expenses associated with this sustainable practice can lead to long-term savings and increased corporate value.

3.2.4. Use of sustainable fuels

Sustainable fuels are considered the most effective means of accelerating the decarbonization, especially for sea and air transport - two supposedly hard-to-abate sectors due to a lack of well-defined pathways towards net-zero transition (McKinsey, 2023). The rapid growth of the sustainable fuel market is prompting DHL to set the pace of innovation. Since 2021, DHL invested 28 million EUR in sustainable fuel for air, sea, and road freight and achieved a 1.3% blending share (DHL, 2021). In 2022, they added EUR 66 million to accelerate their ambitious goal of reaching a 30% blending target by 2030 (DHL, 2022).

Types of sustainable fuels utilized by DHL

Before delving into DHL's strategies, it is essential to understand the types of sustainable fuels used by DHL in the context of decarbonization. Based on fuel types, sustainable fuels can be classified into 02 broad categories: biofuels and synthetic fuels (DHL, 2020). Whereas, based on their compatibility with existing infrastructure, sustainable fuels can be divided into: drop- in fuels and non-drop-in fuels.

Fuel type / Applicability	BIOFUELS • *Produced from biomass, mostly organic waste (e.g. used cooking oil).* • *Combustion releases only the CO2 captured by biomass during lifecycle.*	SYNTHETIC FUELS (OR E-FUELS) • *Produced from renewable energy sources (solar,wind); fossil fuels (coal, natural gas), captured carbon dioxide.* • *Those from renewables and captured CO2-potentially carbon-neutral.*
DROP-IN *(No modification needed)*	• Hydrotreated vegetable oil (HVO) • Biokerosene • Sustainable Aviation Fuels (SAF) • Sustainable Marine Fuels (SMF)	• E-kerosene • E-diesel • E-gasoline
NON-DROP-IN *(Modification to engine and infrastructure needed)*	• Hydrogen • Bio-LNG/Bio-CNG • Bio-methanol • Bio-ammonia • Ethanol	• Hydrogen • E-LNG/E-CNG • E-methanol • E-Ammonia • Direct power usage

Figure 6: Classification of sustainable fuels based on fuel types and applicability

Source: Authors' adaptation from DHL (2023)

While non-drop-in fuels are already proving to be a game-changer for net-zero transition, sustainable drop-in fuels have recently emerged as a crucial enabler in this transition (DHL, 2023). Currently, three most outstanding drop-in biofuels used by DHL are: Hydrotreated vegetable oil (HVO) for road freight; sustainable aviation fuel (SAF) for air; sustainable marine fuel (SMF) for sea transport (DHL, 2023).

HYDROTREATED VEGETABLE OIL (HVO)	SUSTAINABLE AVIATION FUEL (SAF)	SUSTAINABLE MARINE FUEL (SMF)
Made by the hydrocracking or hydrogenation of vegetable oil.	Made from used cooking oil, waste oils, agricultural residues, and municipal waste	Made from biofuels, renewable fuels of non-biological origin (RFNBOs), recycled carbon fuels
Up to 88% GHG emissions reduction compared to conventional diesel fuel.	Up to 80% GHG emissions reduction compared to conventional jet fuel	Up to 90% GHG emissions reduction compared to conventional heavy fuel oil (HFO)
Can be used both pure (100% concentration), as well as blended in any ratio with e.g. fossil diesel.	Can be blended with traditional jet fuel at up to 50%	Can be blended with traditional marine fuel at up to 100%

Figure 7: Characteristics of sustainable fuels currently utilized by DHL

Source: Authors' compilation

DHL's utilization of Hydrotreated vegetable oil (HVO) for road freight

DHL has pioneered the utilization of hydrogenated vegetable oil (HVO) diesel vehicles, a drop-

in fuel compatible with standard diesel engines, to cut road transport emissions (DHL, 2022). Primary feedstock for this endeavor comprises cooking oils or by-products from producing paper with hydrogen to create hydrocarbons.

DHL's approach to developing its use of HVO (Hydrotreated Vegetable Oil) has been characterized by a gradual progression, beginning with retrofitting existing diesel vehicles for HVO use. This enables a smooth transition to cleaner fuels by ensuring compatibility with the existing infrastructure while allowing for flexible blending ratios to match HVO availability. DHL initially used 26% HVO-blended vehicles and later introduced a few trucks with 50% (HVO50) or 100% (HVO100) HVO. Such approach reduces operational disruption and allows DHL to assess HVO's viability and efficiency. As of Q1 2019, DHL had 677 vehicles with a 26% fuel blend and 171 trucks using 50% or 100% HVO (DHL, 2019). Recently, DHL has expanded its use of HVO100 in partnership with Formula 1, deploying 18 new trucks for the 2023 European season. Running on HVO100 drop-in fuel, these trucks transported 300 tonnes of freight per race, cutting carbon emissions by 83% compared to diesel trucks (DHL, 2023).

Figure 8: DHL's HVO100-powered trucks for 2023 European Formula 1 season

Source: DHL (2023)

Furthermore, integrating HVO into DHL's supply chain is a multifaceted process. DHL is consistently engaged in expanding reliable supply of HVO via strategic partnerships with highly qualified partners. Presently, Neste stands as the principal supplier of sustainable gasoline for DHL. HVO-powered vehicles are also used in DHL's GoGreen Plus program for eco-friendly transportation, allowing customers to book shipments using HVO.

DHL's utilization of SAF and SMF through "Book & Claim" system

Latterly, DHL has actively embraced sustainable fuels and the so-called "one- atmosphere approach", which posits that all carbon emissions are emitted into the same atmosphere, regardless of location (Zusman et al., 2021). Therefore, using sustainable aviation fuel (SAF) or sustainable

marine fuel (SMF) to cut emissions is effective regardless of where it's deployed, as long as overall atmospheric emissions decrease. This approach has led DHL to utilize a “Book and Claim” system to track and transfer the environmental benefits from sustainable fuel across the value chain.

“Book and Claim” is a chain-of-custody model that can be used to de-couple specific attributes from the physical product and transfer them to another party (DHL, 2023). The system employs a “*Book the fuel and Claim the benefits”* mechanism, whereby fuel producers “book" the emissions savings associated with each metric ton of sustainable fuel produced to generate SAF/SMF certificates (SAFc/SMFc). These certificates represent the environmental benefits of using SAF/SMF, like reduced greenhouse gas emissions (DHL, 2023). When DHL obtains these certificates, they are not purchasing the actual SAF/SMF fuel, but instead acquiring their environmental benefits, even though it is not physically added to their own aircrafts or ships. This means that the SAF/SMF isn't directly transported to and loaded onto DHL's particular aircraft or ship. Instead, it is introduced into the fuel system at an airport close to the SAF/SMF.

production facility. SAF/SMF quantity produced and integrated into the hydrant system is carefully tracked and verified. Subsequently, carbon emissions credits are calculated and assigned to the organizatiaon paying the fuel premium via SAFc/SMFc. The environmental benefits can be reaped either by DHL offsetting their own emissions or by selling certificates to customers for their own carbon footprint offset.

Figure 9: DHL's mechanism of Book and Claim system

Source: Author's adaptation from DHL (2023)

This approach allows DHL to support SAF/SMF production without physical fuel procurement (DHL, 2023). The system regenerates revenue for reinvesting in sustainable fuel growth and infrastructure expansion, thereby fostering long-term SAF and SMF market development. Recently, DHL signed a significant SAFc agreement with World Energy, covering a seven-year period and 668 million liters of SAF, with the goal of offsetting 1.7 million metric tons of CO2. This is equivalent to a year's emissions from 77,000 DHL conventional aircraft in the US (Air Cargo News, 2023). Furthermore, DHL extends the use of sustainable fuels to its customers through the GoGreen Plus service, making itself the first global express courier to enable customers to use both SAF & SMF to “inset” (reduce) their shipments' carbon emissions (DHL, 2020).

Conclusively, DHL's proactive approach has set an example for other companies aiming to lessen their environmental footprint and aid global climate change mitigation. DHL has shown that

it is possible to be sustainable and profitable at the same time.

4. Evaluation of DHL's Decarbonization Strategies

4.1. Positive impact

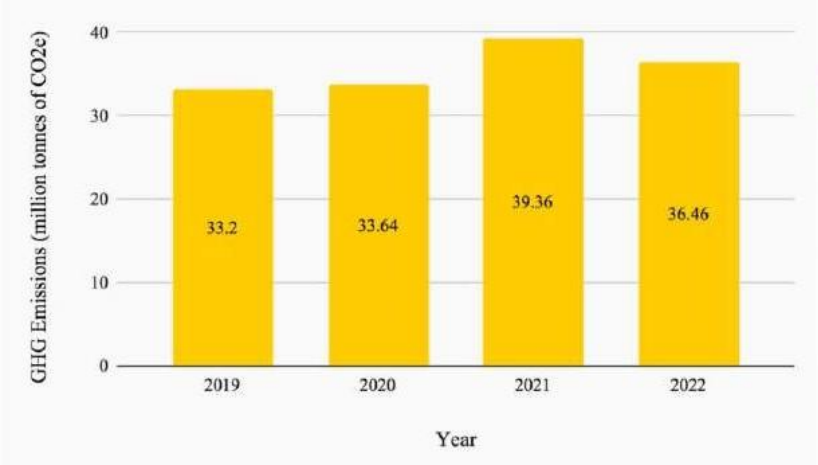
DHL's commitment to decarbonization is a multifaceted approach, with the positive impact reflected through 03 aspects: Environmental - Economic - Social.

4.1.1. Environmental Impact

According to the DHL Annual Report (2022), the favorable environmental outcomes of DHL' initiatives are evident in positive changes of (1) Absolute logistics-related GHG emissions and (2) Realized Decarbonization Effects (RDEs).

(1) Absolute logistics-related greenhouse gas (GHG) emissions

DHL's absolute logistics-related GHG emissions have increased slightly over the past five years, from 33.2 million tonnes in 2019 to 39.36 million tonnes of CO2e in 2021. However, since 2022, GHG emissions have shown significant decrease thanks to DHL's prompt and comprehensive decarbonization strategies.



Year	Change from previous year
2019	-
2020	0.44 (1.3%)
2021	5.72 (17.0%)
2022	-2.9 (7.4%)

(*Unit: million tonnes of CO2e*)

Figure 10: DHL's Absolute GHG Emissions from 2019 to 2022

Source: Author's adaptation from DHL (2022)

From 2019 to 2020, DHL's GHG emissions saw a slight increase of 1.3% from 33.20 to 33.64 million tonnes of CO2e. This increase was potentially influenced by the early stages of the COVID-19 pandemic, characterized by a surge in online shopping and an elevated volume of goods transported by DHL. This increase in volume may have offset the company's efforts to reduce its emissions. Between 2020 and 2021, DHL experienced a substantial rise in greenhouse gas (GHG) emissions, escalating from 33.64 million tonnes of CO2e to 39.36 million tonnes of CO2e. This increase was primarily due to the global economic recovery following the COVID-19 pandemic

which greatly amplified demand for logistics services. In response to this surge, DHL decarbonization measures came in handy to mitigate the situation. Coupled with reduced transport volumes and improved utilization of passenger aircraft following the progressive relaxation of pandemic-related restrictions, DHL ultimately managed to slash its GHG emissions down to 36.46 million tonnes of CO2e in 2022 (DHL, 2022).

(2) Realized Decarbonization Effects (RDEs)

RDEs is used to gauge the emissions reductions achieved by DHL through the utilization of renewable energy sources and sustainable technologies in contrast to conventional energy and technologies. Therefore, rising RDEs reflect DHL's improved emission reduction.

(*Unit: kilotonnes of CO2e*)

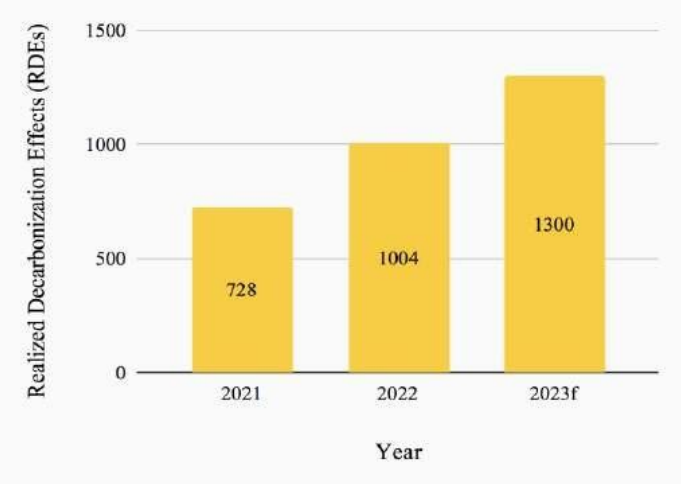


Figure 11: DHL's Realized Decarbonization Effects from 2021 to 2023

Source: Author's adaptation from DHL Annual Report (2022)

The significant increase in DHL's Realized Decarbonisation Effects (RDEs) in recent years is a direct outcome of the company's prompt and resolute measures towards decarbonization. In 2021, the RDEs was 728 kilotonnes tonnes of CO2e. Prior to 2022, DHL had set a specific goal to achieve Realized Decarbonisation Effects (RDEs) amounting to 969 kilotonnes of CO2 equivalent (DHL, 2022). It is noteworthy that the actual RDEs attained during the year greatly exceeded expectations, totaling an impressive 1,004 kilotonnes of CO2 equivalent (37.9% year-over-year increase). By the end of 2023, it's expected to reach 1.3 million tonnes of CO2e, showcasing DHL's unwavering commitment to decarbonizing its logistics operations.

4.1.2. Economic Impact

DHL's decarbonization strategies can yield various potential economic benefits that positively influence the company's long-term financial performance.

● **Market positioning:** DHL's commitment to decarbonization can enhance its reputation as a sustainable leader, thus enabling it to attract more environmentally conscious customers (DHL,

2022).

- **Reduced exposure to volatile fuel prices:** Transitioning to alternative fuel sources or electric vehicles can help DHL mitigate risks associated with conventional fuel price fluctuations and supply disruptions due to climate-related challenges (DHL, 2023)

- **Carbon offset markets:** DHL can generate revenue by selling carbon credits earned to other businesses seeking to offset their emissions (DHL, 2023).

4.1.3. Social Impact

DHL's decarbonization strategies not only align with global environmental goals but also have positive implications for local communities and society at large.

- **Job creation:** By investing in EVs and charging infrastructure, DHL furnishes employment opportunities in the clean energy sector, the automotive industry, and the construction industry (DHL, 2023).

- **Increased awareness:** DHL's public declaration to achieve carbon neutrality and unwavering decarbonization efforts convey a resounding message that businesses can be profitable and sustainable simultaneously. This has also raised consumers' awareness regarding sustainable practices' significance and empowered them to make more environmentally responsible choices (DHL, 2022).

4.2. Limitation

DHL has achieved significant milestones in implementing decarbonizing its logistics operations, however, there exists certain shortcomings in their application of these strategies.

Data inconsistency

Collecting consistent emission data can be an uphill task since the level of difficulty depends on various factors, including size and complexity of the organization, scope of emissions being measured, and data availability. Since 2018, the metrics used to measure the effectiveness of DHL's decarbonization activities in its sustainability reports have been changed biennially, posing challenges in consistently evaluating and comparing these values over time (DHL, 2023). DHL has also admitted that the information required for calculating product carbon footprints and logistics emissions is frequently inconsistent, decentralized, and lacking transparency throughout supply chains values (DHL, 2023).

Dependence on fossil fuels

Despite substantial investments in sustainable transportation such as electric-powered air fleets or harnessing alternative fuels to minimize environmental impact, DHL still heavily relies on fossil fuels. In fact, a significant portion (~90%) of the emissions generated during DHL's operations comes from the use of fossil fuels (DHL, 2022).

Lacking well-defined steps towards goals realization

Despite setting ambitious goals to reduce emissions by 50% by 2030 and achieve net- zero certification by 2050, DHL has not provided specifically and clearly outlined steps to materialize their future decarbonization goals. Consequently, the lack of a well-defined plan may raise doubts among investors and customers about the feasibility of realizing these decarbonization targets.

5. Implications for Vietnamese enterprises in implementing decarbonization towards climate-neutral logistics

5.1. Overview of decarbonizing logistics strategies by Vietnam's enterprises

Vietnamese logistics companies have initiated various decarbonization strategies, but these have been typically confined to a small segment of their overall operations. The implementation of measures in the logistics sector is also predominantly concentrated among a few large companies, lacking interconnectivity, synchronization, and collaboration among businesses. These limitations can be subjected to both external factors (poor public infrastructure, ineffective government policies and lack of platform for collaboration) and internal factors (low financial capabilities, lack of expertise, etc.). These factors collectively contribute to the difficulties in attaining desired outcomes when implementing decarbonizing strategies within the logistics industry in Vietnam. Currently, Vietnamese enterprises are only focusing on decarbonizing logistics in three aspects: transportation, warehousing, and packaging, with a primary emphasis on transportation.

5.1.1. Transportation

Transition to lower emissions modes of transport. Vietnamese enterprises have started the transition from transportation by road to by rail and inland waterway due to their superior carbon efficiency. As a prime example, Saigon Newport Corporation, a leading logistics service provider in Vietnam, significantly reduces carbon emissions by shifting 80% of freight transportation from Cai Mep - Thi Vai port and surrounding areas to barges, which produce less carbon footprint than trucks (VIR, 2023). Despite these efforts, road transport remains dominant, comprising 74.4% of total transportation, followed by inland waterway transport at 19% (Ai Vân, 2023). The low utilization of inland waterway mode can be explained by long waiting times to fulfill one shipment (lack of demand makes it time-consuming for logistics enterprises to gather enough containers from separate suppliers for one shipment) and suboptimal logistics infrastructure (low vertical clearance and lack of separate port for inland waterway transport) (Truong Quoc Cuong, 2023). Regarding rail transportation, the aging railway system also significantly limits transport capabilities and hinder the shift to this mode of transport. Recent government efforts to upgrade the Hanoi - Ho Chi Minh City national railway line has also experienced significant delays due to issues related to land clearance and investment resources (Phan Trang, 2023).

Figure 12: Low vertical clearance of Duong Bridge makes it difficult for large barges to pass through

Source: Anh Minh (2018)

Digitalization of process and infrastructure.

The widespread adoption of digitalized processes has become a norm in Vietnam, with 99.65% of businesses actively engaging in electronic customs procedures (Ministry of Finance, 2022). This trend is exemplified by the proactive implementation of e-customs (electronic customs declaration), e-ports (electronic system for container lifting procedures and other services at ports), and e-office (use of computer-based information technology for office work) by Saigon Newport Corporation, leading to substantial reductions in cargo truck access time at ports (from six to two minutes), directly contributing to decarbonization by cutting idle time and emissions (VIR, 2023).

Electrification of logistics vehicles and equipment.

Logistics companies have started their transformation to electric vehicles with a notable example of the collaboration between VinFast and Ahamove, in which VinFast will supply Ahamove with 100 electric motorcycles in 2022 with plans to scale up to 10,000 by 2025 (Bao Han, 2023). However, currently the electrification process by most logistics companies is still quite slow due to high vehicle replacement cost and also lenient government policies regarding carbon emissions. For example, the Environmental Protection Tax (EPT) imposes relatively low taxes on coal ($0.50 per tCO2e), gasoline ($77.60 per tCO2e) and diesel ($32.90 per tCO2e) compared to other countries (World Bank, 2022).

Efficient container utilization.

Efforts to optimize container usage include initiatives like Smartlog Technology Company's Internal Reuse model, which efficiently utilizes import containers for exports, reducing the need for new container production and aiding in carbon reduction. Though effective, these initiatives are

still only implemented internally and there lacks a platform for enterprises to reuse empty containers of other enterprises. Together with the lack of inspection and repair procedures for empty containers before delivery to cargo owners, these limitations explained the low rate of empty container reuse by Vietnamese enterprises (less than 1,5%) (VLA, 2022). Another method for container utilization is the Milk- run approach (collect goods from multiple suppliers simultaneously) applied by InterLog which reduces the number of vehicles and partially empty containers transited.

5.1.2. Packaging

There have been positive changes toward eco-friendly packaging in Vietnam's logistics sector with 44.1% of surveyed businesses using eco-friendly packaging (paper, carton and wood) while only 35.7% use less eco-friendly materials (foam, nylon, and recycled plastic) (Bao Han, 2023). An example is the Nam Ha Noi cold storage facility, which implements biodegradable packaging materials (woods, paper, etc.) for wrapping goods, thereby minimizing the use of harmful materials and reducing CO2 emission. However, enterprises face difficulties in sourcing sustainable materials due to limited availability and high costs (risk of increased expenses and recovery within a reasonable timeframe).

5.1.3. Warehousing

For decarbonizing warehouse operations, using renewable energy is one of the most popular methods with an implementation rate of 31.4%. An example is U&I Logistics who have implemented a solar power project on the roof of their warehouses, which improves efficiency, and reduces CO2 emissions by 2,000 tons per year (Bao Han, 2023). However, limited implementation of information technology in warehouse coordination and management hinder businesses in energy consumption control within their warehouses and thus undermine decarbonization effectiveness.

5.2. SWOT analysis of decarbonizing logistics strategies by Vietnam's enterprises

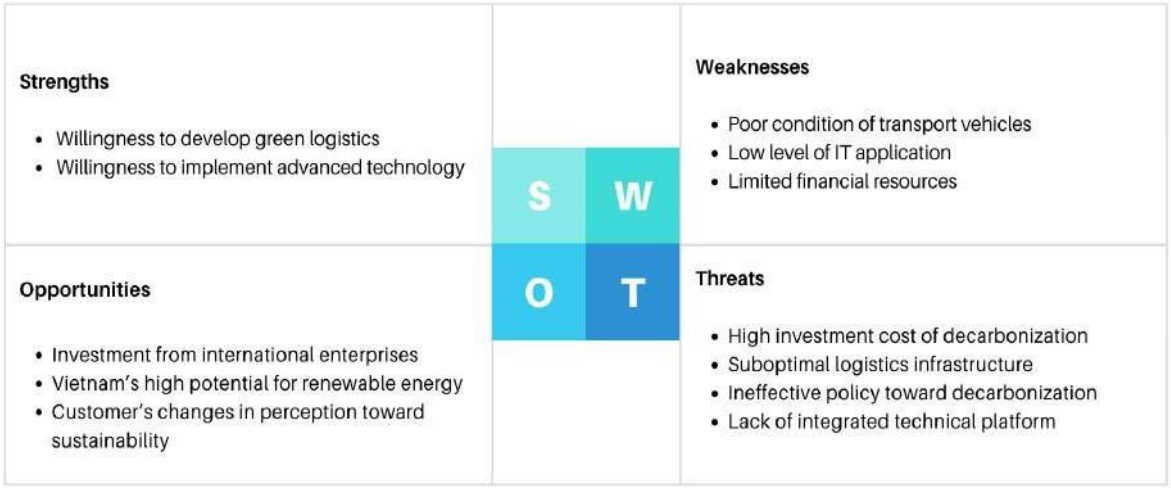


Figure 13: SWOT analysis of decarbonizing logistics strategies by Vietnam's enterprises

Source: Author's own construction

5.2.1. Strengths

Vietnamese enterprises have shown growing interest and willingness to develop green logistics and IT infrastructure. Evidently, 73.2% surveyed enterprises stated that green logistics was part of their business strategy (VietnamPlus, 2023). This level of willingness means that enterprises are more proactive in their plan to implement decarbonization solutions in the future.

5.2.2. Weaknesses

Poor condition of transport vehicles

Obsolete inland waterway vehicles and trains is one of the significant weaknesses of Vietnamese enterprises as compatibility issues stemming from outdated vehicles hinder the seamless integration of more advanced and environmentally friendly technologies.

Low level of IT application

The utilization of Information Technology in logistics by Vietnamese enterprises still lags behind international standards, making them unable to immediately deploy the most advanced management tools to decarbonize logistics operations.

Limited financial resources

The majority of Vietnamese enterprises (89%) are small to medium, with capital below 10 billion Vietnamese dong (Pace Institute of Management). This limits Vietnamese enterprises ability to apply decarbonization on a large scale due to their limited financial resources while decarbonization requires high upfront investment.

5.2.3. Opportunities

Investment from international enterprises and organizations

International organizations such as HSBC, World Bank, and Asian Development Bank (ADB) have invested significantly in green development of the logistics sector (Fox, 2023). These investments have accelerated the decarbonization process as it provided the fundamental platform for Vietnamese enterprises to acquire the financial resources.

Vietnam's high potential for renewable energy

Adopting renewable energy to achieve full decarbonization in logistics demands considerable energy consumption. Therefore, Vietnam's substantial potential in renewable energy serves as a solid foundation for businesses to stably transit toward decarbonized logistics operations (McKinsey, 2022).

Customer's changes in perception towards environment sustainability

There has been rising demand for green services, such as energy-efficient and sustainable transportation, which promotes decarbonization by service providers. Hence, enterprises are incentivized to decarbonize their operations to remain competitive.

5.2.4. Threats

High investment cost of decarbonization

Substantial costs of implementing sustainable strategies could impede these enterprises from fully embracing decarbonization within their logistics processes, as they might prioritize spending their resources elsewhere (to boost growth or profit).

Suboptimal logistics infrastructure

Suboptimal logistics infrastructure may hinder the decarbonization process as a majority of these solutions (e.g. advanced technologies integration) are highly dependent on the infrastructure quality.

Ineffective policy toward decarbonization

Despite new decarbonization strategies, Vietnam's fiscal policy has failed to provide a strong incentive for extensive decarbonization (World Bank, 2022). Lacking supportive financial policies hampers SMEs' efforts to fully implement decarbonization solutions while lenient carbon tax demotivates enterprises to accelerate the decarbonization process.

Lacking integrated technical platform

The fragmented IT infrastructure, with varied systems for tracking and managing shipments across logistics companies, obstructs seamless data exchange and collaboration. This poses a challenge for logistics enterprises in consistently implementing decarbonization strategies across the industry.

5.3. Implications for Vietnamese enterprises

For Vietnamese enterprises, we recommend utilizing the ASI (Avoid - Shift - Improve) strategies as this is the model proposed by GIZ-SUTP to structure solutions exclusively and exhaustively.

Figure 14: ASI strategies for logistics decarbonization by Vietnamese enterprises

Source: Author's adaptation from GIZ-SUTP (2019)

5.3.1. Avoid

In the logistics context, “Avoid” refers to strategies aimed at eliminating or reducing carbon emissions within the logistics processes.

Avoid unnecessary empty container movement by reusing and sharing containers

Enterprises should repurpose import containers for exports to reduce empty container movements and the necessity of transporting new ones. Moreover, instead of sending partially filled containers, they can share available container space to promote resource optimization, thereby significantly reducing the number of trips with underutilized containers and increasing fuel and carbon emissions savings. For this solution to be applied widely across the industry, logistics and technology enterprises need to closely collaborate to create an integrated system for container renting, container sharing and container reusing.

Avoid unnecessary use of materials by shipping items in their original packaging

By utilizing manufacturer-designed packaging when suitable, businesses could enhance efficiency and minimize waste. Collaborating with partners to redesign product packaging and opting for single-layer packaging instead of double layers helps reduce waste and maximize container space, thereby reducing trips and subsequent CO2 emissions.

5.3.2. Shift

"Shift" in logistics entails the deliberate transition from high-carbon to low-carbon practices.

Shift to waterborne transport by promoting inland waterway transport (IWT)

Shifting from road freight towards inland waterway transport (IWT) is a potent decarbonization strategy for logistics enterprises due to their ability to move large cargo quantities efficiently. To facilitate this transition, port companies need to build more wharf for barges, ease unloading processes, and reduce waiting times for port entry. Moreover, enterprises could explore lowering the pricing of IWT services to stimulate demand. This approach not only promotes the adoption of a lower-emission transport mode but also potentially bolster profits by enabling enterprises to dispatch more shipments.

Shift to electric vehicle and renewable energy

The transition from traditional combustion engine vehicles to electric vehicles (EVs) is important in decarbonizing logistics, as they curtail tailpipe emissions and are highly energy-efficient. Shifting to EVs will be more cost-efficient for logistics enterprises as the government has implemented the policy in 2021 to halve the vehicle registration cost.

Shift to eco-friendly packaging

Enterprises should shift to eco-friendly packaging (recycled cardboard, biodegradable plastics) which generates substantially less waste and emissions throughout their lifecycle than traditional packaging.

5.3.3. Improve

The "Improve" element within logistics centers on enhancing existing logistics operations' efficiency.

Improve ships' fuel utilization through enhancement of ship efficiency

Enterprises can improve ship efficiencies through the application of low-friction hull coatings, bulbous bows, and waste heat recovery, which can cut emissions by approximately 5% (HLA, 2022). These design upgrades reduce water resistance, resulting in reduced energy consumption and fuel use, while waste heat recovery systems boost overall energy efficiency, thereby further reducing CO2 emissions.

Improve environmental responsibility through carbon certificate

The use of carbon certificates signifies a commitment to offsetting emissions through recognized carbon reduction initiatives. These certificates provide a tangible way for logistics operations to mitigate their environmental impact. Businesses can invest in projects that reduce or capture an equivalent amount of emissions, effectively neutralizing their carbon footprint.

Improve route optimization by integrating technology

Improving route optimization by integrating cutting-edge technology is a pivotal step in decarbonizing logistics operations. By harnessing the power of advanced route planning software such as VRP (Vehicle Routing Problem) software, GIS (Geographic Information System) and so on, businesses can identify the most fuel-efficient routes, reduce unnecessary mileage, avoid traffic congestion, and ultimately lower carbon emissions.

6. Conclusion

This research focused on discussing and analyzing the theoretical foundation as well as the practical aspects of applying decarbonization strategies in logistics, through the examination of DHL's real-world experiences. By evaluating the effectiveness of DHL's decarbonization strategies, the research highlights the opportunities and challenges that logistics businesses in Vietnam may face when applying these strategies. The study's findings could serve as a reference for logistics enterprises desired to integrate decarbonization strategies into their operations.

However, the research has certain limitations that should be addressed in further studies. Firstly, data limitation poses a significant barrier to providing a more comprehensive assessment of the effectiveness of DHL's decarbonization strategies. Secondly, focusing exclusively on DHL may limit the generalizability of the findings to the broader logistics industry due to discrepancies of resources and capability. Therefore, future research should encompass a broader range of companies to offer the most overarching perspective on applying decarbonization strategies within the logistics field.

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