SPECULATING ENVIRONMENTAL SUSTAINABILITY STRATEGY FOR LOGISTICS SERVICE PROVIDERS BASED ON DHL EXPERIENCES

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ABSTRACT

Abstract: As logistics providers are becoming more aware of the changes in sustainable growth around the globe, they set out their own sustainability goals including environmental aspect. Hence, the logistics organizations' priority is to utilize natural resources towards the highest reduction in CO_2 consumption from their logistics activities. It is rarely seen that a logistics organization publishes its strategy. This is true especially when it comes to sustainability elements; because it could be a potential threat to the leakage of the organization's confidential data.

Purpose: The purpose of this study is to discuss environmental sustainability strategies for logistics service providers (LSPs) based on the case study of DHL. In particular, this research explores two distinctive aims: 1) Constructing the general framework of environmental sustainability strategy for LSPs with the support from actual data of DHL to eventually applying it to other LSPs, and 2) Discussing the impact of environmental sustainability strategy on both logistics organization's activities and the environment in general.

Methodology: The study data collection was entirely conducted by the secondary approach. More specifically data has been collected from actual DHL annual report from 2010 to 2017 which was professionally and independently audited by PWC. A general framework of environmental sustainability strategy is proposed by investigating the case study of DHL in their period 2010-2017 sustainability campaign.

Findings: The findings of this research indicate the need for an environmentally sustainable strategy for logistics firms using the data from DHL case study. Prior to this study no framework has been offered or implemented except for internal DHL operation. Hence, it is inevitable to build up a general framework to help other logistics businesses gain awareness of the importance of environmental sustainability. The findings will help their growth and will improve the community as affected by pollution. The strategic framework is tested with the actual DHL data to perceive how practical this strategic framework would perform in reality.

Research implications: This study would help logistics firms to have a better understanding of the applicability of the aspects of the framework in their businesses. Logistics organizations may put some of the elements up to the scale to view what is the best for them

towards their environmental sustainability goal. As the businesses grow faster and bigger, their new adaptation of environmentally sustainable strategies will benefit from the findings of this decade-long study.

Keywords: Logistics, Logistics Service Providers (LSPs), Environmental Sustainability Strategy, DHL

INTRODUCTION

Environmental sustainability has become a significant concern to both academics and practitioners (Sarkis & Zhu, 2018; Berawi et al., 2019). An increasing number of firms in the logistic industry are consistently addressing the environmental concerns raised internally and by their customers. By executing their performance in environmental dimension, logistics providers might mitigate the environmental negative consequences of their service activities leading to the enhancement of their competitive advantage (Wong et al., 2016). Hence, logistics service providers somehow participate in contributing to the sustainable environment.

Logistics service providers (LSPs) are defined as an organisation that delivers service management over the flow of goods and materials between original points to the end users destination. The service operators mainly handle delivery, inventory & warehousing management, labelling & packaging for shipments (Falagara Sigala & Wakolbinger, 2019; Rushton & Walker, 2007; Virum, 1993). In another word, LSPs primarily refer to the logistics function in an organisation being outsourced to the outside firms who specialise in the field of transportation and related activities. The LSPs are now comprehensively thinking towards the future generation which will intensively require businesses to change the way we are operating in different industries with the primary purpose of protecting the environment (Croom et al., 2018; Bolumole, 2003). Environmental changes have been negatively influencing human being in their health, longevity and causing a lot more natural disasters. Logistics activities in a daily operation have produced a relatively high portion of pollution and waste to the environment which is in need of being resolved by the environmental sustainability strategy (Croom et al., 2018; Sathaye et al., 2006).

This qualitative study is going to conceptualise a strategy for logistics providers towards the environmental sustainability. First we evaluate the ecological presence in the general supply chain activities leading to the need for raising awareness of environmental issues in logistics area. Then, we identify the importance and different approaches towards the environmental sustainability strategy for the logistics industry in general, and for DHL in particular. These factors could substantially contribute to the framework structure of environmental sustainability. The opportunities and challenges will also be discussed in the completion of implementing the strategy. The purposes of this paper are: 1) to assess the components of environmental sustainability in logistics industry, 2) to identify and evaluate the approaches to the environmental sustainability strategy.

LITERATURE REVIEW

Sustainability

According to the United Nations General Assembly (1987), there is none of the universally-official agreed term on sustainability due to the complexity and various approaches to achieve the outcomes. However, the original concept of sustainability was generated from the views of sustainable development in the World Commission on Environment and Development Summit in 1992 in Rio describing "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Albert, 2019). In the business context, Hoppmann et al. (2018) suggested the sustainability goal requires an increase in profit once the initial investments are made. Any business operation considers environmental, social and economic aspects, then should link to their sustainable activities. Khoshnava et al. (2018) suggested that sustainability concept can be categorised and illustrated as the three pillars "social, economic and environmental" to fully evaluate sustainable dimensions in the commercial world. Janker et al. (2019) addresses the social sustainability more focuses on the process of creating healthy and liveable communities which could improve the well-being of people who are living in those places. This dimension of sustainability supports the present and the future generations to maintain healthy living and working societies. From a business perspective, social sustainability refers to the comprehension about the impacts of corporations on people community which might affect their daily-life routine, community engagement and future well-being (Hale et al., 2019). On the other hand, Läpple & Thorne (2019) clarified that businesses seek for economic sustainability through the economic system, which implies the current level of productions fulfils the consumptions without compromising future needs. In another word, economic sustainability promotes available resources to achieve the best advantage for the long-term benefits. From the business-practical view, organisations have been using the available resources for a long run while consistently increasing their business profit. However, environmental sustainability always prioritises the conservation of the natural resources and seeks for the alternative sources of power while gradually lower the pollution and wastes harming the surrounding environment (Blowers, 2013). The principle leads people thinking towards long-term outcomes involving environmental-friendly projects such as replanting and protecting natural areas through education and society communication.

Environmental Sustainability Activities and Operations

Simane et al., (2016) determined the climate change is an on-going evidence affecting the environment due to the unawareness of protecting the nature which has led to natural disasters along with an increase in risks to people's health and living conditions. Doppelt (2017) and Curren & Metzger (2017) had the faith that the environmental sustainability is the key to keep the consistency of preventing green-house effects and changing the way of ecological thinking for the future generation for better conditions. Despite the fact that organisations found it costly to face up the sustainability challenges, big corporations are still leading the group with urgent actions to change their supply chain operation with the primary purpose of confronting climate-change issues and resource scarcity (Esty & Winston, 2009; Gruchmann et al., 2019).

Tran (2015) and Brack (2017) have both shown that there are few initiatives taken by a range of companies are excellent evidence of balancing the cost, quality and service while still retaining the quality of environment with a minimum negative impact to the globe. Brand-owners have also endeavoured to reduce excessive waste and emission throughout their whole supply chains including upstream (suppliers) and downstream (distributors and consumers) entities (Brădescu, 2014). Along with organisational policy and strategy, firms are also forced by a regulatory government body to act against damaging the environment and maximise supporting environmental protection (Dechezleprêtre & Sato, 2017; Knudsen et al., 2015). The environmentally friendly supply chain indeed enhances competitiveness and creates better customer service, which on overall generates profitability to organisations (Epstein & Buhovac, 2014; Wu & Pagell, 2011). In another word, to achieve competitive advantage durability, organisational sustainability requires an impressive intervention between economic, environmental and social degrees. It may suggest that businesses should be able to concentrate on continuing profit-growth that could simultaneously reduce the societal and ecological risks.

Regarding the growth of logistics business, as the sustainability status have ideally helped logistics operators to create brand value, a range of opportunities in growth not just increase financial capabilities but also draw and retain the potential talented workforce for the innovation (Narteh, 2018; Fazal-e-Hasan et al., 2018). The business strategy might lead to business practice which environmental sustainability is an influencing factor assessing current perceptions of their brand. The higher the perception, the more brand value the strategy would create (Keller, 2016). However, it depends on how successful logistics organisation's investment on their sustainability project, in accordance with their strategy. With regard to competitive advantage, Epstein (2018) figured out sustainability targets can enhance by creating products and services for consumers who desire to live in a sustainable world. With this approach, LSPs could make their clients recalled immediately their brand as environmentally-protected attitude. Robertson et al. (2019) and Bose et al. (2019) shared a mutual view that the improved brand image would not just attract the loyal and future-promising customers but also potentially-capable employees as well as investors. As they might join the team, the logistics businesses would be expanding with a promising workforce. From different view, Evangelista (2014) critically discussed that the standardisation in employee training to adapt with "Green strategy" is also considered as concerning challenge for the company. Big investment, time and effort would be highly required to adjust whole operation. Moreover, relating to international logistics enterprises, accustoming "environmental-friendly strategy" into different countries and cultures with new strategy is even much more challenging in the perspective of human resource management (Rivera, 2019).

Although, for most of the World-leading logistics firms, the cost of initial investment for innovation is heavy, the return would be enormous with cost-saving in transportation, warehousing, packaging and waste-treatment which have been proved in DHL's annual financial report (DHL, 2017). According to Wincuinas (2015), in 2013 total consumption of diesel fuel was 440 million litres in road transportation and 3,400 million kWh in estimation of energy usage operating global facilities which compared to those in 2009 were significantly higher. As the result, the company's profit has been gradually increasing because of less spending on operational expenses along with gaining more market-share (Pasetti, 2016). Logistics service providers (LSPs) were created due to the increasing demand from logistics users such as manufacturers and retailers (Vega & Roussat, 2015). Typically, the logistics activities which are

being outsourced to LSPs include inbound and outbound logistics management, warehousing and inventory management, material handlings as well as planning supply or demand to meet a certain level of customer's requirements (Gürcan, 2016). Rahman et al. (2017) believed that 3PL businesses' primary purposes are to cut down operational costs, provide logistics flexibility and more importantly minimise the initial capital investment to logistics users. Due to the expansion of logistics users in recent years after financial crisis, numbers of 3PL operators have taken an initiative to broaden their operational logistics scope to meet the increasing demand (Langley et al., 2018; Evangelista et al., 2017). World logistics giants have been the leaders in delivering different services that range from simple logistics activities such as warehousing and transportation to last-mile distribution with variously-knowledgeable logistics expertise. Many of them, included UPS, Fedex, DHL, recognised the considerable growth of their global operation as a forcing factor to go beyond what their 3PL functioned, which is to initiate and manage changes across their users' supply chain turning them into a 4PL (Abidi et al., 2015). It suggests that the firms might be now capable of consulting, designing users' network, planning the supply chain along with changes in different projects while still maintaining 3PL performance. In this way, logistics operators are able to maximise the benefit of outsourcing by their expertise in the aspect of time, techniques and knowledge.

The logistics service is considered to be generating more pollution compared to other service sectors as it gets vehicles and machines involved in different stages throughout the entire operation (Garza-Reyes et al., 2016). Admittedly, challenges are inevitable when it begins to standardise the sustainable perspective in organisations' supply chain via logistics function. The difficulty relates to initial and maintenance transportation costs due to the gradual increase in fuel and vehicle prices. Consequently, LSPs might have to execute cost-cutting initiatives to optimise transporting networks in the first place rather than entirely concentrating on environmental sustainability. Therefore, the pollution issues might not be solved or even get worse due to heavy cost preventing organisations from environmental-concentration to cost-saving manner, which is not on the right track towards sustainability. Another one might come from the buyer dimension. Rajala (2016) advised suppliers are putting many investments into accomplishing their environmental objectives. As a result, considering the green of entire supply chain, LSPs are supposedly called for more improvements to their environmental qualifications and sustainability proficiency to support the environmental approaches towards their customers' expectations.

Theorical Logistics Sustainability Presence

According to Weijers et al., (2012), a matrix of sustainable activities was created comprising the internal and external approaches along with the consideration of optimising and innovating factors which would be the influencing aspects to those approaches. Internal approaches refer to methods which can be arranged by the LSPs themselves. In opposition, the External approach is treated as the aspect which needs to cooperate with outsiders such as shippers, governments, competitors, stakeholders or the like. Those aspects which are listed in Figure 1 are associated with two distinctive objectives: Optimising and Innovating. The internal approach relates mostly to the vehicle aspect, which forces firms go as much green as possible in how they control their driving efficiency attitudes by using less-fuel-consumption trucks together

with a smart scheduled internal plan. This saving program is optimised by advanced software applications, upgraded-hybrid and larger capacity vehicles which will allow more goods being transported with less emissions. In the other side, the external approach refers to the improvement of general supply chain operation with highly-efficient delivery planning which would have a knock-on effect in both vertical and horizontal business lines. In vertical lines, the businesses are in partnership with this logistics firms would be influenced to stick with green operation which then will eventually have effect on the final consumers, which makes them more aware of the effort of companies trying to protect the environment. In horizontal lines, internal logistics operation makes processing order greener with recyclable packaging and show to customers few steps of how they can easily contribute to the environment just on the package. This sustainability activity matrix has made a contribution to construct the strategy framework for environmental sustainability.
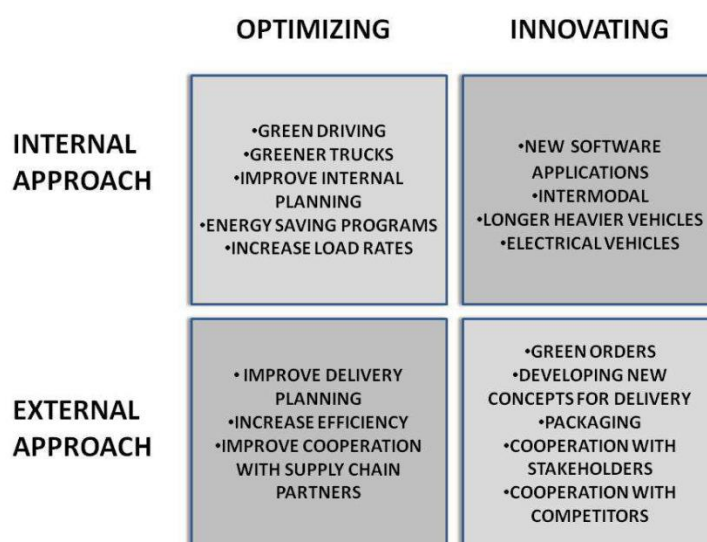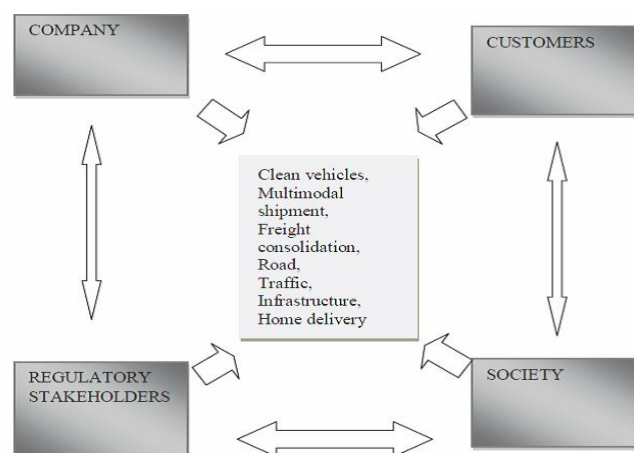

FIGURE 1
SUSTAINABILITY ACTIVITY MATRIX (WEIJERS ET AL., 2012)

From different view, Schmied (2010) distinguishes the four considerations interfering green aspect in logistics-company, customers, regulatory stakeholders, and society (Figure 2). Customers who are highly aware of environmental issue, may expect the products being delivered by hybrid or electric vehicles or being packed in recyclable boxes, which are pushing-factors to suppliers going green as much as possible. Therefore, customer is a crucial dimension for organisations in general that are examining measurements in green logistics then proved to the society their sustainable policy as well as its helpful benefits. By understanding the essential consumers function in environmental sustainability logistics, it would be advantageous for firms to improve their competency level in protecting the environment matched with consumers' expectations. Home delivery would greatly have an impact on customers' satisfaction as they are the final users of the service. Regarding the regulatory stakeholder's, the regulations executed by

the government would reflect the thoughts and idea proposals from society to force logistic organisations to go green. These elements can be considered into the sustainability strategy framework.

Since the last recent decades, there have been major evolutions in the emerging field of green logistics. Sweeney et al., (2013) introduced these significant improvements have resulted in LSP's capabilities in identifying and adopting various approaches in the procedure of turning their basic logistics operations more environmentally-sustainable. Thanks to the recent *adoption of new technology* into the controlling system, logistics firms are much better off in selecting the most efficient and effective mode as well as route of shipping method. The cutting-edge innovation also offers the ability to assess the amount of CO_2 emission from the active vehicle on the road. On top of it, logistics firm has modified their structure design of supply chain towards green solutions including the logistics function turning the management strategies more efficient.

FIGURE 2
GENERAL FACTORS AFFECTING GREEN LOGISTICS (SCHMIED, 2010)

Evangelista et al., (2017) have identified some distinctive internal and external drivers in Figure 3, which influenced the adoption of green logistics operations. Internal drivers shown are to force the logistics organizations acquiring environmental initiatives and consider a new strategy for it. On the other hand, those drivers also represent the irreplaceable advantage which leads to cost reduction, company risks reduction, firm's profitability increase and firm reputation enhancement in the market. This is beneficial to the firms as they can see the results of understanding and adopting the sustainable path as of considering more about the ecological system of the Earth. If as the firms are able to cut down their operational costs, their profitability will likely to go up, which requires the effort of deciding appropriate modes of transport, considering types of vehicles run with energy efficiency and locating optimum points for their warehouses as well as operating them with less energy listed out in Figure 4. Besides, providing training to employees also another smart option to both make them be more aware and recognize the benefits protecting the environment along with displayed emission information system, eventually resulting in lower carbon footprints in logistics operations.

Governmental support is considered one of the most influential external drivers to lead logistics firms implementing strategies towards green initiatives, which is the key element to offer funding incentives as well as alter relevantly supportive regulations for firms to maximise growth. Environment tends to be a push-factor of companies to chase up their target which refers to Customer, another significantly influencing aspect to green logistics functions of organizations, is likely able to change the entire supply chain to be a more ecological one. This Evangelista's research is making the research concept likely more understandable and the general of the framework is clearer.

Importance of drivers influencing the adoption of green initiatives.

	Drivers	IT1	IT2	IT3	IT4	IT5	UK1	UK2	UK3	UK4	UK5
Internal	Cost reduction	○	◑	◑	●	●	○	●	●	●	●
	Green initiatives requested by top management/strategic board	◑	●	○	◑	◑	●	○	○	◑	●
	Increase of the company's profitability	○	○	◑	●	◑	●	●	●	●	●
	Reduction of company risk	○	○	◑	◑	◑	●	○	●	●	●
	Improvement of corporate image on the market	○	○	◑	●	●	●	●	●	◑	●
External	Improvement of customer relationships	○	◑	●	●	●	●	●	●	●	●
	Improvement of the overall customer supply chain effectiveness	○	○	●	●	●	●	◑	◑	●	◑
	Green initiatives implemented/requested by customers	○	●	●	●	◑	○	◑	●	●	○
	Green initiatives implemented by competitors	●	○	●	●	○	○	◑	○	○	○
	Green initiatives implemented by 3PLs partner	○	◑	◑	●	○	●	◑	○	◑	○
	International, national, regional or local regulations	○	●	◑	◑	◑	○	●	●	◑	○
	EU, national, regional funding/economic incentives	●	●	◑	◑	◑	○	●	○	●	●

Key: ○ = low importance; ◑ = medium importance; ● = high importance.

FIGURE 3

IMPORTANCE OF INTERNAL AND EXTERNAL DRIVERS IN ADOPTING GREEN INITIATIVES (EVANGELISTA ET AL., 2017)

Green initiatives adopted by the case study companies.

Area		Initiative
Point Initiatives	Vehicle use	Changing vehicle specifications
		Reducing empty running
		Improving vehicle loading phase
	Transport modes and intermodality	Using lower energy transport modes
		Greater use of intermodality
	Energy efficiency	Renewable energy (including alternative fuels)
	Recycling materials and packaging	Increasing waste recycled
		Reducing packaging
	Warehousing and green building	Eco-friendly building design
		Energy-efficient material handling equipment
		Use of alternative energy sources in warehousing
		Efficient land use
Supply Chain Initiatives	Environmental training and information	Employee training (including eco-driving and tyre pressure monitoring)
		Customer/supplier training
		Information on carbon footprint
	Supply Chain re-organisation	Transport planning (including route optimization)
		Changes in logistics system
	Supply Chain collaboration on shared green targets	With customer
		With other 3PLs
	Collaborative planning and environmental control	Environmental Management System (ISO 14001)
		Emission off-set programs
		Setting lower GHG targets

FIGURE 4
ENVIRONMENTAL INITIATIVES (EVANGELISTA ET AL., 2017)

Framework of Environmental Sustainability for LSPs

Logistics operators are in need of an "officially standardised strategy framework" to improve their environmental sustainability target, which is the reason why the research is carried out. The strategy framework is expected to support the logistics operators in managing their operation in accordance with their environmentally sustainable manner. It is not only beneficial to logistics firms but also to whom are business-associated with. The users could be able to estimate the level of sustainability due to the target to create the entire supply chain more sustainable.

According to the accumulated theoretical researches of Weijers's logistics matrix (Weijers et al., 2012), Schmied (2010), Sweeney et al. (2013) as well as Evangelista et al. (2017) listed out The environmental sustainability strategy is created to fall under two main headings: (1) Logistics operation; and (2) Future vision illustrated in Figure 5. Logistics operation can be categorised into two distinctive approaches as internal and external factors.

Internal and External Factors

Training is a vital tool to improve the environmental recognition to all employees particularly the drivers who have direct control over fuel consumption efficiency, depending on their driving techniques. Technology is an irreplaceable factor to the sustainability. Implementing technology also helps to determine the optimum location of logistics providers' distribution centres as the result of lower demand for fuel consumptions.

Considering new vehicle replacement or upgrade could also cut out a significant portion of carbon emission due to the advanced engine consuming less fuel and emitting less CO_2. Some programmes which are prioritised for all employees with the primary purpose of raising their self-manner in ecological protection. Customer satisfaction is one of the keys to the success of business presence as it determines the level of how businesses treat their customers with quality products and outstanding after-sale customer support. This would force logistics businesses to change their direction towards environmental sustainability which can conceivably satisfy their existing customers and attract the potentials.

Society voice is a practical approach forcing logistics operators to replenish the damaged parts of the environment which cause by logistics activities influencing the local community. The trend in logistics sectors progressing to environmental sustainability could create a wave to other organisations in the field which make them operate more sustainably. Finally, governments are known as strictly-regulated institutions to logistics providers, which control their movements under the public law. These regulations would create a new standard in ecological aspect for logistics firms to accompany. Directing to perceive the future vision can be seen as a unique technique either owned by individual logistics firm or may be generated by the entire industry depending what level of sustainability they are seeking. It is very likely to have domino effects on medium and small enterprises, not just big organisations due to the phenomenon of sustainability spreading out in the commercial world. Seeking for an alternative to fossil resource can reduce the CO_2 emission, which is an ideal replacement for the existing sources and also helps to reserve the remaining for future generations. The research gap is now partly evaluated by the clarification of this framework. However, with data discussions of DHL case in the

comparision with other rival logistics firms in the field such as Fedex (2018), UPS (2018), or DB Schenker (2016), the authors will be able to thoroughly test the practical ability of this framework in physical logistics providers. From that, it will be easily evaluated if this framework is valid to the majority of existing LSPs.
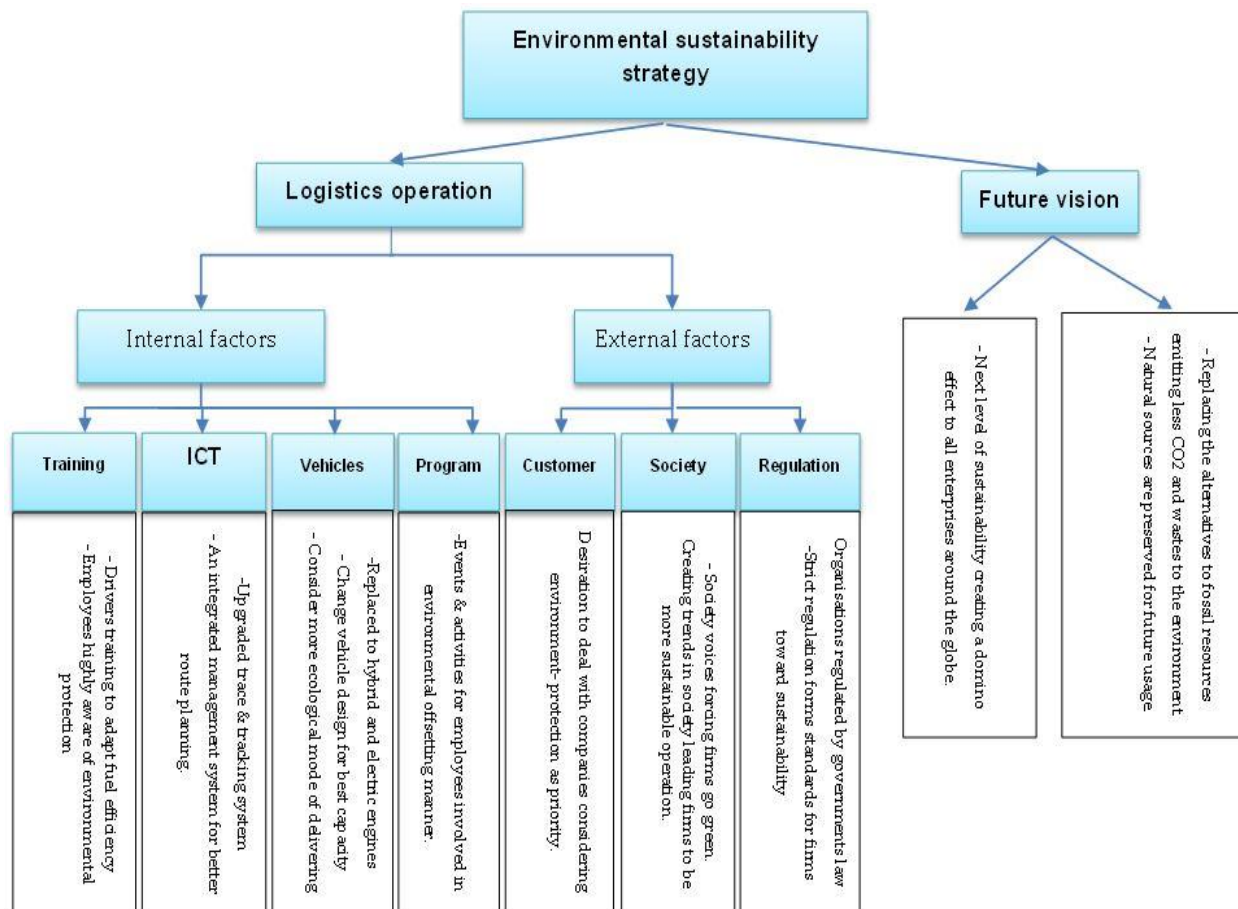
FIGURE 5
THE ENVIRONMENTAL SUSTAINABILITY STRATEGY FRAMEWORK

METHODOLOGY AND DATA COLLECTION

This research format will be executed by the deductive research approach to adopt existent theory from secondary roots to test the final outcome (Saunders et al., 2016; Wilson, 2010). The deductive approach delivers a low-risk data set which has been gathered from highly-assured secondary academic origins (Adam & Khan, 2007). Besides, it would enhance the implication of the theoretical concept into realistic data which possibly links with the research's initial designation. As priority, the author is going to signify the hypotheses in literature review to inspect how widely the consequence of logistics functions influencing to the environment using the concept in sustainability. This approach was selected as the main aim of paper is to

demonstrate a formulated theory suiting the sustainable logistics operation in general, which then has been verified by the DHL case study. In advance of deducting the final framework of environmental sustainability for LSPs, a range of theoretical concepts in environmental sustainability perspective have been well-clarified to support structuring the framework. The reason various elements are considered in logistics function as it is supposedly to standardise the framework to logistics organisations that desire for sustainability in operation. Due to the fact that, DHL ranges their operation from simple logistics activities to last-mile distribution service, if the framework eligibly fills in DHL operation, there would be a high possibility for others to implement it. This is a good chance to compare the research findings with the literature review research findings.

Adam & Khan (2007) hold the view that the qualitative data has no link associated with numerical input, which requires analysing with immense level of comprehension and interpretation of the environmental solutions being conducted by DHL. The qualitative data set from reliable secondary source is used to conduct the research. It implies that actual DHL data will be used to verify the new form of strategic framework in environmental sustainability performing well. DHL data has been collected from the period of 2010 to 2017, which is mainly to: 1) reduce the risks and uncertainties in the set of data considered in continuous years; 2) compare the significant improvements in their sustainability programs.

RESULTS

DHL Environmental Protection Program

DHL, a multinational organisation, in fact, has built a Group-wide environmental protection program particularly called GoGreen logistics solutions (DHL Graduates, 2017). This programme represents one of their innovative strengths in the sustainability field. It consists of diversified techniques in innovation that hugely contributed to the improvement in fuel efficiency and reduction in air and noise pollution as well as few other sustainable approaches. In 2007, DHL set out an efficiency rate goal to be achieved by 2020, but it reached out the target long before the deadline in 2016 to reduce 30% of total carbon emission (DHL, 2017). DHL has been working on an interim strategic goal in four aspects as global emissions, local emissions, green solutions, and employee engagement to approach the next 2025 target of 50% and the final 2050 target of zero net carbon emission in any transport-related activities illustrated in Figure 6 (DHL, 2017).

In Figure 7, the efficiency principle was clarified to represent the efficiency gain in different modes of transport (DHL, 2017). The volume of each delivery should increase while the CO_2 gas emissions are supposed to be minimum to the lowest possible. The difference in between the capacity carried by the transportation and the reduction in CO_2 emissions is how much efficiency DHL gains in delivery. As illustrated in Figure 7, the efficiency gap has stretched bigger towards 2016 which refers to the more efficiency has been obtained by increasing the transport volumes and maintaining the CO_2 emission at minimum points possible (DHL, 2017).
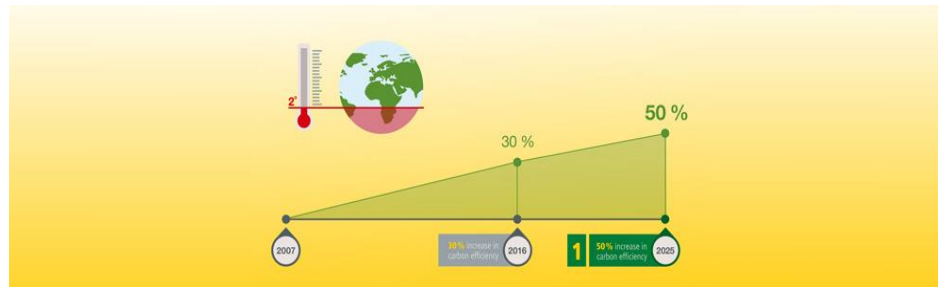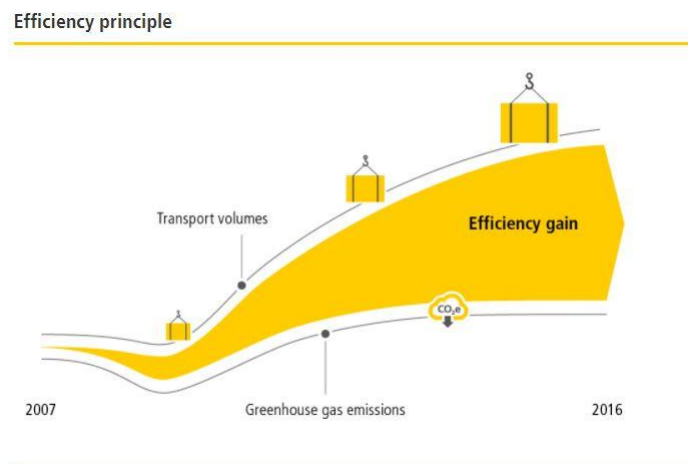
FIGURE 6
CARBON EMISSION TARGET BY 2025 TOWARDS 2050 (DHL, 2017)

GoGreen Carbon Reporting and Climate Neutral Logistics Solutions

Based on Figure 8, green products are the outcome of GoGreen programme which help the users determine their *carbon reports* including analysis and simulations the gas emission in their logistics activities (DHL, 2017). Regarding the climate neutral, DHL initiates ecological protection projects to offset the carbon emissions areas in the societies.

Lastly, the *green optimisation* is tailored in accordance with the strategies of individual customers. This customised solution identifies the efficient way to reach sustainability not only for the customers and DHL but also other subcontractors involved in the supply chain.

FIGURE 7
EXPLANATION IN DHL EFFICIENCY PRINCIPLE (DHL, 2017)

At DHL, by utilising the two products: a "*Carbon Report*" and an "*advanced Online Carbon dashboard*", is the first step to greening the logistics function (DHL, 2017). The calculation of carbon report is generated by the Greenhouse gas (GHG) Product Standard then approved by externally audited by Société Générale de Surveillance (SGS) every year, which mainly shows the data of map emissions from their logistics network in monthly, quarterly or annually basis

(DHL Press Release, 2012). Compared to 2015, there was a slight reduction in total greenhouse carbon emission down to 4.4 million tonnes in 2016 being recorded in the Carbon reports (DHL, 2017). By utilising the internationally accepted GHG Protocol and the ISO 14064 standard, DHL can precisely track and control the progress of the carbon reports and analysis. The Online Carbon Dashboard is an advanced essential tool in analysing emission data from the operation compared to the basic function being featured in the carbon report. The map emissions are integrated in the entire supply chain at each individual level and party making the management job easier. The dashboard also enables creativity of managers in evaluation as well as simulating the emission level from the reports to give the most accurate decision making as possible.
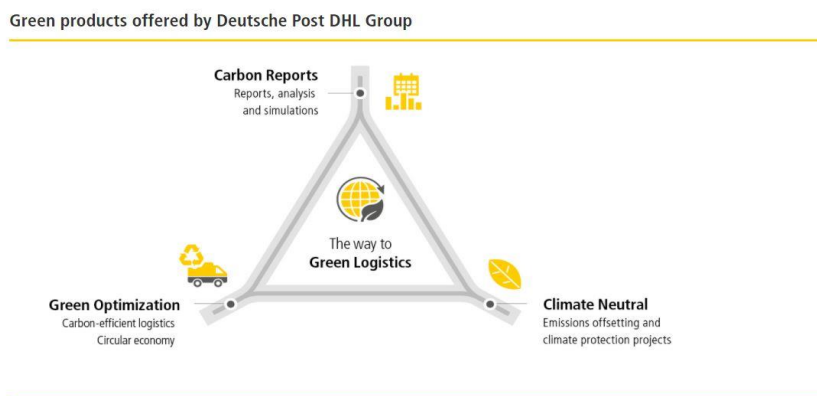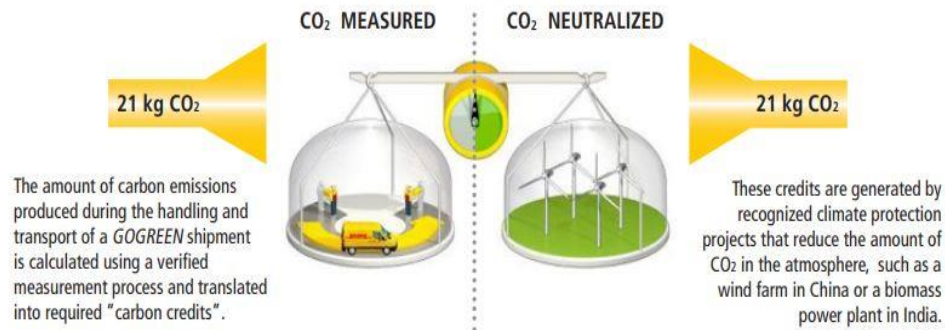

FIGURE 8
GREEN PRODUCTS DELIVERED BY DHL GROUP (DHL, 2017)

DHL and their partners can offset the transportation emission rate by initiating environmental protection projects, which is calculated by GHG and verified by SGS annually. Figure 9 is a very illustrative example of presenting climate neutral offsetting which takes the measurement of the CO_2 emission amount then to be translated into required "Carbon credits". These carbon credits would be produced by the environmental protection projects such as planting trees, turning faming waste into biogas energy for local communities and the like to balance the amount of CO_2 emission and CO_2 neutralised.

One of their projects in climate protection would be the involvement of the Fairtrade Premium of €1 per carbon credit which eventually contributes to the local communities for the local climate adaption programs (DHL, 2017). In 2010, DHL initiated another climate protection project called as SAVE80 in 10 thousand households in Lesotho, Africa where people using wood-burning stoves in their daily life. The project achieved the reduction of 80% less firewood being used eventually lessen the carbon emission to the environment from these households (DHL, 2012).

Green Optimization within the Supply Chain

Optimizing the green logistics is an approach to the environmental sustainability within DHL supply chain network, which consists of vehicle and fuel management, fleet optimization along with the modal shift with intermodal and multimodal transportation (DHL, 2017).

FIGURE 9
BALANCING CO_2 EMISSION AND CO_2 AMOUNT NEUTRALISED (DHL, 2012)

Vehicle and fuel management with fleet optimisation

The efficiency management concept is revealed in Figure 10, can be enhanced by many ways based mainly on the basic principles of "Burn less" and "Burn clean" in managing the type of vehicle selection and fuel consumption as well as the energy usage within the supply chain network (DHL, 2017). "Burn less" approach intends to help to reduce the energy and fuel consumption in logistics management operations while "burn clean" approach takes the use of alternative energy resources into consideration for the potential of CO_2 reductions (Masoud & Jayakrishnan, 2017). DHL implementation of these approaches proved the actual positive impact on local and global noise and air pollution. DHL attempted to use none emission delivery method for first and last-mile delivery such as bicycles and e-mobility. The "burn less" approach is represented explicitly in the statistics of trucks being used in 2016 which is part of DHL vehicle renewal plan to consume less fuel.
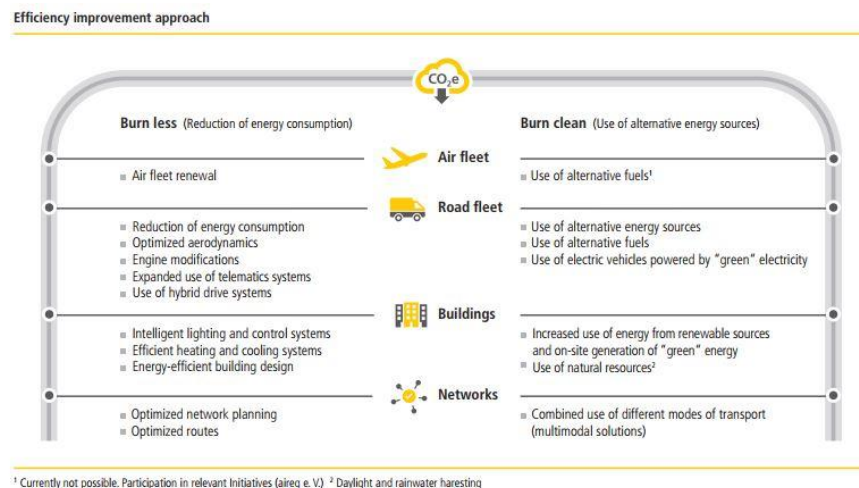
The number of trucks driven by DHL drivers has met the standard of Euro 6, and Euro 5 +EEV occupied 76% of the total vehicle, which is very recent and strictly allow the emission to the environment shown in Figure 11 (DHL, 2017). Since there was a new upgrade in the emission allowance standard, DHL has been leading the market to replace and switch their vehicles to meet higher level as lately released. Arguably, the trends could be altered when the technology comes to present and more affordable for logistics businesses.

Intermodal and multimodal transport

One of the pieces of evidence supported the selection of multiple transport modes in back in 2008 in Australia when a tech firm collaborated with DHL in designing a new container transhipping centre location for a practical outcome (DHL Green Logistics, 2017). The result was more than 40% CO_2 emission being cut down after the relocation which reduced the demand

for road transportation and utilised the usage of the vehicle in general. Again, in 2009, DHL advised an environmentally friendly concept for two manufacturers in Germany. Being rewarded from the concept, DHL was able to switch from road vehicle to ocean freight and trains which are the less polluted transport mode compared to the road (DHL Green Logistics, 2017). This elimination cut down about 120 deliveries by trucks every week. As a result, the kitchen appliances producer successfully cut out 60% the CO_2 emissions from their current operation. Besides, the other one was a pharmaceutical firm which achieved a reduction of 11 Kg of less CO_2 being emitted per ton for each freight, equivalent to 30% efficiency by only switching from lorries to inland-waterway vessels.

Efficiency improvement approach

Burn less (Reduction of energy consumption)　　　　　**Burn clean** (Use of alternative energy sources)

Air fleet
- Air fleet renewal　　　　　　　　　　　　　　　　　■ Use of alternative fuels[1]

Road fleet
- Reduction of energy consumption　　　　　　　　　■ Use of alternative energy sources
- Optimized aerodynamics　　　　　　　　　　　　　■ Use of alternative fuels
- Engine modifications　　　　　　　　　　　　　　■ Use of electric vehicles powered by "green" electricity
- Expanded use of telematics systems
- Use of hybrid drive systems

Buildings
- Intelligent lighting and control systems　　　　　　■ Increased use of energy from renewable sources
- Efficient heating and cooling systems　　　　　　　　and on-site generation of "green" energy
- Energy-efficient building design　　　　　　　　　■ Use of natural resources[2]

Networks
- Optimized network planning　　　　　　　　　　　■ Combined use of different modes of transport
- Optimized routes　　　　　　　　　　　　　　　　　(multimodal solutions)

[1] Currently not possible. Participation in relevant Initiatives (aireg e. V.)　[2] Daylight and rainwater haresting

FIGURE 10
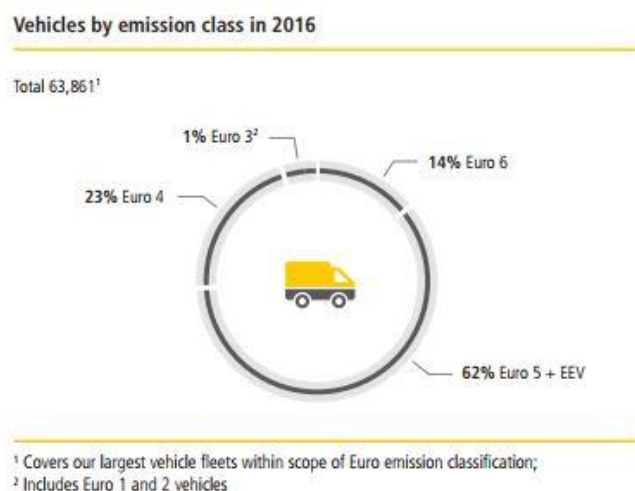**EFFICIENCY IMPROVEMENT APPROACH BY FLEET OPTIMISATION (DHL, 2017)**

Envirosolutions-environmental solutions

Aiming to reach a higher standard, DHL established three central logistics solutions under the roof of "Environmental Solutions" also known as "Envirosolutions" programme (DHL Envirosolution, 2017). They are as "Waste management", "Extended Producer Responsibility" and "Lead Environmental Partner" which refers to the integrations between logistics and the environment presenting an enormous commitment to the environmental protection. This program is also under the *GoGreen logistics solutions*. The solutions are very complicated in term of operation which required high level of management and expertise in the supply chain field to be successful.

Partnering with London Gatwick Airport, DHL constructed World first airport Materials Recycling Facility to firstly save £1000 of energy and waste management cost per day (London Gatwick Airport, 2016). The partnership targets to lift the recycle rate from 60% in 2017 to 75% in 2018 and 85% in 2020. Converting airline waste into biomass energy is also a big mission of this plan. Impressively, the airport could save 2 million litres per annum in water consumption. DHL has supported Gatwick Airport to become the first airport in the world that turn category 1 airline waste onsite into renewable energy. Category 1 airline waste can be explained as mixed

food waste from non-EU flights. This waste is governed strictly due to the threat of potential disease spread and infectious material. Previously, this waste required specialist and offsite process to deal with. Approximately 20% of Airport waste is Category 1.

Vehicles by emission class in 2016

Total 63,861[1]

1% Euro 3[2]

14% Euro 6

23% Euro 4

62% Euro 5 + EEV

[1] Covers our largest vehicle fleets within scope of Euro emission classification;
[2] Includes Euro 1 and 2 vehicles

FIGURE 11
TRUCKS STANDARD RUN BY DHL (DHL, 2017)

Landbell group specialises in processing Waste Electrical and Electronic Equipment (WEEE) (Landbell, 2017). Early on January 2017, DHL and Landbell group announced their strategic partnership which DHL delivered a service named European Recycling Platform to Landbell group consisting of Data and Regulatory Compliance Services. To be more specific, Landbell which processes waste from batteries and packaging materials witnessed a significant increase in the collection of Ni-Cd batteries between 106 tonnes in Q2 2016 to 423 tonnes in Q2 2017 that is equivalent to 299% efficiency increase. The two companies ideally match its function together to achieve Landbell business objectives in delivering environmental-friendly services.

DHL Envirosolutions also get involved dramatically in the transformation of JLR's supply chain. A significant result was presented by a long-standing relationship formed by the two companies' management (DHL Global, 2017). Moreover, it was the first JLR's partner that was awarded the Quality Award for "Best Business Process Quality Improvement Project" (DHL Press Release, 2009). Optimizing transport route and improving the use if loading capacities are the primary missions for DHL and Fujitsu partnership. Fujitsu, a Japanese technology group with concern in boosting its carbon efficiency and cutting down the adverse environmental impacts of its logistics operations. Hence, the partnership has successfully cut off 50% of its CO_2 emission. Moreover, the success of this partnership has received the "Green Logistics Award" by the Japanese Ministry of Economy, Trade and Industry (Deutsche Post DHL, 2009).

Local air pollutants (tonnes)[1,2] ✔ PwC

	2013	2014	2015[3]	2016
Mono-nitrogen (NO$_x$)	32,518	31,965	32,352	32,255
Road transport	18,178	17,625	15,971	15,634
Air transport	14,340	14,340	16,381	16,621
Sulfur dioxide (SO$_2$)	1,825	1,771	1,930	1,922
Road transport	675	621	615	588
Air transport	1,150	1,150	1,315	1,334
Particulate matter (PM$_{10}$)	1,195	1,129	1,157	1,134
Road transport	976	911	907	881
Air transport	219	218	250	253

[1] Emissions data covers our own aircraft and road vehicles only.; [2] Emissions of local air pollutants from road transport are calculated based on actual consumption data; calculations of emissions from air transport are based on route profiles. Emission factors published in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (2013) as well those published by the US Environmental Protection Agency were applied.; [3] Adjusted

FIGURE 12
TOTAL AIR POLLUTANTS IN TONNES (DHL, 2017)

Achievements

According to Figure 12, the reported data since 2013 was going down gradually from 35,538 tonnes to 35,311 tonnes in 2016 regardless of three types of air pollutants as Mono-nitrogen (NO$_2$), Sulfur dioxide (SO$_2$) and Particulate matter 10 (PM10) emitted from DHL aircrafts and road vehicles (DHL, 2017). The figure somehow reflects their effort towards the environmental sustainability target.

Brand value is not only treated as DHL achievement but also one of the tools for recognising DHL performance in the core logistics management area. Being one of the 100 most valuable brands across the globe, their brand value which has consistently increased in the past few years especially was rising from approximately 5.1 million USD in 2014 to 5.7 million USD in 2016 (Figure 13).

[1] Source: Brand Finance, 2016; [2] Source: Interbrand, 2016; [3] Source: Millward Brown, 2016

FIGURE 13
BRAND VALUE FROM EXPANDING DHL IDENTITY. (DHL, 2017)

Environmental Programs in Logistics Market

In the current logistics market, rival firms are fiercely competing each other in environmental aspects with their own strategy. This competition is not just for occupying the globally billion-US dollar-value market share but also mainly concentrating in pursuing the most appropriate strategy to reach their desired target of environmental sustainability. The Table 1 is illustrating programs of Fedex, UPS and DB Schenker to approach different solutions to the environmental issues in their logistics performance. These programs can be compared with current program of DHL being shown above, which is likely being executed in a similar manner towards green initiatives. They are mostly being applied with innovative solutions such as AI, cloud-integrated software along with the effort of human involvement in training and thinking, which the logistics services are easily, be able to cope with various situations of environmental challenges.

| TABLE 1 ENVIRONMENTAL SOLUTIONS PROGRAMS OF LOGISTICS GIANTS			
Solutions programs			
Fedex-Earthsmart	Innovations-Fedex services and assets covers vehicles, facilities and other services qualified for an innovative environmental sustainability (Fedex, 2018).	Outreach-Commitments to contribute to the society for a better ecological system	At work-Engaging employees to contribute to the environmental sustainability of Fedex qualifying business's initiatives
UPS	Managing network's footprint-Focusing on the environmental issues and locating where the issues raised from to solve from the root of the challenges (UPS, 2018).	Building Smart Logistis network-Applying advanced analytics AI to refine the logistics network to boost operation efficiency which makes the package flows smoothly to final destination	Sustainable Urban logistics-Implementing various logistics functions to adapt to the need of demand of busy cities which are facing congestion, smog and noise pollution. It requires new modes of transport for low and zero emission delivery. It allows more shipments with least impact to the environment.
DB Schenker-Eco Solutions	Environment-friendly transport for every mode. It includes rail, road, sea and air which will be offset or even completely cut off CO_2 emissions (Schenker, 2016).	Eco-warehousing targeting at warehouse operations which can reduce CO_2 emissions by 35%	Eco Neutral to specific carriers-it shows the high level of flexibility of DB Schenker to each partnership to eventually contribute to improve climate change.

DISCUSSION

The Impact of DHL GoGreen Logistics Solutions

GoGreen logistics solution is DHL number one tool in their environmental protection project approaching the sustainability. GoGreen program data has been collected regardless of its four main products "Carbon report"; "Climate neutral"; "Green optimisation" and "Envirosolutions" which can be processed to fully evaluate the impact of DHL green solutions

for their environmental sustainability target (DHL Envirosolution, 2017). Realistically, in 2015, DHL already reduced the carbon emission by 25% and going towards to increase this efficiency to 30% in 2020 as planned, illustrated in Figure 14. However, one year later, in 2016, the company announced their better-than-expected achievement of 30% reduction in carbon emission, which originally set out for the 2020 goal (DHL, 2016). It can be easily observed that the rate in increasing efficiency goes at a faster rate more than estimated, supporting the company in drawing the attention from potential investors and local governments.

The report is useful for analysing the carbon emission of transportation activities which DHL and their partners, at management level, are able to select the least emission option ensuring the carbon emission level always under control. The decision-making process can be easier due to the simulation provided by the carbon dashboard which managers can decide whether to take the most accurate action possible considering the impact of each action made on the environment. Locally, DHL is increasing their first and last-mile logistics service by bike and electric vehicle, as a result, to improve the overall quality of their customers' and employees' life in the cities that they live and work. Their aim is, by 2025, they could train 80% of their employees certified GoGreen specialists which in hope gets them involved in more other environmental protection activities such as planting a million trees every year and the like (DHL, 2017). These employees are intended to take part in "climate neutral" projects which would be ideal to offset damaged environmental parts from DHL logistics activities. Local community can benefit from these projects as the living condition is improved, as the result of raising better awareness for DHL ecological reputation and brand value to their potential customers.

Development of Carbon Efficiency Index ✔ PwC

0% | +13% | +18% | +25% | +30%

2007 | 2010 | 2012 | 2015 | TARGET 2020
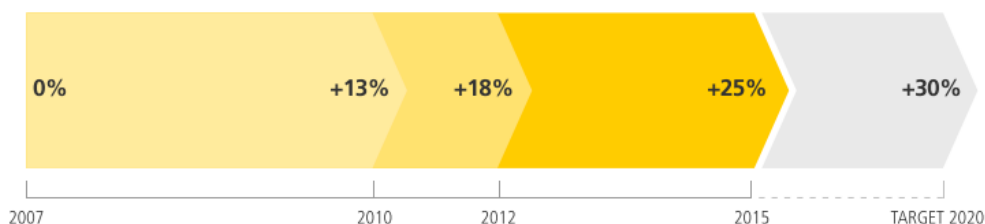
FIGURE 14
CARBON EFFICIENCY INDEX ACHIEVED BY 2015 (DHL, 2016)

DHL has taken the advantage of running multiple mode of transport selection to maximise the efficiency in individual shipment while keeping carbon emission per unit lowest as possible. DHL looked into future fuel replacement to find alternative sources which avoid or at least reduce the pollution generated from the vehicles. Fuel consumption represents level of carbon emission in the environment so the objective of new alternative fuel has to be environmentally-friendly but might be costly for initial research and set-up investment. Envirosolutions solution simplifies the operational system with highly-flexible adaption to the legislative change, social attitudes and concentrate on the competitive advantage (DHL, 2017). Moreover, it is a helpful hand for business to enhance its corporate commitment and brand value

within the increasingly challenging global economy. Hence, focusing more on the environmental solutions offers many open doors for DHL to approach more and more business sectors and industries. So that they could provide the advanced "greener" and "friendlier" business solution to not only restructure and improve the business performance but also nurture and replenish our "Mother Nature".

DHL *GoGreen logistics solution* analysis has shown their real achievement stages and positive consequences in obtaining the environmental sustainability objectives. Each individual environmental product being generated from the program contributes directly to decision-making, promising strategies and increases their flexibility in making the environment more sustainable for the business and other associated activities. Nonetheless, in each GoGreen product, DHL has to trade-off a very high opportunity cost which might severely damage the business in case of failure.

Environmental Sustainability Strategy Implementation in DHL Operation

According to Figure 5, the authors is going to examine if DHL logistics activities fit in the general framework for environmental sustainability strategy which has been gathered and formed from existing theoretical frameworks in the logistics area. However, in previous works, researchers have not specified any particular case or organisation into their theories, which should have been testified in practical conditions. Under the strategy, DHL has both considered their logistics operation and a new long-term vision for their future perspective in order to direct the business heading the right way.

Logistics operation

Regarding to internal factors influencing on their current logistics function, DHL requires their drivers to undertake at least 35 hours approved driving training in every five years, which is to test and maintain their skills level and keep them updated to new training programs (DHL Training, 2017). Good driving techniques are checked in these tests which ensure their ability to take controls over the vehicle responsibly for more effective fuel consumption. Benefits being gained from their skills eventually are added up the delivery efficiency of DHL with less CO_2 emission as presented in "burn less" approach and monitored by the annual "carbon report". Training is part of DHL environmental protection programmes which the main purpose to spread out this concept to all employees within the organisation making them aware of being sustainable for the environment and society. DHL employees are theoretically and practically trained to get involved in environmental protection projects such as planting 1 million trees every year with its partners (DHL, 2017). By organising and participating in such events, DHL is standardising their culture towards ecological-protected manners which fully requires the individual action from their staff to achieve the full effect of sustainability.

Regarding their technology, being a leader in the field, DHL is confident to own an advanced and cutting-edge technology facility and informatics system which its partner would be benefited from. As being the 4PL operator, DHL is capable of designing the optimum location for their distribution centres and its partner's inventory locations which might help to reduce the demand and the distance for transportation (DHL, 2017). Technology also gives DHL the ability

to track and reroute the delivery options to save fuel and transportation time with high interaction with their drivers. The amount of CO_2 emissions being measured has significantly reduced by the majority replacement of their vehicle as Euro 5 and Euro 6 standards (DHL, 2017). Being flexible in selecting the appropriate modes of transport offers DHL a greater control over the quantity of vehicle being on the road or on the air as the result of lead times being optimised, capacity each shipment increased and inventory costs minimised to the lowest and efficiently managing other related transportation cost. This potential aggregated result contributes directly to environmental sustainability, lower down carbon footprint generated from supply chain network. However, technology and vehicle replacement would take time and cost heavily for DHL investment.

In term of external factors, take a great consideration from their customer satisfaction which is a priority to their performance and achievement. Allen, member of the board of management express division of DHL, valuably considered that "People are still one of our core assets, as they directly deliver the customer experience" (DHL, 2017). Customer satisfaction greatly influences the way DHL delivers the service. The goal is still to reach time-definite while optimise the route planning and efficient-energy consumption for the least emission and highest efficiency by low-noise vehicle. Combination of those aspects will also depend on DHL highly trained drivers by their green driving techniques and highly aware of negative environmental impact in DHL employees. On another word, customer who has raised the concern about environmental issue is the forcing factor leading DHL to go ecologically-sustainable. DHL has taken action over society voice to obtain environmental sustainability. The society voice is a direct way to present people's thoughts about the service delivered by DHL, which also impacted to reduce emission from their daily operation. Alternatively, being the leader of environmental protection trend in logistics and supply chain society, DHL has pulled the attention from other organisations to act upon the environment protection program as a result of a positive knock-on effect to their sustainability goal. The target of being environmentally sustainable now might be enlarged as a priority in other businesses as well due to the trend created by DHL Regulation reinforces DHL to comply with the limit of emission allowed which is released as a standard for logistics firms so that DHL possibly has to restrict their operation in some activities to not go beyond the regulation. Not just the amount of CO_2 emission is under control but the materials which DHL is using to pack and label the parcels are also considered to be highly recyclable. As the law would create a new standard for entities in logistics industry, DHL and partners will have to associate with the law to create new level of standard of the environmental protection towards environmental sustainability.

Future vision

It is highly important to take "future vision" aspect into account, which is an appropriate approach to the direction of DHL future perspective. As what they are partnering up featured with some highly ecological protection manner, DHL is hoping that both companies together would successfully implement the strategy to improve the sustainability for the system. DHL might transfer their knowledge and technology to help the partner achieve the new sustainable goal especially in environmental dimension. Other businesses associated in the field might see the full beneficial effects such as increasing brand value, reputation, potential market and the like

of sustainability from DHL and its partners. It is likely that they will follow up creating sustainable objectives for their own operation. It can be assumed that the sustainability might become a phenomenon spreading out to all businesses including small and medium enterprises around the World, which would be tremendously good for future human-generations. Due to the fact that organisations care more about living condition being severely contaminated, resource scarcity and worse ones, alternative approaches will be taken to avoid using fossil resources, and minimise waste and emission to be discharged to the environment. DHL is realistically switching to use electric or less emitted vehicles, or bio-fuel to completely replace regular fuel as the main intention of protecting in the natural resources and the environment taking another step to the future of sustainability.

In this section by taking the advantage of collecting actual DHL data, it is possible to test the validity of the strategic framework concept in Figure 5. It can be observed that the data collection from DHL sustainability reports are highly matched with the concept of the strategic framework in term of DHL logistics operation and their future vision for the business. It identified then evaluated the internal and external components in DHL strategies towards future ecological sustainability which, in fact, have protected the environment and saved the nature resources for next generations. The factors in logistics operations not only offer DHL some good opportunities from unique programs, new technology for their growth as well as reputations but also many challenges coming from its own opportunities which they need to overcome to achieve their objectives.

Other Aspects Contributing to the Success of Environmental Sustainability

Sustainability is a long journey to be achieved which simply demands a lot of participations and contributions from individuals. To get an Individual understand this complex concept, young generation should be well-educated with regard to environmentally-protected altitude. Youngsters clearly are the next in line to be responsible for protecting the environment and natural resources. Since they fully comprehend the idea, in later time, it would be much easier for them to be part of sustainable target whether they are working for a company or a government agency. Education should have included the impact of human's daily activities on the environment so that action will be taken based on what people have learnt through education or exclusive training programs such as the DHL certification of GoGreen specialists (DHL, 2017). Therefore, education initially contributes a great influence on the success of the environmental sustainability perspective not only within DHL but the society.

DHL ecological logistics solution literally creates plentiful opportunities to the society in term of employment rate, health enhancement, and financial ability. The success of the strategy somehow will be determined how positive it will impact on the people in the society. By organising the ecological protection projects, DHL will automatically open job to get people participated in, which helps to increase the employment rate in the economy. As the final outcome, DHL expects to see in people health better-off in the long run because what people intaking everyday would be cleaner and safer. The combination of employment rate and health improvement increases to show the ability to earn, save more and boost financial capability which then is one of the sources to expand the sustainable World. As been determined, the strategy might generate a domino effect throughout the total supply chain. The further influence

might spread the environmental sustainability phenomenon to other manufacturers or service entities who are also seeking for sustainable operation goal. The scene would now show the full effect picture of being sustainable to the fullest bringing advantageous benefits to every single individual across the World including the wealth, health, comfort and security.

Apart from what DHL and the society are truly benefited from their green sustainability strategy, there are other aspects also contributing to the success of their strategy, which are considered as challenges to DHL. These factors are evaluated in this section as education, health and how enormous sustainability phenomenon can create to influence other businesses leading the entire World adoption of a higher sustainability level.

CONCLUSIONS

In order to conclude the research, it is essential to relist the research objectives of the research toward evaluation of how much this work has justified for the research question. The aims of this research are: 1) Constructing the general framework of environmental sustainability strategy for LSPs with the support from actual data of DHL to eventually applying it to other LSPs, and 2) Discussing the impact of environmental sustainability strategy on both logistics organizations' activities and the environment in general. In addition, to strengthen the answer, the authors identify and assess the opportunities as well as difficulties when LSPs implementing the strategy.

By comprehending the existing researches about environmental sustainability in logistics industry, the authors offer the framework for logistics service providers. The framework then is tested with the actual DHL data to perceive how practical this strategic framework would perform in reality. This strategic framework consists of two main factors which LSPs need to consider in implementing environmental sustainability as logistics operations aspect and future vision aspects. Each factor creates its own opportunities and challenges which, in the case of DHL, the company has to face up and overcome for the successful environmental sustainability outcome. Considering the execution of the framework in DHL's service activities, the level of matching between academic theory and actual evidence which, is very high, represents in the reality of DHL programs and directions with internal, external factors and future vision in the theoretical framework. The authors have, in fact, linked every individual dimension of the concept in the Figure 5 to DHL green logistics activities. The result has shown the good link and suitability between the theory and the actual evidence represented in chapter 5 discussion.

In addition to the application of the framework into DHL case, the outcome from the discussion has shown various opportunities but also challenges to DHL in obtaining the environmental sustainability status. Opportunities can be seen as a better management system helping decision-making process less complicated. The green program created a high-quality workforce along with cutting edge technology, which pushed DHL to be the leader of logistics industry. To gain an outstanding reputation, DHL has satisfied the society including their loyal customers with the aim to reach a new better standard. However, difficulties were also identified throughout the strategy implementation process. It can be easily observed that all DHL activities in achieving sustainability cost them a huge investment and time. The uncertainty should be very high in practice for other smaller-scale businesses. The direction was to create the phenomenon of environmental sustainability to affect firstly other businesses in the field, then at a larger

scope, and the countries with worldwide scale. However, this is hardly practical because of many interventions from the economy, customer preferences, politics and the like.

Eltagouri (2017) reported in the latest update of the Earth Ozone that the hole is shrinking and reached the smallest size ever since 1988. This is a good sign of environmental quality recovery and improvement which have been contributed by the worldwide environmental protection programmes and sustainability targets of organisations potentially including the outstanding achievements from DHL. It might suggest that the sufficient impact of protection regulations or programs toward environmental sustainability actually work well for improvement but require time and consistency in worldwide scale.

LIMITATIONS

Regarding the theoretical contents in literature review, the concept of environmental sustainability strategy was gathered from different researchers in different period and length of time. Therefore, the accuracy of data might be not at the same standard. Considering different researches present the data in their own way, the authors of this research might perceive those pieces of data from different views at different level of knowledge leading to the uncertainty in representing again the theories in literature review section. Due to the research methodology selected as secondary data, despite the benefit the work could gain from this method, there are limitations to the feasibility to produce a more reliable and practical piece of work. In fact, there was a high chance of lacking data which can only be archived from other people work rather than originally from the authors of this research. In addition, there was a limited vision in how the original data was collected and conducted making it hard to verify the authenticity and credibility of data.

With regard to the data collection and discussion, the main source of data was from DHL annual sustainability reports due to the confidentiality of data. The authors are so much dependent on the DHL report rather than other sources, which might be a bit biased when the data came only from DHL perspective. On top of that, even the data was originally from DHL, but there is still some uncertainties and inaccuracies which are hidden to external parties including the authors of this research. The research has been carried out to relate only in the case of DHL logistics function. Even the theories collected was intended to apply in different cases but due to the limited length and time of the research, the scope could not be expanded and go beyond to other case studies to fit within this research boundary. Therefore, the main limitation of this research is the limited ability to check the validity and practical valuations of the theoretical framework to different business scales in logistics sector.

It can be easily observed that there is a time lag between the theories and the evidence of DHL data. Previous theories are ranged in different time which could be from 20 years back and some up to 2017. The reason why the authors did not select all data from later dates because it would help to view a bigger picture of environmental sustainability in logistics sector from the past to present. The authors are able to evaluate how dramatic this dimension has changed over time to take into consideration valid points to the research. The research might observe the full effect of the strategy in the future but not now because from what has been discussed, DHL goals were set for until year 2050.

RECOMMENDATIONS

The effectiveness of this research can be improved by expanding the scope of the research to connect with other logistics firms ranged from small to big scale organisations in order to observe the differences. From that, it is possible to adjust and determine a more accurate and precise strategic framework in environmental sustainability for various logistics entities. The research validity and reliability can increase by conducting primary research which authors can perceive the data directly from the management level of individual logistics organisation. When interviewing the people from management level, they might express more their vision and thoughts about the business operation which could give researchers better idea of interpreting the data. There are more interactions between the managers or directors and the researcher, the primary data can now somehow influence the final outcome as researcher understanding is now perceived straight from the people leading the businesses. By this way, uncertainties might be minimised to the lowest level helping to produce a better piece of work. However, it is very hard to be in the position to conduct an interview with those people due to the scope of work and data confidentiality which top management teams do not want to share publicly.

In case of DHL, further study can be implemented when they launch a new environmental protection product or extendedly a new strategy towards the general sustainability of businesses. It is vital to find out the negative points of this research so that if other researchers who are interested in this field can continue to fix the concept and extend the workload of research for more appropriateness. Future research should not be limited as a dissertation because it will be very challenging again in term of research time length and capability to obtain data. In future research, the further research can be carried out by investigating the trend of environmental sustainability which might be changed later due to the fluctuation of the economy, society and climate. Alternatively, the future research should consider figuring out the concepts in other aspects of sustainability such as social and economic dimension rather than just the environment. It would somehow help the community to growth, people live in a better place.

This study discusses environmental sustainability strategies for logistics service providers (LSPs) based on the case study of DHL. An extension of our paper could study sustainability of other research, for example, sustainability in portfolio optimization (Bai et al., 2009; Abid et al., 2014; Li et al., 2018), sustainability in herding behaviour (Batmunkh et al., 2018), sustainability in stock market (Zheng, et al., 2009; Cheng et al., 2019; Demirer et al., 2019), sustainability in REITs (Chiang et al., 2008; Gupta et al., 2019), sustainability in financial crisis (Fung et al., 2011; Lean et al., 2015; Vieito et al., 2015; McAleer et al., 2016; Guo et al, 2017a; Zhu et al., 2019), sustainability in market efficiency (Lean et al., 2010; Guo et al., 2017b; Ng et al., 2017), sustainability in production (Guo et al., 2018), Sustainability of firm (Moslehpour et al., 2018, 2019), sustainability in the applications of copulas (Ly et al., 2019a, 2019b), sustainability in credit risk (Mou et al., 2018), sustainability in life insurance (Tsendsuren et al., 2018), and sustainability in derivatives (Lean et al., 2010; Qiao et al., 2012; Clark et al., 2016; Wong et al., 2018). There are many other researches for sustainability. Readers may refer to Chang et al. (2018) and the references therein for more information.

REFERENCES

Abid, F., Leung, P.L., Mroua, M., & Wong, W.K., (2014). International diversification versus domestic diversification: Mean-variance portfolio optimization and stochastic dominance approaches. *Journal of Risk and Financial Management, 7*(2), 45-66.

Abidi, H., de Leeuw, S., & Klumpp, M., (2015). The value of fourth-party logistics services in the humanitarian supply chain. *Journal of Humanitarian Logistics and Supply Chain Management, 5*(1), 35-60.

Adams, J., & Khan, Hafiz T. A. (2007). *Research methods for business and social science students*.

Albert, M. (2019). Sustainable frugal innovation-The connection between frugal innovation and sustainability. *Journal of Cleaner Production, 273*, 117747.

Bai, Z.D., Liu, H.X., & Wong, W.K. (2009). Enhancement of the applicability of Markowitz's portfolio optimization by utilizing random matrix theory. *Mathematical Finance, 19*(4), 639-667.

Batmunkh, M.-U., McAleer, M., Moslehpour, M., & Wong, W.K. (2018). Confucius and Herding behaviour in the China and Taiwan stock markets. *Sustainability, 10*(12), 4413.

Berawi, M. A., Miraj, P., Windrayani, R., & Berawi, A. (2019). Stakeholders' perspectives on green building rating: A case study in Indonesia. *Heliyon, 5*(3), e01328.

Blowers, A. (2013) *Planning For A Sustainable Future*. New York: Earthscan.

Bolumole, Y. (2003) Evaluating the supply chain role of logistics service providers. *The International Journal of Logistics Management, 14*(2), 93-107.

Bose, S., Pradhan, S., Siriguppi, D., & Alreddy, S. K. (2019). Customer-based place brand equity and investments: study of West Bengal. *Place Branding and Public Diplomacy, 15*(2), 67-77.

Brack, D. (2019). *International trade and the montreal protocol. Routledge Library Editions: Environmental and Natural Resource Economics*. Taylor & Francis, London, UK.

Brădescu, G., (2014). Green logistics-a different and sustainable business growth model. *Studies in Business and Economics, 9*(1), 5-23.

Chang, C.L., McAleer, M., & Wong, W.K. (2018). Big data, computational science, economics, finance, marketing, management, and psychology: connections. *Journal of Risk and Financial Management, 11*(1), 15.

Cheng, A.W.W., Chow, N.S.C., Chui, D.K.H., & Wong, W.K. (2019). The three musketeers relationships between Hong Kong, Shanghai and Shenzhen before and after Shanghai-Hong Kong stock connect. *Sustainability, DPI, Open Access Journal, 11*(14), 1-20.

Chiang, T.C., Lean, H.H., & Wong, W.K. (2008). Do REITs outperform stocks and fixed-income assets? new evidence from mean-variance and stochastic dominance approaches. *Journal of Risk and Financial Management, 1*, 1-37.

Clark, E.A., Qiao, Z., & Wong, W.K. (2016). Theories of risk: testing investor behaviour on the Taiwan stock and stock index futures markets. *Economic Inquiry, 54*(2), 907-924.

Croom, S., Vidal, N., Spetic, W., Marshall, D., & McCarthy, L. (2018). Impact of social sustainability orientation and supply chain practices on operational performance. *International Journal of Operations & Production Management, 38*(12), 2344-2366.

Curren, R., & Metzger, E., (2017). *Living well now and in the future: Why sustainability matters*. MIT Press.

Dechezleprêtre, A., & Sato, M. (2017). The impacts of environmental regulations on competitiveness. *Review of Environmental Economics and Policy, 11*(2), 183-206.

Demirer, R., Gupta, R., Lv, Z.H., & Wong, W.K. (2019). Equity return dispersion and stock market volatility: evidence from multivariate linear and nonlinear causality tests. *Sustainability, 11*(2), 351.

Deutsche Post DHL (2009). *Living responsibly. Corporate responsibility report 2009/10*. Deutsche Post DHL.

DHL (2012). *DHL Gogreen services*. DHL Group.

DHL (2016). *Essential Corporate responsibility report 2015*. DHL Group.

DHL (2017). *Seeing the bigger picture Corporate responsibility report 2016*. DHL Group.

DHL Envirosolution (2017). *DHL environmental solutions-Envirosolutions*. DHL Group.

DHL Global (2017). *DHL to provide in-plant logistics for Jaguar Land Rover's new factory in Itatialia*, Brazil.

DHL Graduates (2017). *Gogreen-DHL*. DHL Group.

DHL Green Logisitcs (2017). *DHL Green logistics solutions*. DHL Group.

DHL Mission (2017). *DHL mission & vision*. DHL Group.

DHL Press Release (2009). *Jaguar and land rover recognizes DHL's supply chain performance with quality award*. DHL Group.

DHL Press Release (2012). *Climate protection gets easier with DHL GOGREEN*. DHL Group.

DHL Training (2017). *DHL training-driver certificate of professional competence*. DHL Group.

Doppelt, B. (2017). *Leading change toward sustainability: A change-management guide for business, government and civil society*. Routledge, Taylor & Francis, London, UK.

Eltagouri, M. (2017). *The Earth's ozone hole is shrinking and is the smallest it has been since 1988*. The Washington Post.

Epstein, M. J. (2018). *Making sustainability work: Best practices in managing and measuring corporate social, environmental and economic impacts*. Routledge, Taylor & Francis, London, UK.

Epstein, M.J., & Buhovac, A.R., (2014). *Making sustainability work: Best practices in managing and measuring corporate social, environmental, and economic impacts*. Berrett-Koehler Publishers, San Francisco, USA.

Esty, D., & Winston, A., (2009). *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage*. John Wiley & Sons.

Evangelista, P. (2014). Environmental sustainability practices in the transport and logistics service industry: an exploratory case study investigation. *Research in Transportation Business & Management, 12*, 63-72.

Evangelista, P., & Colicchia, C., & Creazza, A. (2017). Is environmental sustainability a strategic priority for logistics service providers?. *Journal of environmental management, 198*, 353-362.

Falagara Sigala, I., & Wakolbinger, T. (2019). Outsourcing of humanitarian logistics to commercial logistics service providers. *Journal of Humanitarian Logistics and Supply Chain Management, 9*(1), 47-69.

Fazal-e-Hasan, S. M., Ahmadi, H., Mortimer, G., Grimmer, M., & Kelly, L. (2018). Examining the role of consumer hope in explaining the impact of perceived brand value on customer–brand relationship outcomes in an online retailing environment. *Journal of Retailing and Consumer Services, 41*, 101-111.

Fedex (2018). *Fedex Earthsmart Program*.

Fung, E.S., Lam, K., Siu, T.K., & Wong, W.K. (2011). A new pseudo bayesian model for financial crisis. *Journal of Risk and Financial Management, 4*, 42-72.

Garza-Reyes, J. A., Villarreal, B., Kumar, V., & Molina Ruiz, P. (2016). Lean and green in the transport and logistics sector–a case study of simultaneous deployment. *Production Planning & Control, 27*(15), 1221-1232.

Gruchmann, T., Schmidt, I., Lubjuhn, S., Seuring, S., & Bouman, M. (2019). Informing logistics social responsibility from a consumer-choice-centered perspective. *The International Journal of Logistics Management, 30*(1), 96-116.

Guo, X., Jiang, X.J. and Wong, W.K. (2017). Stochastic dominance and omega ratio: measures to examine market efficiency, arbitrage opportunity, and anomaly. *Economies, 5*(4), 1-16.

Guo, X., Li, G.-R., McAleer, M., & Wong, W.K. (2018). Specification testing of production in a stochastic frontier model. *Sustainability, 10*, 3082.

Guo, X., McAleer, M., Wong, W.K., & Zhu, L.X. (2017). A Bayesian approach to excess volatility, short-term underreaction and long-term overreaction during financial crises. *North American Journal of Economics and Finance, 42*, 346-358.

Gupta, R., Lv, Z.H., & Wong, W.K. (2019). Macroeconomic shocks and changing dynamics of the U.S. REITs sector. *Sustainability, 11*, 2776.

Gürcan, Ö. F., Yazıcı, İ., Beyca, Ö. F., Arslan, Ç. Y., & Eldemir, F. (2016). Third party logistics (3PL) provider selection with AHP application. *Procedia-Social and Behavioral Sciences, 235*, 226-234.

Hale, J., Legun, K., Campbell, H., & Carolan, M. (2019). Social sustainability indicators as performance. *Geoforum, 103*, 47-55.

Hoppmann, J., Sakhel, A., & Richert, M. (2018). With a little help from a stranger: The impact of external change agents on corporate sustainability investments. *Business Strategy and the Environment, 27*(7), 1052-1066.

Janker, J., Mann, S., & Rist, S. (2019). Social sustainability in agriculture–A system-based framework. *Journal of rural studies, 65*, 32-42.

Keller, K.L., (2016). Reflections on customer-based brand equity: perspectives, progress, and priorities. *AMS review, 6*(1-2), 1-16.

Khoshnava, S. M., Rostami, R., Valipour, A., Ismail, M., & Rahmat, A. R. (2018). Rank of green building material criteria based on the three pillars of sustainability using the hybrid multi criteria decision making method. *Journal of Cleaner Production, 173*, 82-99.

Knudsen, J. S., Moon, J., & Slager, R. (2015). Government policies for corporate social responsibility in Europe: A comparative analysis of institutionalisation. *Policy & Politics, 43*(1), 81-99.

Kohtamäki, K., & Rajala, R.(2016). Theory and practice of value co-creation in B2B systems. *Industrial Marketing Management, 56*, 4-13.

Landbell Group (2017). *European Recycling Platform*. Landbell Group, UK.

Langley Jr, C., Belman, D., & White III, C. (2018). *Logistics service providers*. In: Trucking in the age of information, Taylor & Fransis, pp 101-125.

Läpple, D., & Thorne, F. (2019). The role of innovation in farm economic sustainability: generalised propensity score evidence from irish dairy farms. *Journal of agricultural economics, 70*(1), 178-197.

Lean, H.H., McAleer, M. and Wong, W.K. (2015). Preferences of risk-averse and risk-seeking investors for oil spot and futures before, during and after the Global Financial Crisis. *International Review of Economics and Finance, 40*, 204-216.

Lean, H.H., McAleer, M., & Wong, W.K. (2010). Market efficiency of oil spot and futures: A mean-variance and stochastic dominance approach. *Energy Economics, 32*, 979-986.

Li, Z., Li, X., Hui, Y.C., & Wong, W.K. (2018). Maslow portfolio selection for individuals with low financial sustainability. *Sustainability, 10*(4), 1128.

London Gatwick Airport (2016). *Decade of change. 2016 Performance summary- our journey to be the UK's most sustainable airport*. London: London Gatwick Airport.

Ly, S., Pho, K.H., Ly, S., & Wong, W.K. (2019a). Determining distribution for the quotients of dependent and independent random variables by using copulas. *Journal of Risk and Financial Management, 12*(1), 1-27.

Ly, S., Pho, K.H., Sal Ly, S. and Wong, W.K. (2019b). Determining distribution for the product of random variables by using copulas. *Risks, 7*(1), 1-20.

Masoud, N., & Jayakrishnan, R. (2017). Autonomous or driver-less vehicles: implementation strategies and operational concerns. *Transportation Research Part E: Logistics And Transportation Review, 108*, 179-194.

McAleer, M., Suen, J., & Wong, W.K. (2016). Profiteering from the dot-com bubble, subprime crisis and asian financial crisis. *Japanese Economic Review, 67*(3), 257-279.

Moslehpour, M., Pham, V.K., Wong, W.K., & Bilgiçli, İ. (2018). e-Purchase intention of Taiwanese consumers: sustainable mediation of perceived usefulness and perceived ease of use. *Sustainability, 10*(1), 1-17.

Mou, W.M., Wong, W.K., & McAleer, M. (2018). Financial credit risk evaluation based on core enterprise supply chains. *Sustainability, 10*(10), 3699.

Narteh, B. (2018). Brand equity and financial performance: The moderating role of brand likeability. *Marketing Intelligence & Planning, 36*(3), 381-395.

Ng, P., Wong, W.K., & Xiao, Z.J. (2017). Stochastic dominance via quantile regression with applications to investigate arbitrage opportunity and market efficiency. *European Journal of Operational Research, 261*(2), 666-678.

Pasetti, A. (2016) *Analysis: deutsche post DHL-staying optimistic for 2016, but caution advised-the loadstar*.

Qiao, Z., Clark, E., & Wong, W.K. (2012). Investors' preference towards risk: Evidence from the Taiwan stock and stock index futures markets. *Accounting Finance, 54*(1), 251-274.

Rahman, S., Ahsan, K., Yang, L., & Odgers, J. (2017). An investigation into critical challenges for multinational third-party logistics providers operating in China. *Journal of Business Research, 103*, 607-619.

Rivera, J. (2019). An integral model for the implementation of environmental policy strategy. *Business Strategy and the Environment, 28*(5), 909-920.

Robertson, J., Lord Ferguson, S., Eriksson, T., & Näppä, A. (2019). The brand personality dimensions of business-to-business firms: a content analysis of employer reviews on social media. *Journal of Business-to-Business Marketing, 26*(2), 109-124.

Rushton, A., & Walker, S. (2007). *International logistics and supply chain outsourcing*. London: Kogan Page.

Sarkis, J. & Zhu, Q. (2018). Environmental sustainability and production: taking the road less travelled, *International Journal of Production Research, 56*(1-2), 743-759.

Sathaye, N., Li, Y., Horváth, A., & Madanat, S. (2006). *The environmental impacts of logistics systems and options for mitigation*. TRID the TRIS and ITRD database, UC Berkeley Transportation Library, University of California.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students*. Harlow, England: Prentice Hall.

Schenker, D. B. (2016). *DB Schenker recognized as sustainability leader*.

Schmied, M. (2010). *Aktuelle entwicklungen zur standardisierung der co2-berechnung 2 presentation*, Hannover.

Simane, B., Beyene, H., Deressa, W., Kumie, A., Berhane, K., & Samet, J., (2016). Review of climate change and health in Ethiopia: status and gap analysis. *Ethiopian Journal of Health Development, 30*(1), 28-41.

Sweeney, E., Evangelista, P., Huge-Brodin, M., & Isaksson, K. (2013). The role of third party logistics providers (3PLs) in the adoption of green supply chain initiatives. *The European Financial Review, 84*, 32-34.

Tran, T. (2015) *Corporate social responsibility and profits: a tradeoff or a balance*? Stanford University.

Tsendsuren, S., Li, C.S., Peng, S.C., & Wong, W.K. (2018). The effects of health status on life insurance holding in 16 European-countries. *Sustainability, 10*(10), 3454.

United Nations General Assembly (1987). *Report of the world commission on environment and development: Our common future*. Oslo, Norway: United Nations General Assembly, Development and International Co-operation: Environment.

UPS. (2018). UPS 2017 *Corporate sustainability progress report*. on the leading edge.

Vega, D., & Roussat, C. (2015). Humanitarian logistics: The role of logistics service providers. *International Journal of Physical Distribution & Logistics Management, 45*(4), 352-375.

Vieito, J.P., Wong, W.K., & Zhu, Z.Z. (2015). Could the global financial crisis improve the performance of the G7 stocks markets? *Applied Economics, 48*(12), 1066-1080.

Virum, H. (1993). *Third party logistics*. Sandvika: Norwegian School of Management.

Weijers S., Glöckner H.H., & Pieters R. (2012). Logistic service providers and sustainable physical distribution. *LogForum, 8*(2), 157-165.

Wilson, J. (2010). *Essentials of business research: a guide to doing your research project*. SAGE Publications, p 7.

Wincuinas, J. (2015). *CSR logistics*: How DHL packages its environmental initiatives.

Wong, C.W.Y., Lai, K., Lun, Y.H.V., & Cheng T.C.E. (2016). *Environmental management practices with supply chain efforts*. In: Environmental Management. SpringerBriefs in Applied Sciences and Technology, Springer, Cham.

Wong, W.K., Lean, H.H., McAleer, M. and Tsai, FT. (2018). Why are warrant markets sustained in Taiwan but not in China?, *Sustainability, 10*(10), 3748.

Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management, 29*(6), 577-590.

Zheng, Y, Chen, H., Wong, W.K. (2009). China's stock market integration with a leading power and a close neighbour. *Journal of Risk and Financial Management, 2*, 38-74.

Zhu, Z.Z., Bai, Z.D., Vieito, J.P., & Wong, W.K. (2019). The Impact of the global financial crisis on the efficiency of latin american stock markets. *Estudios de Economía, 46*(1), 3208090.

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