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## **THE STRATEGIC HGVS PLANNING PRACTICES FOR SUSTAINABLE GREEN LOGISTICS IMPLEMENTATION**

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### **Abstract**

The Malaysian government is introducing a number of initiatives to try and reduce the effects of global warming. One of these is the road haulage industry, which contributes significantly as one of Malaysia's largest industries to the nation's effort to reduce its transportation emissions to 45% by 2030. However, the empty movement of trucks and improper transport planning by the management caused some delivery trucks to come back to the headquarters empty and did not fully utilise the space of the vehicles. Therefore, the researchers aimed to propose heavy goods vehicle (HGV) planning practice to solve the problems. This is a mixed-mode research paper in which data was gathered through interviews and estimated calculations. The data has been analysed by comparing the result of the simple estimation calculation with the operational cost and carbon emission. Based on the results, most of them agreed that by using the right strategy, operational costs and carbon emissions can be reduced. The researchers had introduced a few recommendations to enhance the firm's transport planning practices that could contribute to the field of green logistics as well as the road haulage industry in Malaysia.

**Keywords:** Transport Planning, Green Logistics, Optimization, Heavy Good Vehicles, Sustainability

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## **INTRODUCTION**

Over the past few decades, people around the world have just realised that climate change and global warming issues have developed into serious problems for society and the environment. To tackle this issue, sustainable development is the key to achieving a better world with rich natural resources and a cleaner environment for upcoming generations. A revolutionary method is needed to mitigate climate change and global warming problems, which is green logistics. It is specifically designed to concentrate on reducing carbon emissions during the process of production and distribution, taking into account social, economic, and environmental factors (Dekker et al., 2012; Homayouni et al., 2021). The best approach to green logistics is to design distribution systems that take environmental impact into consideration, reduce energy consumption and carbon emissions, and manage waste. This is because the existing supply chain methods being applied are not properly sustainable (Sbihi & Eglese, 2007; Bouchery, 2012).

In an attempt to mitigate global warming problems, a variety of actions are being introduced by the Malaysian government. It has been shown in the Tenth Malaysia Plan that Malaysia has already reached a 33% decrease in carbon emissions. The road haulage industry, which plays a significant role as one of the largest industries in Malaysia in reducing its transport emissions (Daim, 2021). There are tonnes of strategies and improvements that can be implemented by the road haulage industry to meet the goals of reducing carbon emissions, which can lead to global warming. Besides that, by having an effective transport plan such as route and load planning, logistics performance could be increased, and these methods are the main key elements in transport operations (Alaharja & Helo, 2015).

In fact, route planning can achieve up to 10% cost efficiency and energy savings. This can be supported by the statement by Blanco and Sheffi (2017) that transport routing and arrangement are one of the most effective practices for the environment. Besides that, Kamakate and Schipper (2009) reported that effective load planning for trucks can reduce fuel consumption and carbon emissions.

The major issues that can be discovered in many transport companies are the empty movement of lorries and improper transport planning by the management. The issue of empty movement is not new in Malaysia, but it is a very serious issue concerning all countries around the world. The right approach for handling empty movements will result in cost savings. It also has the additional benefit of reducing global warming. One of the elements that is being studied in order to determine the efficiency of the strategies is cost savings. Rodrigue (2017) said that the purpose of business is to gain profit. The company will adapt a strategy that will enable them to cut costs, especially transportation costs. This study demonstrates the significant role of cost as a main standard in

transport planning. Other than that, carbon emissions are also an important component that plays an important role in transport planning. A study conducted by Ubeda, Arcelus, and Faulin (2011) stated that the reduction in distances and carbon emissions shows the importance of optimising transport operations. Proper planning can reduce fuel use and, consequently, average greenhouse emissions per vehicle.

Nevertheless, a further study is needed to provide a better understanding of green logistics implementation in Malaysia because there is a lack of information for road freight companies on how to implement green logistics practises in Malaysia. Poor planning in transport operations can lead to unnecessary fuel usage and a high level of carbon release. Thus, an effective approach to transport planning is required to reduce operational costs, which will indirectly reduce carbon emissions (Tarudin, 2013; Tarudin & Adlan, 2022). The government and industry must sit at the same table to discuss and come up with a variety of green strategies that can be implemented.

Therefore, the researchers intend to assess the best strategic transport planning practises in transport companies towards supporting green logistics and find a way to cut operational costs and reduce carbon emissions. If transport companies fail to make changes to their logistics activities, more complications will affect the whole supply chain of the business in the future, such as losing the business opportunity because of high operational costs and contributing to global warming because of high carbon emissions.

## **DEVELOPMENT OF CONCEPTUAL FRAMEWORK**

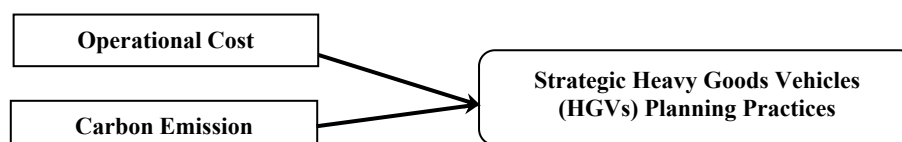
There are many previous studies that support the idea that cost savings can be achieved by supporting green logistics. The main elements of sustainability are the economy, the environment, and society. In other words, sustainability can be achieved through strategies that address the environment, society, and economy all together. A study by Tarudin and Adlan (2020) shows that almost all road haulage firms in Malaysia believe that operating costs can be reduced by having the right plan. Based on the number of trips covering the activity of HGVs, the number of trips by firms adopting the right strategy is lower than the number of trips by firms that do not adopt any strategy. Based on this case, it demonstrates that the development of the road freight sector in Malaysia will indirectly minimise global warming effects because it will cut their operational costs and carbon emissions by adopting the right strategy.

Freight transport operation costs include both internal and external costs. Internal costs are fixed costs paid by the road freight company. It covers operating expenses and capital investments. The total operating cost consisted of electricity, wages, maintenance, costs, depreciation, and insurance. For the transportation industry, fuel prices comprise over 50% of total operating costs.

Fuel prices have taken a significant share of the operating costs of freight transport. The price of oil depends on a range of parameters, such as global Brent prices, the cost of oil purification or import charges, the margin for oil dealers, the expenses of delivery of refined products to end customers, and national taxes on oil (Gohari et al., 2018). According to Kenny (2017), the operating cost of trucks is based on fuel and tolls. Road tolls can contribute to making transport more efficient. The increase in cost has been expected to have an impact on the efficiency of loading trucks as pricing pressure increases the probability of empty movements or inefficient truck loads. Kenny also stated that tolls are necessary if a country wants to move to cleaner and smarter transport systems. Toll is a funding tool capable of encouraging low-emission vehicles and smart transport attitudes while raising money for the public budget.

Reducing carbon emission levels plays a vital role and has become a primary goal for every service provider. A study conducted by Ubeda, Arcelus, and Faulin (2011) points out that the reduction of distance travelled and greenhouse gas emissions correlated with the emergence of transport planning, demonstrating the significance of improving operations. It might seem that fuel efficiency can have an impact on reducing fuel consumption and indirectly reducing the average carbon emissions for every vehicle. In England, for example, vehicle carbon emissions are one of the main causes of air pollution. But with the implementation of green logistics, it will minimise environmental damage, as all operational costs will be reduced and revenues will increase (Rad, 2017).

A conceptual framework is used to demonstrate what the researchers want to find through the research. It includes how the variables might relate to one another. This conceptual framework proposes green practises for sustaining HGVs in terms of cost-effectiveness with regards to the operational strategy viewpoint. The conceptual framework has been proposed by utilising empirical pieces of evidence in the existing literature, whereas future research will be carried out to validate the proposed conceptual framework. For a deep understanding, this proposed framework adds value to the existing body of knowledge regarding the effort to support green logistics practices, especially in the road haulage industry. From a managerial point of view, managers could utilise the proposed framework to improve their insights on how to manage their HGVs using green planning tools.



**Figure 1.** Conceptual Framework  
*Source: Author's Drawing*

## METHODOLOGY

This is a mixed-mode research paper, combining quantitative and qualitative research, because the researchers have conducted an estimated calculation of the operation's cost and also the carbon release. The researchers also conducted an interview to get a better understanding of the transport planning practises at transport companies. Hence, for this study, the purpose is to assess the best strategic transport planning practises in transport companies towards supporting green logistics. The researchers' role would be to analyse the data with the hope that the findings from this study can reduce the companies' operation costs and carbon emissions to help sustain the world's environment for future generations.

### Method of Data Collection

The data collected for this study comes from several sources, such as primary and secondary data. Primary data refers to data and materials attained by the researcher on the variables of sources for the purposes of the study (Sekaran & Bougie, 2016). Generally, primary data is gained from interviews, observations, and questionnaires. Thus, the researcher used an estimated calculation and a personal interview as the methods of data collection.

A personal interview method was conducted, which involves face-to-face communication where the researchers verbally ask the respondent questions as the primary data. McNamara (2022) stated that interviews are the most suitable method to learn from respondents' experiences. The researchers also acquired accurate information about the operation by receiving follow-up from the respondent through interviews. In this study, the researchers conducted interviews with certain groups in order to obtain information based on the respondent's experiences and observations. The researchers used this technique in the early part of the study as they attempted to explore the issues that arose in the organization. The researchers also used the interview method to gain more data and get a clearer picture of the operation.

In addition, the researchers used an estimated calculation to determine the cost of the operation as well as the percentage of carbon emissions. Figure 2

shows the calculation of the formula that has been used in this study to calculate the operational cost.

$\text{Total Cost} = a1 + a2 + a3 + \dots$
a is the element of cost Total Cost per Day = Fuel Cost + Toll Fuel Cost = Fuel (L) x Price (RM/L)

**Figure 2.** Formula for Operational Cost

*Source: Assessing Heavy Goods Vehicles (HGVs) from Operational Strategy Perspective in Reducing Global Warming (Adlan & Tarudin, 2018)*

The researchers also used the simplest and most reliable method for transport firms to measure their carbon emissions, to record fuel consumption and then use regular carbon exchange ratios to turn fuel quantities into carbon emissions. Transport providers that have access to fuel consumption data are therefore encouraged to compile all their fuel consumption data. Each litre of fuel used would contribute to a certain level of CO<sub>2</sub> emissions.

$\text{CO emissions} = \text{fuel consumption} \times \text{fuel emission conversion factor}$ $[\text{Tonnes CO -emissions} = \text{litre} \times \text{kg CO per litre fuel} / 1.000]$
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**Figure 3.** Energy-based Approach (Calculation Method Recommended for use by Transport Companies)

*Source: NSAI Standards (2012). CEN/TC 320/ WG 10 Methodology for calculation and declaration of energy consumptions and GHG emissions in transport services (Freight and passengers).*

**Table 1:** Well-to-Wheel Fuel Emission Conversion Factors

Fuel type	kg CO/liter	kg CO/kg
Motor Gasoline	2.8	
Diesel Oil	2.9	
Gas Oil	2.9	
Liquefied Petroleum Gas (LPG)	1.9	
Compressed Natural Gas (CNG)		3.3
Jet Kerosene		3.5
Residual Fuel Oil		3.5
Bio gasoline	1.8	
Biodiesel	1.9	

*Source: NSAI Standards (2012). CEN/TC 320/ WG 10 Methodology for calculation and declaration of energy consumptions and GHG emissions in transport services (Freight and passengers).*

In addition, the researchers also used the secondary data to complete the calculation analysis. The secondary data comes from the company's internal parts, ranging from records of truck movement until it completed its distribution

operation. Secondary data can be gathered more quickly than primary data because it has already been documented by somebody else prior to the researcher's needs.

### **Sample**

For the purpose of the study, the sample size would be the twelve (12) transport companies in the Klang Valley area, and the targeted respondents would be the workers who had experience in logistics and transport management and operation. The respondents are divided into three groups: big companies, medium-sized companies, and small companies, according to several criteria set by the Companies Commission Malaysia. The size of the company can be determined by looking at its sales turnover per year or the number of employees. In this current study, the researchers chose to look at their sales turnover per year; medium-sized companies ranged from RM 3 million to RM 20 million, while small companies ranged from RM 300,000 to RM 3 million. A maximum of six road haulage companies were chosen for each category: three companies implementing strategic transport planning strategies and three companies that are still implementing the normal transport planning distribution process. The calculations for finding its average and moderate fuel consumption are being done, respectively.

## **RESULTS AND DISCUSSIONS**

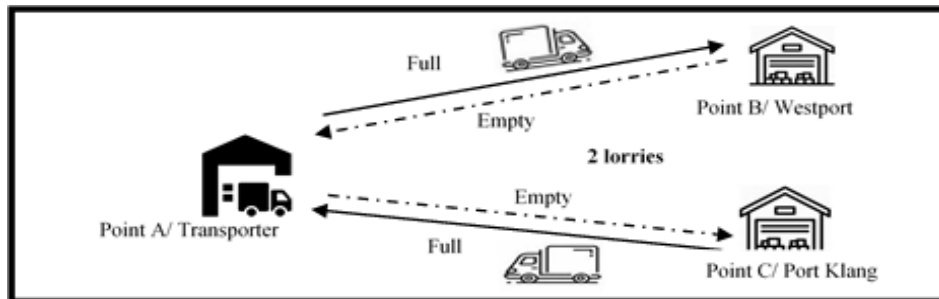
In order to effectively examine each component of the data collected from various sources, analytical and logical reasoning were used to evaluate the data in order to formulate the presented conclusions and findings. This form of analysis proved to be critical in completing the research.

### **Current/Normal Practices**

The researchers began by identifying the current transport planning practises in the transport companies. Thus, the researchers interrogated the interview in order to capture and identify the firm's current transport planning.

#### ***Operational Cost (Current Practices)***

This is an illustration of the current transport planning that is practised by most transport companies in their daily operations. The problem with current transport planning is the inefficient use of space or empty movements of containers, involving empty pickup or empty return. Figure 5 shows an example of current transport planning practises for goods delivery in a common area in Klang Valley; the trip from the transport company location (Point A) to Westport (Point B) is 42 kilometres, while the trip to Port Klang (Point C) is 34 kilometres.



**Figure 5.** Combination of the Process Delivery for Current Practices (Operational Cost)  
Source: Author's Drawing

<p>1 Liter (Diesel): 6 kilometer (estimation)                  Fuel price (Diesel): ***RM 2.15 / liter</p> <p>Point A to Westport: 42kilometres / Two-ways: 84kilometres                  Point A to Port Klang: 34kilometres / Two-ways: 68kilometres</p> <p>Toll (Point A to Westport): RM 3.00 / Two-way: RM 6.00                  Toll (Point A to Port Klang): RM 3.00 / Two-way: RM 6.00</p> <p>Revenue (Point A to Westport): RM 669.95                  Revenue (Point A to Port Klang): RM 669.95</p> <p style="text-align: center;"> <math display="block">\text{Profit} = (\text{RM } 669.95 \times 2) - [\text{RM } 2.15 \times (84\text{km}/6\text{km}) + \text{RM } 6] - [\text{RM } 2.15 \times (68\text{km}/6) + \text{RM } 6]</math> <math display="block">\text{Profit} = \text{RM } 1339.90 - \text{RM } 66.46</math> <math display="block">\text{Profit} = \text{RM } 1,273.44</math> </p> <p>***Malaysia Fuel price for 6<sup>th</sup> – 12<sup>th</sup> January 2022: Diesel RM 2.15 per liter                  *Weekly petrol price adjustments in Malaysia announced by the Ministry of Finance Malaysia (MOF)</p>
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**Figure 6.** Estimation Calculation for Current Delivery Practices (Operational Cost)  
Source: Author's Calculation

This is an example of a profit calculation. This calculation is based on the researcher's observation and also supports data from the companies. For example, the total cost of fuel and tolls for a trip to deliver goods from the transport company's premises to client B and client C locations, then have both trucks come back to the transport company's premises, is RM 66.46. If the revenue collected from the client (Client B + Client C) is RM 1399.90, then after deducting the total costs like fuel and toll, the transport company received RM 1,273.44 in profit for the two truck movements.

### **Carbon Emission (Current Practices)**

This is an illustration of the normal transport planning practises being the same as in Figure 5. The company used 2 trucks instead of fully utilising 1 truck to pick



up stuff from their client. Thus, the carbon emission level will continue to increase if they continue to practise this kind of strategy.

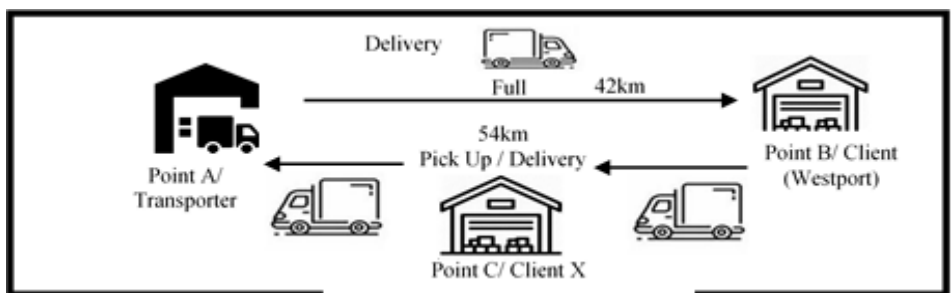
Point A – Westport = 14 liters’ x 2.9 kg CO per liter = 40.60 tonnes CO -emission Point A – Port Klang = 11.33 liters’ x 2.9 kg CO per liter = 32.86 tonnes CO -emission Total CO emission = 73.46 tonnes CO -emissions
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**Figure 7.** Estimation Calculation for Current Delivery Practices (Carbon Emission)  
 Source: Author’s Calculation

This type of practise will not bring much benefit or profit to the company, but it will have more negative effects on the environment because the carbon released by the truck can actually be reduced with proper planning. So, in order to save on operation costs like fuel and tolls and increase profit, the company needs to plan a new strategy that can contribute to high profit and support green logistics to sustain the environment for our future generations.

**Strategic Transport Planning Practices**

Next, the researchers proceeded with Research Objective 2 to propose a better transport planning practise to improve the daily operation of transport companies and fulfil the second research question, which is, "Is there a better transport planning practise to improve the daily operation of transport companies? The researchers will compare the current practises with the new practises to show the changes that effective transport planning can bring.



**Figure 8.** Strategic Transport Planning Practices – Operation Flow  
 Source: Author’s Drawing

The researcher believed that this strategy could bring changes to the transport companies' operations. For example, the lorry will deliver stuff from point A to client B, and on the way back along the same route, the lorry can pick up stuff at client C's location. The keyword here is along the same route. Instead of using two trucks to do the work, transport companies can fully utilise the space of one truck and reduce the empty movement of the truck. By implementing this

strategy, transport companies can not only reduce their operation costs but also increase their profit. The environment will also benefit from this strategy, as the carbon emissions from two trucks will be reduced by fully utilising just one.

***Operational Cost (Optimization)***

Figure 8 shows the illustrations for optimization planning and operational cost if the transport companies implement strategic transport planning in their distribution process. This is an example of a profit calculation. This calculation is based on the assumptions of the researchers. For example, if the total cost of fuel and tolls for the trip to deliver goods from the transport companies' premises to the client location and to go back to the transport companies is RM 18.05. What if the transport planner can find a client along the route and schedule the truck to pick up their product on the way back to the transport company? This can help reduce the operation's cost. If the revenue collected from client B is RM 669.95, then on the way back along the route to the transport company, they can pick up the product at client C and get another RM 669.95. Then, after deducting the operation costs such as fuel and tolls, the transport company can receive up to RM 1,299,50 in profit.

$\begin{aligned} \text{Profit} &= \text{Revenue} - \text{Point B} - \text{Point C, Client X} \\ \text{Profit} &= (\text{RM } 669.95 \times 2) - (\text{RM } 2.15 \times 7\text{km} + \text{RM } 3) - (\text{RM } 2.15 \times 9\text{km} + \text{RM } 3) \\ \text{Profit} &= \text{RM } 1339.90 - \text{RM } 18.05 - \text{RM } 22.35 \\ \text{Profit} &= \text{RM } 1299.50 \end{aligned}$
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**Figure 9.** Estimation Calculation for Optimization Distribution (Operational Cost)  
*Source: Author's Calculation*

***Carbon Emission (Optimization)***

The researcher thought that transport companies may use this new practise to reduce empty movement as well as carbon emissions, which is the main agenda of all transport provider companies in the world. This illustration shows the most optimised transport planning practises that a transport company can implement. Instead of using two trucks, a transport company can fully utilise one truck to pick up items from their client by properly planning the load and route. The calculation showed that by having effective route and load planning, the firm can reduce its carbon emissions because the distance travelled by 2 lorries is reduced by fully utilising 1 lorry.

$\begin{aligned} \text{Point A} - \text{Westport} - \text{Client X} - \text{Point A} &= 16 \text{ liters} \times 2.9 \text{ kg CO per liter} \\ \text{Total CO emission} &= 46.4 \text{ tonnes CO -emissions} \end{aligned}$
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**Figure 10.** Estimation Calculation for Carbon Emission (Optimization)  
*Source: Author's Calculation*

### **Summary of Estimated Calculation**

The researchers used an estimated calculation to calculate the profit gain and carbon emission percentage saved before and after implementing green strategies. By looking at the table, it shows that by planning the route effectively, the company can reach up to 2.05% of profit just by using 1 truck per trip, and if the company implements this strategic plan for all trucks, it will generate more profit for the company. Besides that, transport companies can also reduce their carbon emissions by up to 36.84% when they implement this strategy, and it is a good practise towards supporting our Malaysia agenda towards reducing carbon emissions. The researchers believe that a green logistics strategy is the best transport planning practise for their daily operation because there is a positive change between the normal practises and the new practises after the route optimization in terms of cost and carbon emissions.

**Table 2:** Comparison of the Profit and Carbon Emission Produce

<b>Comparison</b>	<b>Current/Normal</b>	<b>Strategic Planning / Optimization</b>	<b>Percentage (Differentiation)</b>
<b>Profit</b>	RM 1,273.44	RM 1,299.50	2.05 %
<b>Carbon Emission</b>	73.46 tonnes CO	46.4 tonnes CO	36.84 %

*Source: Author's Calculation*

### **CONCLUSION**

In a nutshell, the researchers have identified the current transport planning practises of transport companies through interviews with the right employees that handle the transport distribution operations. It shows that the current transport planning practises can be improved to minimise carbon emissions and gain more profit in the future. Logistics are a vital part of today's economic activity and a key driver of globalisation to promote trade. Logistics operations are thus responsible for a massive proportion of carbon emissions and other toxins. Transport companies must select a good practise to support green logistics. The main purpose of doing business is to gain profit, but the best practises for transport planning for daily operations are those that will benefit the economy, society, and environment.

Improvement is always possible; it is the main key to success. All firms must improve in order to remain competitive. In this study, the researcher has proposed a new approach for the firm to achieve the goals of sustainable development in their daily operations based on economic, social, and environmental drives. It will not only benefit the firm, but it will also help settle the world's biggest threat, which is climate change. Route planning and load planning are some of the best practises that can be used in transport planning because, by applying the right strategy, the company can reduce costs and carbon

emissions. Therefore, it is necessary for transport companies to apply green logistics in their operations to attain a sustainable ecosystem and continue business in the long term.

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Nur Farizan Tarudin, Muhammad Akmal Asyraaf Adlan, Rudiah Md Hanafiah Fatin Najwa Mohd Nusa,  
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