Operational Strategy of Heavy Goods Vehicles in Enhancing the 2030 Agenda of SDGs Implementation: Cost-Effectiveness

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Abstract. The logistics industry in Malaysia has faced numerous issues and challenges, one of the important concerns in this industry is to reduce operational costs. Government and agencies tend to give more attention to road passenger transports rather than road freight transport especially Heavy Goods Vehicles (HGVs) in a matter of service quality and efficiency. Despite in Malaysia, certain road haulages have not yet implemented the right strategy in their operation to fully optimize their resources and operation. Therefore, the aim of this study is to assess the green strategy for HGVs implementation in their operations to support Malaysia voluntary target to increase economies of scale. The conceptual framework was developed for this study’s and the evaluation is based on the HGVs operators’ perspective. The data had been analyzed by using a quantitative approach and simple calculation on the operational cost based on fuel cost. Based on the finding gathered, most of the respondents agreed that by using a suitable strategy, the operational cost can be reduced and sustain their businesses. Therefore, this study can be as one of the guidelines for the industry to be aligned with Malaysia 11th Plan and also the 2030 Agenda in developing sustainable development goals more aggressively.

Keywords: Green Strategy, Heavy Goods Vehicles, Operational Cost, Operational Strategy, Sustainability

1. Introduction
Most of the industries and agencies in Malaysia have their operations based on the 17 Sustainable Development Goals (SDG) which can improvise their operations and business for the future requirement. SDGs is a set of 17 goals that imagines a future just 15 years off that would be rid of poverty and hunger, and safe from the worst effects of climate change. SDGs were adopted by the United Nations General Assembly in September 2015 and it takes a holistic and multi-disciplinary approach to explore the economic, environmental, and social issues surrounding sustainability policy [1]. There are six SDGs related to the transport and logistics sector which are Ending poverty, hunger and achieving food security; Improving road safety; Improving energy efficiency in the transport sector; Development of quality, reliable, sustainable and resilient transport infrastructure; Climate impacts on transport & mitigation and adaptation measures; Collaboration and partnership to develop sustainable transport system.

From this development, this study is inspired on finding solutions in the transportation sector to support SGDs, especially from the freight transport industry. Economics sustainability and environmental sustainability are two dimensions of sustainability [2], and from the economic perspective, it can be referred to as the ability of an economy to support a defined level of economic
production indefinitely. Meanwhile, from an environmental perspective, is the ability of the environment to support a defined level of environmental quality and natural resource extraction rates indefinitely. Therefore, for this study, the main focus is on analysing the economic and environmental opportunities for the road haulage industry and to be in line with the world and the nation's sustainable development objectives.

However, most public and private agencies are overlooked by road haulage companies, especially on Heavy Goods Vehicles (HGVs) as they focus more on sustaining public transportation and private passenger vehicles in a matter of service quality and efficiency. Normally, road haulage in Malaysia operates its daily HGVs routine based on trips. Therefore, poor planning in managing their HGVs operation can lead to excessive fuel usage and high carbon emission. Consequently, the right strategy in their operation was needed to reduce their operational cost and it will indirectly support the carbon emission reduction [3]. To solve these HGVs problems, the industry must come out with several green strategies which have been put into practice.

Based on own study, it is safe to assume the company will be less likely to be profitable to operate from a fleet of five to 10 trucks and it needs the economy of scale to sustain the business due to a high capital-intensive nature. They are also less likely to be financially equipped on purchasing new engine models that are more environmentally friendly. In contrast, hauliers with a larger fleet and good management system will be more likely to easily enjoy a 5% to 10% margin more compared to others. This issue may cause local firms especially small to medium companies to be unable to participate in the ASEAN Economic Community (AEC). Subsequently, most small local road haulage companies cannot sustain their business for a long-term period [4]. AEC supports improvements in transport connectivity and other infrastructure networks as these can facilitate cross-border transportation and contributes to reducing the overall costs of business.

Goods vehicles, predominantly diesel, are measured by the same source to travel 70,000 km annually on average [5]. The fleets are used to distribute goods to retail outlets, move raw materials and finished goods to processing plants and shipping centres. They also mentioned there is a significant amount of container traffic to and from the various ports as well as running from Thailand to Singapore through peninsular Malaysia. The free movement of goods across countries will attract potential competitors to saturate the market. Therefore, the question remains on whether Malaysian road haulages can meet the criteria of these concepts for future needs expansion.

Based on these scenarios, it can be concluded that all stakeholders in the road haulage industry can be initiated to move forward towards green implementation. However, it is believed that facing the challenges independently might complicate the process altogether and probably the stakeholders will exclude themselves from achieving the sustainable goal together. Thus, this study proposes suitable guidelines for supporting the sustainability of local standard HGVs from the managerial perspective in a matter of cost-effectiveness. This effort directly supports green logistics implementation in Malaysia and this research is therefore intended to make contributions to the field of green logistics as well as the road haulage industry in Malaysia.

2. Development of Conceptual Framework
Vehicle condition essentially is another dimension that needs to be considered due to its performance affecting largely on cost. According to Zacharof [6], vehicle condition refers to the state of the vehicle in terms of maintenance, like for example the timely change of oil, check of tyre pressure and proper tyre type usage. Under this dimension, the element of fuel consumption has been selected in order to assess and monitor the HGVs operation. This is due to the study only calculated the journey of HGVs after exit the warehouse gate and not within the area of the warehouse. Therefore, the vehicle maintenance element is excluded for optimal results. This can be supported by Armstrong [7] and Aamuvuori’s [8] study that shown vehicle condition needs to be monitored especially on fuel consumption plus the maintenance and also to focus on utilizing the usage of HGVs. The vehicle fuel consumption is influenced by the type of engine used, the transmission and driveline and other vital aspects of the vehicle. Fuel consumption mainly depends on a lot of factors including the time travelled, speed and weight of the vehicle, air resistance and the resistance due to the inclination of the road which can directly affect the overall cost of transportation. The operation of HGVs is also limited due to the
designs, sizes, weights and technologies along with environmental restrictions enforced by federal and state laws. Therefore, the appropriate choice of engine size, correct axle ratio and a desired maximum speed of the vehicle based on legal regulations and guidelines are desirable for enhancing fuel efficiency [9].

Generally, there are carbon emission and fuel consumption standards for engines and vehicles to be implied based on regions around the world. US engine standards are in units of emissions per unit of work. On the other hand, China engine standards measure vehicle fuel consumption on a given cycle at a given payload determined by their regulations. The vehicle standard assumes generic engine fuel maps provided by the regulators, and are in terms of emissions per unit of distance travelled. Consumption of fuel is usually maximised during acceleration which subsequently leads to a higher cost per kilometre travelled. Therefore, it is highly recommended to possibly avoid routes with high congestion rates, frequent stops, traffic lights, multiple turnings, and fluctuating gradients. Besides that, that truck freight transport tends to generate significantly more costs (infrastructure, air pollution, accidents and traffic congestion) that are not passed on to consumers than rail and water freight transport [10]. However, most of these costs were external costs imposed on society and considered as lower-bound estimates. As cost becomes the prior consideration among stakeholders [11] therefore, the study intended to evaluate the cost-effectiveness by implementing the HGVs sustainable initiatives particularly, road haulage companies’ operational cost.

Affirmed that all the costs in transportation, distribution costs accounted for a very huge proportion [12]. Its effectiveness has a great impact on improving the whole efficiency of the logistics system and diminishing transport costs. The transportation cost should relate to the travel distance between the warehouse and destination, and such cost should include the driver’s wages, equipment cost, and in-transit inventory cost [13]. Besides that, based on Pakthi [13] and Gao [10] study, the transport cost can be divided into two which are fixed costs such as vehicle cost, vehicle insurance, driver salary, and overhead cost meanwhile the variable costs involved in transportation are running costs such as fuel cost, vehicle maintenance, the trip allowance, and other operating costs. Therefore, fuel costs are more vulnerable compared to other types of costs because of the constant rise in energy costs due to the shortages in the season of high demand such as the festive season. The reduction of fuel costs contributes the most to the increase in the profit margin of enterprises [10].

Figure 1. Framework of Study

This conceptual framework proposed green practices for sustaining HGVs in the matter of cost-effectiveness with regards to the operational strategy viewpoint. The conceptual framework has been proposed by utilizing empirical pieces of evidence in the existing literature, whereas future research is carried out to validate the proposed conceptual framework. For deep understanding, this proposed framework adds value to the existing body of knowledge regarding the effort in supporting green logistics practices, especially in the road haulage industry. From the managerial point of view, managers could utilize the proposed framework in improving their insights on how to manage their HGVs using green planning tools.

3. Research Methodology
In the identification process for detailed cost-saving and carbon emission reduction, a simple estimation calculation was used by adopting cost-saving calculation from [14][3][7] and [15]’s study. These
calculations also had been applied in order to determine the comparison based on results between companies that implemented the sustainable HGVs distribution with companies that are not or still reluctant to implement the sustainable HGVs distribution process. There are 431 company that runs the operation on the road haulage in the Klang Valley area as registered in the Malaysia Logistics Directory 2019/2020, and the optimal sample size from this population that suit in this study is about the range of 92-96 companies. Thus, a survey of 100 companies was conducted to achieve the optimal results on data collection. According to Sekaran and Bougie [16], convenience sampling can obtain the necessary primary information from the particular target respondents who are most conveniently available to provide desired information needed. The data were collected by questioning and distributing questionnaires to respondents.

The formula for cost-saving was adopted from both studies performed by [3], [7] and [15]. The combination of HGVs fuel cost incurs for short-haul and long-haul distances respectively. Total HGVs fuel cost is assumed to be the sum of fuel cost and toll cost (refer to Figure 2). As for fuel cost, it is a product of how much fuel is consumed per litter. The total price of tolls was included in this calculation due to the fact that toll charge bears a significant cost by the road hauliers if they want to use the infrastructure in accordance with the law. The cost of fuel used is RM 2.18 per litre of diesel as announced by the Malaysian Ministry of Domestic Trade, Cooperatives and Consumerism (KPDNKK).

Therefore, a comparison is made based on the result of operation cost between the companies that implementing green logistics as their primary operation motivation and companies that are still not implementing green logistics as their primary operation motivation. As a result, it is found that companies that implementing green logistics as their primary operation motivation were rewarded with a high-cost reduction as compared to the others. Based on the simple estimation calculation of fuel-saving, this study has intended to further investigate the data and the potential relationship between a category of a road haulage company and the impacts of implementing either green strategy or not as its primary means of managing its HGVs operations. A maximum of six road haulage companies was chosen for each category; three companies implementing green strategy and three companies that are still not implementing green strategy. Correspondingly, the number of respondents chosen from big-sized, medium-sized and small-sized has to be confined to 3. The calculation of finding its average and median of fuel consumption is being done respectively. The respondents are divided into two groups which are medium companies and small companies according to several criteria company set by Companies Commission Malaysia. The size of the company can be classified by looking at its sales turnover per annum or the number of employees. In this current study, the researchers chose to look at their sales turnover per year; Medium company is ranging from RM 3 million to RM 20 million while Small company is ranging from RM 300,000 to RM 3 million.

The cost-saving analysis was based on the simple estimation calculated from a company operating cost, focusing on three majors which are recognized as tools for measurement which had been selected from literature based on its suitability in the context of Malaysia’s logistics and transport environment. The simple estimation calculation for measuring cost saving had been done by combining the cost of fuel consumed by prime mover per day in which each one of them is specialized in short-haul and long-haul usage. The kilometre travelled and trips made by HGVs have also been calculated. Furthermore, the researcher also included the cost of toll into this calculation due to certain payments for accessing highways in Malaysia.

The cost-saving analysis is based on the simple estimation calculated from the green strategy as a tool for measurement which had been selected from literature based on its suitability in the context of Malaysia’s logistics and transport environment. This approach is adapted from a study conducted in [7], [15] and [3]. The simple estimation calculation for measuring cost saving from fuel consumption had been done by combining the cost of fuel consumed by two vehicles travelling and that each one of them specialized in the short-haul and long-haul usage.
Formula: Fuel Calculation

\[
\frac{\text{Distance Travel (km)}}{3} \times \text{Fuel Price (RM)} = \text{Fuel Cost (RM)} + \text{Toll Cost (RM)}
\]

Based on 2019 price
1 Liter Diesel = RM 2.18 (actual price)

Example calculation:
Distance travel (km) = 60km
Fuel price (RM) = RM 2.18/L
Toll Cost = RM 50

\[
\frac{60 \text{km}}{3} \times \text{RM 2.18} = \text{RM 43.60 (fuel cost) + RM 50 (toll cost)}
\]

*Malaysia Fuel price at 30th November 2019: Diesel RM 2.18 per liter
*Weekly petrol price adjustments in Malaysia announced by Malaysian Ministry of Domestic Trade, Cooperatives and Consumerism (KPDNKK)

**Figure 2.** Estimation of Fuel Calculation

4. Results and Discussions

Based on the calculation analysis, the result shows that by implementing the right strategy for their road planning and load planning, the cost can be reduced and indirectly support the reduction of carbon emission. The result of the simulation also had shown that the Medium Company can save up to -16.1% for short-haul operation; 8.2% for long haul operation, meanwhile Small Company can save up to 12.2% from the short-haul operation and 7.6% from long haul operation per day. Therefore, researchers provided the total fuel consumption per day by HGVs according to Medium-size companies and Small-size companies comparison; Green Logistics as their primary motivation, Green Logistics not as their primary motivation.

**Table 1:** Comparison of Fuel Saving of a Truck Per Day (Medium Company)

| Types of Company      | Comparison Of Fuel Saving Per Day | Short Haul | Long Haul |
|-----------------------|-----------------------------------|------------|-----------|
|                       | Not Yet Implemented Green Logistics (A) | Already Implemented Green Logistics (B) | A-B/A (%) | Not Yet Implemented Green Logistics (A) | Already Implemented Green Logistics (B) | A-B/A (%) |
| **Medium Company**    | Fuel Consumption                  | RM 361.60  | RM 419.73 | -16.1     | RM 710.40  | RM 652.27  | 8.2       |
| Kilometer Traveled    | 200 KM                            | 100 KM     | 466.67 KM | 266.67 KM |
| Trips                 | 3                                 | 5          | 3         | 3         |

Table 1 illustrates the fuel consumption and distance travelled of a truck in a one-day operation for the short and long haul for a medium company. It was recorded that green user for medium company expenses was around RM 420 with 5 trips frequency which resulting in 100 km distance travelled in the short-haul task. Apart from that, green user estimation of fuel consumption for the long haul was about RM 652 with 3 trips frequency which resulting around 267 km travelled. Meanwhile, it was recorded that not yet-green user estimates to spend around RM 362 with the frequency of 3 trips resulting in 200
km distance travelled for short-haul operation and estimates to spend around RM 710 with the frequency of 3 trips resulting around 467 km travelled for long haul operation.

By looking at the total fuel consumption cost of the medium companies, there is about -16.1% cost saving for short-haul operation as the truck used for green users consumed more fuel than the not-yet green users. However, this value is valid if the number of trips is the same for both situations. Trucks used by green users in this situation had two more extra trips with 100 km lesser in distance travelled than the other, thus the cost-saving is favoured to the green user with 16.1% differences and additional trips and significantly lesser distance travelled. As for the long haul, there is 8.2% of cost saving experienced by green users compared to the not-yet green users with about 200 km lesser distance travelled on the same number of trips. This shows that the green user is a lot more effective in routing and not yet green user cost more fuel and more CO2 emission for both short-haul and long-haul operations with a huge difference than big company operation. These show that the implementation of green logistics in medium companies will significantly benefit more than big companies.

Table 2: Comparison of Fuel Saving of a Truck Per Day (Small Company)

| Types of Company | Comparison Of Fuel Saving Per Day |          |          |
|------------------|----------------------------------|----------|----------|
|                  | Short Haul                        | Long Haul|
|                  | Not Yet Implemented Green Logistics (A) | Already Implemented Green Logistics (B) | A-B/A (%) |
|                  | Not Yet Implemented Green Logistics (A) | Already Implemented Green Logistics (B) | A-B/A (%) |
| Small Company    | Fuel Consumption                  | RM 477.87 | RM 419.74 | 12.2 |
|                  | Kilometer Traveled                | 166.67 KM | 100 KM    | 466.67 KM | 333.33 KM |
|                  | Trips                            | 4        | 3        | 3 |

Table 2 above illustrates the fuel consumption and distance travelled of a truck in a one-day operation for the short and long haul for small companies. It was recorded that for short-haul operation, the truck for green user cost about RM 58 lesser from the cost for truck used by a not-yet green user with 40% reduction in distance travelled with a same number of trips. This trend is the same with the long-haul operation with the truck for green user cost about RM 58 lesser with 29% reduction in distance travelled with a same number of trips.

By looking at the total fuel consumption cost of a small company, there is about 12.2% cost saving for short-haul operation and about 7.6% cost saving for long haul operation. Based on the discussion above, the implementation of green logistics will improve both short-haul and long-haul operations. However, the benefits are more favoured on short-haul operation as it has 4.6% more in cost-saving and 11% differences in reduction of distance travelled from long haul operation.

Therefore, by implementing the green strategy, a road haulage company can significantly reduce its operating cost, thus generating more revenue for the company. This result is supported by a previous study where it was shown that the effectiveness and efficiency of the implementation of the strategy can reduce operational costs. This is similar to the study that was conducted by Chang et. al., (2006), where the authors conclude that a cost reduction in the range of 5% to 46% is achievable if a combination of the container types in the supply and demand nodes is found by dealing with the empty container reuse system. To summarize the result, the percentage of truck operation cost reduction from fuel consumption perspective are Medium Company: -16.1% for short-haul operation (extra 2 more trips compare not-yet green user); 8.2% for long haul operation, Small Company: 12.2% from the short-haul operation, and 7.6% from long haul operation. Therefore, it was considered acceptable in the attainable range state (5% < x < 46%). Hence, researchers found that there is a positive effect on cost and carbon emission reduction on green strategies implementation towards HGVs distribution operation.
5. Conclusion
This research indicates that the majority of road haulage companies in Malaysia perceive that by having the right strategy, operating costs can be reduced. Based on the number of trips involving HGVs operation, companies that implement the right strategy has higher cost-effectiveness and an efficient number of trips compared to the companies which do not yet implement the right strategy. Based on this scenario, it shows that the development of the road haulage industry in Malaysia can reduce climate change indirectly because when they have implemented the right strategy, it will reduce their operational cost and carbon emission respectively. Moreover, it is just not about supporting efforts towards 2030 United Nation’s SDGs and against climate change, it is also about how they could sustain in their industry for a long-term period.

Based on the result of this study, researchers can conclude that green practices are very good to be implemented in the freight transport industry. Moreover, it can achieve a voluntary target in the eleventh Malaysia Plan. The mission set by the Malaysian Government by 2020 is nearly to be achieved as this study also has been conducted to correspond with Phase 3’s key activities in the Logistics and Trade Facilitation Masterplan (2015-2020) which drive the logistics industry to green initiative’s implementation. Therefore, this study can be as one of the guidelines for the industry to be aligned with Malaysia 11th Plan (2016-2020) and also the 2030 Agenda in developing sustainable development goals more aggressively. Researchers hope that this study can stimulate many further pieces of research in this vital field.

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7. References
[1] United Nations Conference on Trade and Development (2015). UNCTAD annual report; Sustainable Freight transport Systems: Opportunist for developing countries. Geneva: United Nations.
[2] McKinnon A, Browne M, Whiteing A and Piecyk M (Eds.). (2015). Green logistics: Improving the environmental sustainability of logistics. Kogan Page Publishers.
[3] Tarudin N F (2013), ‘Street Turn’ Strategy: An Analysis of its Effectiveness as a ‘Green Logistics’ Tool for the Management of Empty Containers for Road Haulage in Malaysia. Management, 3(1), 16-19.
[4] Allen J, and Browne M (2010). Road freight transport and sustainability in Britain 1984-2007. Green Logistics, (September).
[5] Briggs H, G, and Leong H, K (2016). Malaysia Stocktaking Report on Sustainable Transport and Climate Change. Data, Policy, and Monitoring:GIZ Malaysia: Kuala Lumpur, Malaysia.
[6] Zacharof N, Fontaras G, Ciuffo B, Tsiakmakis S, Anagnostopoulos K, Marotta A, and Pavlovic J (2016). Review of in use factors affecting the fuel consumption and CO2 emissions of passenger cars. European Commission.
[7] Armstrong A (2014). Road Freight Transport: Transport Purchasing and Environmental Impacts. (Master Dissertation, University of Boras).
[8] Aamuvuori A (2014). Project deliveries: barriers & opportunities of transport logistics in the Barents region (Doctoral dissertation, University of Oulu).
[9] Thomas J, Huff S, and West B (2014). Fuel economy and emissions effects of low tire pressure, open windows, roof top and hitch-mounted cargo, and trailer. SAE International Journal of Passenger Cars-Mechanical Systems, 7(2014-01-1614), 862-872.
[10] Gao T, Erokhin V, and Arskiy A (2019). Dynamic optimization of fuel and logistics costs as a tool in pursuing economic sustainability of a farm. Sustainability, 11(19), 5463.
[11] Jayanthiladevi A, Arun Gnana Raj A G, Nik Hashim N A A, Ramesh Kumar V,
Nagaraju V and Regin R (2020). Spectroscopy Analysis for Quality Control Measurement in Waste Management J. Phys.: Conf. Ser. 1712 012037.

[12] Hummels D (2007). Transportation costs and international trade in the second era of globalization. Journal of Economic perspectives, 21(3), 131-154.

[13] Parkhi S, Jagadeesh D, and Kumar R A (2014). A study on transport cost optimization in retail distribution. Journal of Supply Chain Management Systems, 3(4), 31-38.

[14] A I Lubysheva A I, Potashev A V, and Potasheva E V. Calculation of gas flow through the flow of axial turbocompressors. J. Phys.: Conf. Ser. 1709 012006.

[15] Belyaev A I, and Afansyev A S (2016). Efficiency of vehicle operation. International journal of economics and financial issues, 6(2S), 24-30.

[16] Sekaran U, and Bougie R (2016). Research Method for Business: A Skill-Building Approach (7th ed.). Wiley

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