RAIL FREIGHT SERVICES UTILIZATION IN MALAYSIA

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Abstract. Due to the development of international and domestic trade, the growing important of related freight transport services is increasingly. This paper is intended to discuss the factors affecting the utilization of rail freight services in Malaysia. Three factors were identified which include price, time, location and physical. The data are obtained through a questionnaire which has been structured accordingly and distributed to the respondents. The sample collected were 103 through online questionnaire survey. In this study, the data are analysed using descriptive, normality, reliability, and multiple linear regression. All independent variables such as price, time, location and physical were found to show have significant relationship with the utilization of rail freight services in Malaysia. Although sample collected were from different background, but majority were collected in Western Malaysia, may not represent the entire haulage operator and freight customer in Malaysia. The duration of the study further increases the limitation whereby only 3 to 4 months to complete the entire research. Resources in related fields are limited. The use of rail freight services requires more investment, resources, and costs. Finally, the study's findings should help shifting the preference among haulage companies in the use of rail transportation in an effective, efficiency and environmentally friendly way, to increase the utilization rate of rail freight services in Malaysia. This study increases haulage operator and freight customer knowledge and awareness regarding the adoption of rail freight services. This study also encourages the haulage operator and consumer to use sustainable rail transport services. The paper marks an early contribution to the study on factors that affect the utilization of rail freight services in Malaysia.
Keywords: *utilization of rail transport, haulage operator, price, location, time, physical*

Introduction

The strategic location of Malaysia in the Asia-Pacific has made it one of the important logistics hubs for logistics and transportation activities. The main land cargo corridor is situated on the Thailand-Kuala Lumpur-Singapore axis on the west Malaysia along the north-south direction. The growing importance of freight is related to foreign trade development and the country's continued economic development. This has led to an increase in demand for freight services. In fact, in order to allow logistical companies attempt to minimise production and delivery costs, logistics can be used as a strategic tool. Development centralisation is the practice of performing all or most value-added operations in a single location to save on costs and distribution centralisation is increasingly common. Recent years, many logistics and transportation companies willing to use Just-in-Time Delivery concept (JIT) because of idea to reduce the total cost by reduce inventory levels, increase delivery frequency and reduce batch size (Woxenius, 2006; Woodburn, 2003). This encourages the use of road transportation as it is meet the fast, flexible and accessible requirements. But road transport had a various negative impact on economics, environment as well as social aspects. It could be said that reducing global road traffic would benefit the economics, social and environment.

However, in order to do so, the freight must have alternative frequent travel routes. These alternatives include the use of rail transport. Rail transportation mode is the most sustainable land transport method and is generally used for long-distance transport.

The share of transport mode in Malaysia's freight is mainly road transport, which accounted for about 97.5% of domestic transport ton-kilometres in 2017. The rest is represented by railway transportation (2.2%). The result shows that using rail freight services in Malaysia are relatively low (Sgouridis, 2003). Overusing road transportation has an adverse effect on the global environment. The carbon monoxide and the exhaust gas released upon the combustion engine increase the earth's average temperature, thus forming the global greenhouse effect. Other adverse effects of road transportation include obstacles, land use and resource consumption (Ribbink et al., 2005). Not only that, more and more road traffic accidents lead to cargo losses and delays. In addition, cargo hijacking and theft have become a new problem for road transport operators (MOT, 2018). The ideal freight route is from road transportation to railway transportation. Convert freight movement from road transportation to rail transportation as a logistics solution to minimise the country's traffic congestion and environmental pollution to benefit the Malaysia economics, social and environment aspects. Although rail transportation is a cost-effective and sustainable mode of transportation to reduce emissions, at the same time, the flexibility and accessibility of rail transportation will be limited, causing haulage operators to be reluctant to use it. However, it is very challenging to change haulage operator and freight customers' preference shift freight movement from road to rail in the short term. In fact, all these problems are caused by different factors that affect the utilization of rail freight services in Malaysia.

This study is therefore intended to explore factors affecting the utilization of rail freight services with six intended objectives; (1) to analyse the advantages and disadvantages to using the rail freight services; (2) to analyse the preferable transportation mode among haulage operators; (3) to examine the relationship between price factor of rail freight transport and utilization of rail freight services; (4) to examine the relationship between time factor of rail freight transport and utilization of rail freight services; (5) to examine the relationship between location factor of rail freight transport and utilization of rail freight services; and (6) to examine the relationship between physical factor of rail freight transport and utilization of rail freight services in Malaysia.

Literature review

Over the last few decades, the globalization and the development of a broad spectrum of trade organizations make the demand for freight transport of the large number of goods and services to and from specific destinations continues to grow. However, many organisations do not consider rail freight transport as the key priority for harnessing the organisation's viability and sustainability. Nowadays, most of the freight transport still mainly handled by road freight services. In this instance, the traffic flow of cities and intercity highways has continued to grow at a rate that far exceeds capacity expansion, leading to increased delays and accidents related to traffic congestion, air pollution, as well as concern to about the transportation reliability and safety and security and vehicle incursion into the residential area (Bryan et al., 2007). The road freight transport has caused a series of adverse economic, social and environmental impacts. These include: (a) Economic impact: (i) congestion, (ii) low freight efficiency and (iii) waste of resources; (b) Environmental impact: (i) air

pollutants, such as carbon monoxide and other waste gases; (ii) over-usage of non-renewable resources, land and aggregates; (iii) non-recycled waste including tires, engine oil and other materials; (iv) wildlife loss of habitat and related threats to wild species; and (c) Social impact: (i) the physical impact of public health polluting pollution (cancer and other diseases), (ii) traffic accidents cause injuries and deaths, (iii) noise pollution, (iv) hijacking and theft of goods.

Traditionally, previous transportation policies prioritized passenger traffic instead of cargo transport. In recent years, since the E.U. has established environmentally friendly rail transport as a mode of emission reduction, the E.U. is taking a few actions to encourage freight forwarders to transport goods from road to rail. Yet railway companies are struggling to maintain schedules and service levels. Although this is still the right choice for large-volume shippers, those with small quantities of goods and short transit times prefer cheaper road freight.

In order to achieve the goal of developing a more sustainable transportation system, the European Union introduced the "Transportation White Paper 2011" to convert some road transportation into a more sustainable way. Compared with 1990 levels in 2050, the plan sets an ambitious target of reducing transportation greenhouse gas emissions by 60%. For the last 25 years the promotion of more effective and sustainable transport modes, especially rail freight, has played an essential role in E.U. policy. To achieve this aim, the ultimate goal for modes of transition has been established: to move 30% of the cargo of roads over 300 kilometers to other modes of transport, such as rail or water, by 2030, and hit 50% in 2050 (European Commission, 2011).

In Malaysia, issues like road congestion and accidents are growing in direct proportion with the highly dependent on trucking services that create a series of negative impacts on the people and environment in the long term. The share of transport mode in Malaysia's freight is mainly road transport, which accounted for about 97.5% of domestic transport ton-kilometres in 2017. The rest is represented by railway transportation (2.2%). Thus, Malaysia Government had been implementing a new transport policy plan called Nation Transport Policy 2019-2030 to shift cargo transportation from road transportation mode to rail transportation mode. It would reduce the stress on roads and develop a comfortable and safety rail freight transport system towards railway users (Wong, 2019).

For the price factor, price refers to the number of goods obtained or received in exchange for another commodity. In logistics, low freight is always being focussed. The goal of a company is to make the highest profit on the open market. But how to maximise the profit? The solution is selling goods on the global market at low prices (Kannan et al., 2011). One of the most significant factors influencing freight volumes is the rail freight expense (Shi et al., 2012). Lowering the price of rail freight can reduce the unit price privilege to increase traffic volume and increase total revenue. The higher the rail price, the lower the amount of rail transport, if other competitive modes and the rail service level remain unchanged. If not, the lower the price decreases, the higher the amount of transaction.

As for time factor, there is a strong relationship between punctuality and reliability of rail freight transport. Punctuality and reliability measure whether a particular vehicle or goods had to reach on-time arrival in a specific destination in previously set time (Rudnicki, 1997). It is primarily measured the proportion of delayed train arriving or leaving in a particular terminal within a predetermined timetable. Freight shipments depend heavily on the reliability of train schedule and on-time performance, which

primarily affects railway services utilization. As a matter of fact, an aberration from the planned time will reduce the railway service level and possibly affect the entire supply chain management (Dingler et al., 2010).

Location is an important distinction, and it affects the rail terminal that often involves vastly different areas (Rodrigue et al., 2016). Determining the terminal's proper location is a vital component of the terminal establishment process, and the function of the entire cargo distribution chain depends on this decision. Railway hubs and branch lines are usually located near the origin of the product because if the freight is far originating from the hub, it seems uneconomical. The physical is referring to refer to services quality. Service quality attributes included material handling process, safety and security, reliability and environment friendly. The quality of services provided by transport service providers should be beneficial, attractive and sustainable in improving the utilization of rail freight services (Zeybek, 2019). Railway freight also has excellent safety advantages. According to American Railroad Association report, rail freight accounts for only a small percentage of truck deaths and injuries per trillion ton-miles (AAR, 2009). The employee injury rate is about half that of trucks. Besides, The railroad has an excellent track record in the safe transport of hazardous materials. In fact, in Malaysia, all railway carriages containing hazardous materials reached their destinations safely and were not released due to accidents.

Materials and Methods

This research study is an exploratory study because researchers analyse the current relationships among variables in *Figure 1* for the utilization of rail freight services in Malaysia. The type of investigation is a correlational study. In this research, the time horizon used by the researchers is a cross-sectional study. Data gathered from the haulage operators registered under the Association of Malaysia Hauliers from the second week of December in 2020 until the first week of January in 2021.

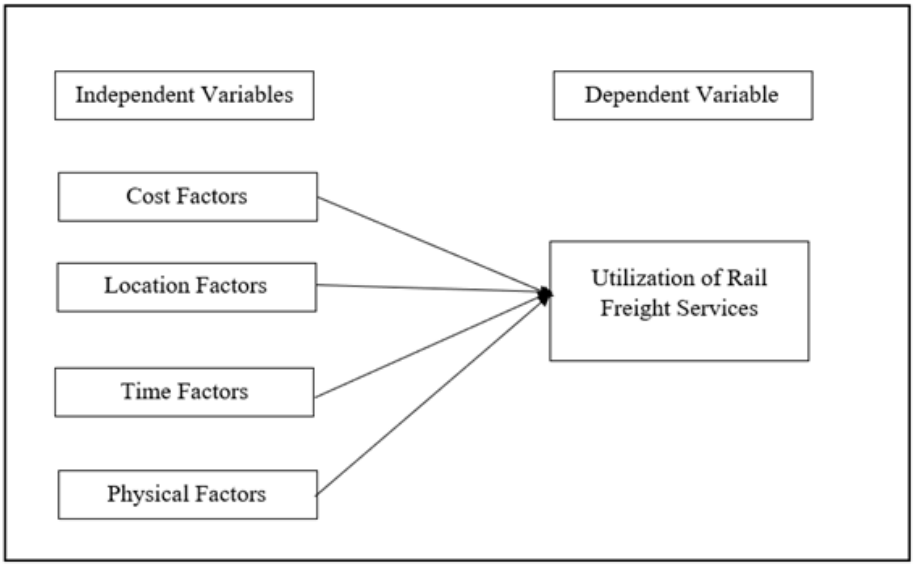

Figure 1. *Research framework*

For this study, quantitative research designs have been implemented by extracting valuable knowledge from primary and secondary information. Researchers obtain data by questionnaire for preliminary data themselves. The questionnaire is handled through Google Form and e-mail remotely. The questionnaire consisted of three types of questions which were closed, multi-choice and ranking questions. During the pilot test (by Google Form) and field survey, carried out in haulage and transportation sector in western Malaysia, the questionnaire is distributed. During the pilot test and the field survey, the real answer obtained was 20 and 103. The target population comes from haulage and transportation based companies. Hence, the unit analysis is organisation. For the respondents' collection in this analysis, the total population sampling technique is used, since the population is smaller, so in the study, the whole population will be the sample.

Results and Discussion

Descriptive analysis is used to describe the demographic background of the profile of the respondents. From *Table 1*, limited liability is the type of company most of the respondents. In the data collection, a total of 103 companies had participated the research survey. 102 companies (99%) are limited liability undertakings, and only one (1%) is corporations.

Table 1. *Types of company.*

Category	Frequency (N)	Percentage (%)
Limited Liability company	102	99
Corporations	1	1
Total	103	100

In *Table 2*, Selangor respondent dominated the sample pool for 69 respondents (67%) and followed by 26 respondents (25.2%) from Johor. There are 4 respondents (3.9%) from Penang and 2 respondents (1.9%) from Kuala Lumpur. Simultaneously, the respondents from Negeri Sembilan and Pahang are the same, which is 1 or 1%.

Table 2. *Company location.*

Category	Frequency (N)	Percentage (%)
Johor	26	25.2
Kuala Lumpur	2	1.9
Negeri Sembilan	1	1
Pahang	1	1
Penang	4	3.9
Selangor	69	67
Total	103	100

In *Table 3*, there are 20 companies (19.4%) having 6 different nature on goods. There are 19 companies (18.4%) having 8 different nature on goods. There are 14 companies (13.6%) that have 5 and 9 different nature on goods. There are 11 companies (10.7%) have 4 and 7 different nature on goods. There are 4 companies (3.9%) with 2, 3 and 10 different goods. There are 2 companies (1.9%) that having 1 nature on goods.

Table 3. *Nature of goods transported.*

Category	Frequency (N)	Percentage (%)
1 goods in nature	2	1.9
2 goods in nature	4	3.9
3 goods in nature	4	3.9
4 goods in nature	11	10.7
5 goods in nature	14	13.6
6 goods in nature	20	19.4
7 goods in nature	11	10.7
8 goods in nature	19	18.4
9 goods in nature	14	13.65
10 goods in nature	4	3.9
Total	103	100

Reliability test indicates the extent to which it is without bias and ensures consistent measurement across time (stability) and the various items in the instrument (internal consistency). *Table 4* shows that the alpha value of Cronbach ranged from 0.734 to 0.832 for each variable. According to Nunnaly (1980), the score below 0.6 is poor; it is acceptable from 0.60 to 0.70; it is good from 0.8 to 0.9 and excellent above 0.9. The reliability of and study variable is therefore good and acceptable.

Table 4. *Reliability test.*

Category	Number of items	Score of Cronbach's Alpha
Utilization	5	0.799
Price	4	0.832
Time	4	0.778
Location	4	0.744
Physical	5	0.734

Correlation analysis establishes the possible connections between variables and studies the strength of the relationship between variables (*Table 5*). Based on the correlation analysis result, the result shows that the r-value of each variable is ranged from 0.571 to 0.705 and all variables are significant with p-value= 0.000. Based on Cohen's rule of thumb (Cohen, 1981), r-value from 0.1 to 0.29 is weak, and the r-value from 0.3 to 0.4 is moderate, and the r-value from 0.5 to 0.99 is strongly correlated. Thus, all independent variables have a strong correlation with the utilization of rail freight services.

Table 5. *Correlation analysis*.

Correlation		Utilization	Price	Time	Location	Physical
Utilization	Pearson correlation	1	0.693**	0.699**	0.707**	0.653**
	Sig. (2-tailed)	-	0.000	0.000	0.000	0.000
	N	103	103	103	103	103
Price	Pearson correlation	0.693**	1	0.625**	0.695**	0.615**
	Sig. (2-tailed)	0.000	-	0.000	0.000	0.000
	N	103	103	103	103	103
Time	Pearson correlation	0.699**	0.625**	1	0.699**	0.705
	Sig. (2-tailed)	0.000	0.000	-	0.000	0.000
	N	103	103	103	103	103
Location	Pearson correlation	0.707**	0.695**	0.699**	1	0.571**
	Sig. (2-tailed)	0.000	0.000	0.000	-	0.000
	N	103	103	103	103	103
Physical	Pearson correlation	0.653**	0.615**	0.705**	0.571**	1

	Sig. (2-tailed)	0.000	0.000	0.000	0.000	-
	N	103	103	103	103	103

*** correlation is significant at the 0.01 level (2-tailed).*

Multiple linear regressions are to test how the dependent variable is affected by two or more independent variables. This type of statistical test also pointed out the relationship between the variables discussing the total variance between the items (*Table 6*, *Table 7*, *Table 8*).

***Table 6**. Multiple linear regression analysis: Model summary.*

Model summary	R	R square	Adjusted R square	Std. error of the estimate
1	0.802[a]	0.642	0.628	0.42228

a. Predictors: (Constant), physical, location, prive, time.

***Table 7**. Multiple linear regression analysis: Anova[a].*

	Model	Sum of squares	df	Mean square	F	Sig.
1	Regression	31.399	4	7.850	44.020	0.000[b]
	Residual	17.476	98	0.178	-	-
	Total	48.875	102	-	-	-

a. Dependent Variable: DV
b. Predictors: (Constant), physical, location, prive, time.

***Table 8**. Multiple linear regression analysis: Coefficient[a].*

Model		Unstandardised coefficients		Standardised coefficient beta	t	Sig.
		B	Std. error			
1	(Constant)	0.193	0.257	-	0.751	0.455
	Price	0.233	0.084	0.252	2.774	0.007
	Time	0.222	0.102	0.217	2.186	0.031
	Location	0.273	0.096	0.272	2/851	0.005
	Physical	0.209	0.099	0.190	2.113	0.037

a. Dependent Variable: DV

From the analysis above, the R2 value is 0.642, representing that all the independent variables explain 43.20% of the utilization of rail freight services. Moreover, the model is significant with F(4,98)=44.020 and p-value smaller than 0.001. Based on the multiple linear regressions analysis result, the p-value for all the independent variables is smaller than the α value of 0.05. Therefore, the null hypotheses are rejected. Each of the predictor variables is significantly related to the dependent variable. All the independent variables have a significant value lower than 0.05 ($p<0.05$), indicating a significant relationship with the dependent variable. With the beta value of 0.273, the location variable is the most vital relationship with utilization if rail freight services compare to price 0.233, time 0.222 and physical 0.209.

H1: There is a significant relationship between price factor and utilization of rail freight services.
As depicted in Table 8, the result shows that a significant relationship between price factor and utilization of rail freight services ($p= 0.007< 0.05$). Thus, H1 is accepted.

H2: There is a significant relationship between time factor and utilization of rail freight services.

As depicted in Table 8, the result shows a significant relationship between time factor and utilization of rail freight services (p= 0.031< 0.05). Thus, H2 is accepted.

H3: There is a significant relationship between location factor and utilization of rail freight services.
As depicted in Table 8, the result shows that a significant relationship between location factor and utilization of rail freight services (p= 0.005< 0.05). Thus, H3 is accepted.

H4: There is a significant relationship between physical factor and utilization of rail freight services.
As depicted in Table 8, the result shows a significant relationship between physical factor and utilization of rail freight services (p= 0.037< 0.05). Thus, H4 is accepted.

Conclusion

This study seeks to examine the associated factors that affect the utilization of rail freight services in Malaysia. The independent variables were selected after reviewing numerous past related studies. Concerning that, this research study's key findings is price, time, location, and physical is significantly related to the utilization of rail freight services. Therefore, MOT and KTMB should pay attention to those factors to bring about desirable outcome to the economics, environment, and social, improve rail freight transport infrastructure and network system, and give subsidiary to the haulage operator and freight customer who willing use rail freight services. Finally, this study could be used by others as a guide for further studies on the subject to broaden research and knowledge. In addition, this research will be useful for practitioners to improve the implementation and practice of railway transportation, as some suggestions are provided to increase the utilization of rail freight services

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Conflict of interest

The author confirms that there is no conflict of interest with any parties involved with this study.

REFERENCES

[1] Association America Railroad (AAR) (2009): The Economic Impact of America's Freight Railroads. – The Association of American Railroads 2p.
[2] Bryan, J., Weisbrod, G.E., Martland, C.D. (2007): Rail freight solutions to roadway congestion: final report and guidebook. – Transportation Research Board 127p.
[3] Dingler, M., Koenig, A., Sogin, S., Barkan, C.P. (2010): Determining the causes of train delay. – In AREMA Annual Conference Proceedings 14p.

[4] European Commission (2011): White Paper on Transport 2011: Roadmap to a single European transport area: Towards a competitive and Resource-Efficient transport system. – Luxembourg: European Union 31p.
[5] Kannan, V., Bose, S., Kannan, N. (2011): An evaluation of ocean container carrier selection criteria: An Indian shipper's perspective. – Management Research Review 34(7): 754-772.
[6] Ministry of Transport (MOT) (2018): Transport Statistics Malaysia 2018. – Ministry of Transport Malaysia 92p.
[7] Ribbink, D., Van Riel, A.C., Semeijn, J. (2005): Policy decisions and modal choice: An example from the European Union. – Transportation Journal 44(1): 33-44.
[8] Rodrigue, J.P., Comtois, C., Slack, B. (2016): The geography of transport systems. – Routledge 454p.
[9] Rudnicki, A. (1997): Measures of regularity and punctuality in public transport operation. – IFAC Proceedings Volumes 30(8): 661-666.
[10] Sgouridis, P.S. (2003): Freight Transportation in Malaysia: Technological and Organisational Issues from an ITS Perspective. – AY 2002/2003 Spring Inception Report, Massachusetts Institute of Technology 47p.
[11] Shi, Y., Fang, X., Chen, Z. (2012): Price Analysis of Railway Freight Transport under Marketing Mechanism. – Physics Procedia: 2012 International Conference on Solud State Devices and Materials Science 25: 2038-2044.
[12] Wong, E.L. (2019): NTP 2019: Optimising the full potential of rail connectivity. – The Edge Market Official Portal. Available on: https://www.theedgemarkets.com/article/ntp-2019-optimising-full-potential-rail-connectivity
[13] Woodburn, A.G. (2003): A logistical perspective on the potential for modal shift of freight from road to rail in Great Britain. – International Journal of Transport Management 1(4): 237-245.
[14] Woxenius, J. (2006): Temporal elements in the spatial extension of production networks. – GROWTH and Change 37(4): 526-549.
[15] Zeybek, H. (2019): Service Quality and its Importance for Rail Freight Customers. – International Journal of Transportation Engineering 7(2): 115-126.