

Determinants of Logistics Performance using Partial Least Squares

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ABSTRACT

Malaysia's logistics performance was last measured in the World Bank Logistics Performance Index (LPI) 2014 at the 25th in the ranking. Further measurement should need to be taken in the context of manufacturer's professionals. Thus, is not only to focus on the scores; however the interpretation should also focus on the determinant constructs that lead Malaysia's logistics performance. The main constructs of this study namely environment-friendly, timeliness, customs efficiency, logistics infrastructures, the quality and competency of logistics services and logistics cost are assessed. A total of 129 surveys from 1248 surveys were responded (10.34%). Eventhough the response rate was low; there was no evidence of bias noted. The empirical results than suggested that customs play a vital role in logistics performance in the national context of study. In addition, all the constructs represent more than 46.70% of variation in Malaysia's logistics performance. Implications and future research directions of this study are discussed.

KEYWORDS: Logistics Performance, Malaysia, Determinants, Manufacturing, PLS-SEM.

INTRODUCTION

Trade and transport facilitation is one of the global initiatives to physically decrease the inefficient border management, especially inbound and outbound of the country activities. This initiative can perhaps reduce the number of forms needed for customs as well as other government agencies. Thus, logistics performance measurement in this context is a paramount due to the fact that logistics has indicated the positive growth in Malaysia's services industry as well as the positive growth in trade. According to the latest Economic Report 2015/2016 report by the Ministry of Finance in Malaysia in the first half of 2015, logistics sector comprises transport and storage subsector expanded to 5.6% as compared 4.8% for the same period in 2014[3]. In addition, the other initiatives including the Logistics and Trade Facilitation Masterplan launched in March 2015 is expected to improve last-mile connectivity to Port Klang and enhance port operations including Port of Tanjung Pelepas (PTP). Furthermore, this initiative then can facilitate clearance processes, procedures and services in future at every border point in Malaysia.

Therefore, logistics performance does not only cover the internal system (within company's department and supply chain), in fact the external system of logistics performance consists of customers and other parties related to the border management and throughout the supply chain.

LITERATURE REVIEW

Trade and Transport Facilitation

As there was growing interest among countries in practicing trade facilitation initiative, talks for understanding the relationship between trade flow and trade facilitation began at the Doha Development Agenda of World Trade Organization [4]. Some scholars highlight there is no standard definition for trade facilitation[5, 6]. In [7]highlight that the definition depends on the extent of measures to be included. The broad definition by the World Trade Organization (WTO) of trade facilitation refers to 'the simplification and harmonization of international trade procedures with trade procedures being 'the activities, practices and formalities involved in collecting, presenting, communications and processing data required for the movements of goods in international trade'.

In [4]considered 4 categories of trade facilitation efforts namely (1) port infrastructure, (2) customs environment, (3) regulatory environment and (4) e-business infrastructure. However, comprehensice analysis explaining the elements associated with trade facilitation in academic literature is lacking[8]. Therefore, this paper intends to identify the key constructs of trade facilitation and logistics performance. From the analysis of the exploratory study, it will also extend the current model of logistics performance

METHODOLOGY

In order to derive the results, three stages have involved in this research, namely research design, test and measurement procedures using statistical test analysis. This study began with identification of all issues in logistics performance in the context of trade facilitation including studies that have been conducted specifically in Malaysia's context. It also consists of the preliminary research with 10 professionals in the Malaysia's logistics industry to understand further the issues in the industry as well as to test the items and to refine the questions in the mail and online surveys that will be the main instrument of this study.

Two main sources of constructs and measures were borrowed from [1,2]. The same 5-point Likert scale in which 5 indicates Strongly Agree to 1 indicates for Strongly Disagree. The questionnaire was divided into 4 sections namely demographics, business development, logistics performance measurement and respondent's profiles.

This study intends to explore the perceptions of logistics service users, namely the manufacturers. The sampling frame was obtained from the 44th Directory of the Malaysian Industries from the Federation of Malaysian Manufacturers (FMM) in 2013. In total, 1248 questionnaires were distributed using two wave's approaches. In summary, 129 (10.34%) responded. In the context of Malaysia, a return rate of 10% is considered normal [9]. Despite the low response rate, there was no evidence of bias noted.

As relevant to this study, the Partial Least Squares-Structural Equation Modeling (PLS-SEM) is much preferred. As a new generation of statistical analysis, PLS-SEM uses the available data to estimate the path relationship in the model with the objective of minimizing the error terms of the endogenous constructs. In fact, PLS-SEM works efficiently with reflective measurement models with no identification problem as well as single item constructs [10].

RESEARCH MODEL

Figure 1 shows the conceptual model of logistics performance with specific focus on trade and transport facilitation dimensions. Using the PLS-SEM to explore the relationships is parallel to objective of this study that focuses on the prediction and exploratory analysis of the logistics performance model. Based on the framework (Figure 1), Six main constructs namely environment-friendly, timeliness, customs efficiency, logistics quality competency, logistics infrastructure and logistics cost as an exogenous latent variable where logistics performance as endogenous latent variables (outcome variable) [1, 2].

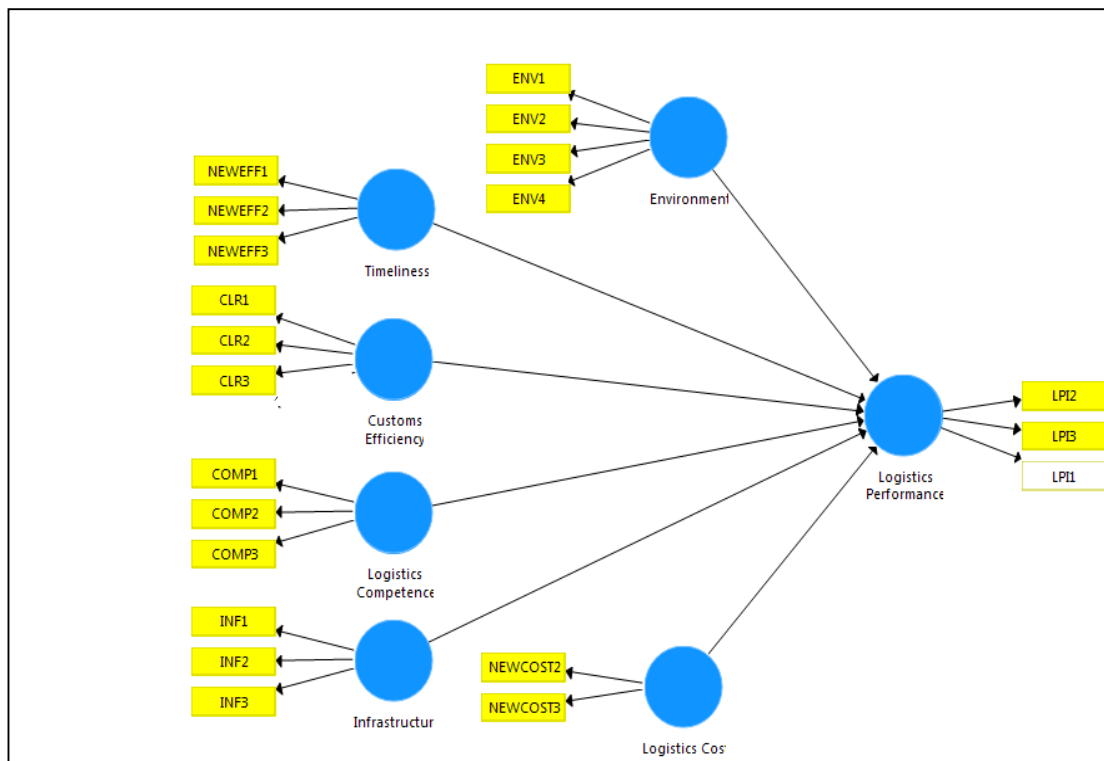


Figure 1: Conceptual model

The results explained the key and determinant indicators that have weightage to Malaysian logistics performance as the outcome variable. The hypothesis of the research are shown in the Table 1. For each construct, different hypothesis were put forward.

Table 1: Summary of hypotheses

Hx	Hypotheses
H ₁	Environment-friendly will lead to better logistics performance
H ₂	Timeliness significantly lead to high logistics performance
H ₃	Better customs clearance significantly influences logistics performance
H ₄	High quality logistics services influences logistics performance
H ₅	Efficient logistics infrastructures will lead to logistics performance
H ₆	The degree of logistics cost influences logistics performance

This study also evaluated the model based on the reflective measurement model. It assumed that the model has a causal relationship between latent variable and the related indicators. Furthermore, to identify the reflective model, it was set up in which the directions of the arrows were from the constructs to the indicator variables [10].

FINDINGS AND DISCUSSION

PLS-SEM has two main evaluations namely the evaluation the measurement model and evaluation of structural models. In conducting statistical analysis, it is necessary that all data go through data screening to ensure that all variables were not miscoded, missing or disorganized. Thus, the first examination is to check the assumptions to verify statistical data.

Checking the Assumptions

The first assessment in this analysis is to check multicollinearity, outliers and normality. Specifically, this study found some missing values which are between 2% to 5%. Supported by [11], this study using mean imputation (MI) to handle the missing value. On the other hand, in the context of normality, only one item (CLR1) showed high kurtosis with the value of skewness ranged from 0.414 to -0.797 and kurtosis ranged 1.209 to -0.838. However, the non-normality on PLS-SEM is not affected because the path coefficients were consistent and thus, it was able to estimate non-normal distributions [12].

Additionally, there is no existence of outliers in this study. Similarly, it is confirmed that there was no non-response bias in this study based on the Levene’s test results. Finally, in the context of multicollinearity, in [13] highlights that the variance inflation factor (VIF) value of 3.3 signals a high multicollinearity. As can be seen, this study has negative results of the collinearity presence in the model.

Evaluating the Measurement Model

As mentioned earlier, two main measurements and structural models are requiring different analysis approaches. As a rule of thumb for the model evaluation, four criteria are highlighted namely loadings, composite reliability, convergent validity and discriminant validity. The summary of rule of thumb with all sources is present below as references to further analysis of the model.

Table 2: The rule of thumb for assessing PLS-SEM results

Analysis	Reference	Rule of Thumb
Outer loading	[14] and [15]	Value is 0.70 and above. It is accepted for the values of 0.40 to 0.50 (exploratory study)
Composite reliability	[10]	Value is 0.70 and above
Convergent Validity	[10]	AVE value of 0.50 or higher

Based on guidelines in Table 2, all values were seen to be acceptable and were above the desirable results. The overall results of this measurement model analysis were summarized in Table 3. On the other hand, this study also applied the Heterotrait-monotrait ratio (HTMT) test for discriminant validity. In summary, discriminant validity has been established for the current logistics performance study.

Table 3: Results of measurement model

Model Construct	Measurement Item	Loading	Composite Reliability	Average Variance Extracted (AVE)
Environment-Friendly	ENV1	0.883	0.937	0.788
	ENV2	0.916		
	ENV3	0.834		
	ENV4	0.917		
Timeliness	NEWEFF1	0.698	0.807	0.583
	NEWEFF2	0.802		
	NEWEFF3	0.785		
Customs Clearance	CLR1	0.911	0.887	0.725
	CLR2	0.824		
	CLR3	0.816		
Logistics Services Competency	COMP1	0.883	0.911	0.774
	COMP2	0.889		
	COMP3	0.867		
Infrastructure	INF1	0.833	0.848	0.651
	INF2	0.867		
	INF3	0.712		
Logistics Cost	NEWCOST2	0.940	0.911	0.837
	NEWCOST3	0.889		
Logistics Performance	LPI1	0.847	0.857	0.669
	LPI2	0.881		
	LPI3	0.716		

Evaluating of the Structural Model

The main analysis is to evaluate the quality of structural model based on the criteria of the path coefficient and coefficient of determination (R^2). In addition, in [16] highlights the other assessment namely f^2 to determine the effect size of exogenous constructs contribution to endogenous variable's R^2 value. It is due to the fact that without the predecessor construct, the results of R^2 value is lower [10].

Therefore, in this section, all hypothesized paths in the model were tested to estimate the significance of path coefficient. As shown in Table 4, the path relationship showed the effects of the main constructs on logistics performance. In addition, it also presents the t-value and decision to support or not support to reject null hypotheses. It was referred to [17] with the guidelines of critical t-value for a two-tailed test, which are 1.65 (significance level at 0.10), 1.96 (significance level at 0.05) and 2.58 (significance level at 0.01). Based on findings in Table 4, three constructs did not show to have statistical significance with t-value below than 1.65 or at the 10% significance level (two-tailed). However, another three showed positive significance in logistics performance and support to reject null hypotheses. In this context, Customs Clearance (H_3) remains the most significant as the significance level was at 1% significance level.

Table 4: Path coefficient and hypothesis testing

Hypothesis	Relationship	Coefficient	t-Value	Decision
H_1	Environment-Friendly → Logistics Performance	0.048	0.725	Not Supported
H_2	Timeliness → Logistics Performance	0.187	1.841*	Supported
H_3	Customs Clearance → Logistics Performance	0.387	3.640**	Supported
H_4	Services Competency → Logistics Performance	0.220	1.915*	Supported
H_5	Infrastructure → Logistics Performance	0.117	1.160	Not Supported
H_6	Logistics Cost → Logistics Performance	0.047	0.535	Not Supported

Note: * $p < 0.10$, ** $p < 0.01$ (Two-tailed)

Subsequently, the R^2 is commonly used in PLS-SEM to evaluate the structural equation model. As stated by [10], the R^2 values represent 0.75, 0.50 or 0.25 which can be described as substantial, moderate or weak respectively for endogenous variables. In the context of this study, the adjusted R^2 value was applied to avoid bias toward model and also to modify especially with the presence of those non-significant constructs. Despite that, another relevant measurement in PLS-SEM, i.e. the effect size (f^2) was used to assess the effect. According to [13], the values of 0.02, 0.15 or 0.35 indicate that predictor variables as low, medium and large effect on the criterion variable respectively.

As a result, Table 5 presents both critical analyses in PLS-SEM with decision to indicate the effect size to the Malaysia's logistics performance.

Table 5: Coefficient of determination (R^2) and effect size (f^2)

Construct	R^2	F^2	Decision
Full Model	0.467		
Construct Excluded			
Environment-Friendly	0.465	0.020	Small
Timeliness	0.435	0.063	Small
Customs Clearance	0.384	0.156	Medium
Logistics Services Competency	0.450	0.033	Small
Logistics Infrastructure	0.460	0.030	Small
Logistics Cost	0.466	0.020	Small

Based on Table 5, the R^2 represented in the model is 0.467 which was relatively weak even though it has almost reached 0.50 that can be described as moderate to logistics performance. However, 0.467 means that 46.70% indicate that the variance of all constructs affected logistics performance. On the other hand, Customs indicated medium effect size of the logistics performance, while others remain at small effect on logistics performance

CONCLUSION AND RECOMMENDATIONS

This study highlighted six main constructs that were hypothesized to have an impact on logistics performance. Based on the findings, three main constructs namely timeliness, customs clearance and logistics service competency and quality were supported on logistics performance and another relationship (environment-friendly, logistics infrastructure and logistics cost) not supported.

In trade and transport facilitation, customs is always been among the main factors contributing to the trade friendliness[18]. In an the Organization for Economic Co-operation and Development (OECD) report published in 2005, it was highlighted that national and corporate levels are adverse outcomes if the customs clearance process is inefficient [19]. Thus, the improvement that should be taken into consideration is to increase the efficiency during clearance include timely information sharing of the changes of procedures and reduce conflicting information from the officers with same agencies or between other related border agencies as well. In addition, improvement of transparency during a process can enhance the efficiency throughout clearance.

On the other hand, based on the results, timeliness was also very important in which the shipments should reach the consignee premises within the schedule of expected time. In this context, in [20]highlights that any delay of consignments potentially could lead to idle production at assembly plant temporarily and thus affect on the ability to minimize production cost.

Certainly, it is proven that the quality and competency of logistics services were significant with logistics performance. In fact, it is parallel with the study by[21]. It is relevant because the quality and competency of logistics services affect delivery time either from the context of clearance processes or cargo delivery to the final destination.

In contrast, this study has a limitation to support logistics cost, logistics infrastructures and environment-friendly to logistics performance. Due to the fact that, the measurement of logistics cost in Malaysia's manufacturers still coherent[22]. Furthermore, the current study is the preliminary and exploratory, this should be some recommendation of future study to examine logistics infrastructures and environment-friendly are a significance of logistics performance. This can be done through a complex model with identification of indirect effect and additional path relationship pointed to logistics infrastructures.

In conclusion, the above recommendations to identify the key construct of logistics performance should be considered. As a strategic industry, logistics should be the core industry especially towards developing high income economy agendas and logistics hub for the region.

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