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Value on multimodal transport and relationship between shipping performances of maritime industry

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Abstract

The aim of this study is to examine service value of multimodal transport and business relationship among the maritime operators towards business performance of cross-border trade in Thailand. Multimodal transport aimed at improving cross-border trade efficiency by transforming the traditional relationship between trading partners and carriers into new cross-border trade partners. The transformed maritime commercial practices had also transformed cross-border trade rules and regulations. Multimodal transport involves more than one

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transport to move cargo internationally to the desired destination using single window system. The multimodal transport service is meant to reduce transportation cost, safe and reliable. The multimodal transport operators can improve business performance by taking advantage of logistics value through minimizing costs and maximizing profits. In addition, multimodal transport operators need to have strong relationship with transport partners to make the best use of transport mobility and connectivity. This study used quantitative approach using self-administered survey questionnaires by adopting 5-point Likert scale with validated multi-items scales measurement. The sampling technique used was quota sampling to sample of 400 respondents from maritime industry in Thailand. The dependent variable is business performance and the independent variables are multimodal transport service value, logistics service value and logistics relationship. This study used the Structural Equation Model (SEM) and Partial Least Square (PLS) analysis had been used to analyse data collected. The finding the study revealed on the relationship between service values of multimodal transport has significant relationship and impact on business performance of maritime industry in Thailand.

Keywords: Business Performance, Multimodal, Logistics, Relationship, Industry.

Valor en el transporte multimodal y la relación entre el desempeño del envío de la industria marítima

Resumen

El objetivo de este estudio es examinar el valor del servicio del transporte multimodal y la relación comercial entre los operadores marítimos hacia el desempeño comercial del comercio transfronterizo en Tailandia. El transporte multimodal tenía como objetivo mejorar la eficiencia del comercio transfronterizo mediante la transformación de la relación tradicional entre socios comerciales y transportistas en nuevos socios comerciales transfronterizos. Las prácticas comerciales marítimas transformadas también habían transformado las normas y reglamentos comerciales transfronterizos. El transporte multimodal implica más de un transporte para mover la carga internacionalmente al destino deseado utilizando un sistema de ventanilla única. El servicio de transporte multimodal está destinado a reducir el costo de transporte, seguro y confiable. Los operadores de transporte multimodal pueden mejorar el rendimiento del negocio aprovechando el valor logístico al minimizar los costos y maximizar las ganancias. Además, los operadores de transporte multimodal deben tener una relación sólida con los socios de transporte para aprovechar al máximo la movilidad y la conectividad del transporte. Este estudio utilizó un enfoque cuantitativo mediante cuestionarios de encuesta autoadministrados mediante la adopción de una escala Likert de 5 puntos con una medición validada de escalas de elementos múltiples. La técnica de muestreo utilizada fue el muestreo por cuotas para una muestra de 400 encuestados de la industria marítima en Tailandia. La variable dependiente es el rendimiento del negocio y las variables independientes son el valor del servicio de transporte multimodal, el valor del servicio logístico y la relación logística. Este estudio utilizó el modelo de ecuación estructural (SEM) y el análisis del mínimo cuadrado parcial (PLS) para analizar los datos recopilados. El hallazgo que el estudio reveló sobre la relación entre los valores de servicio del transporte multimodal tiene una relación e impacto significativos en el desempeño comercial de la industria marítima en Tailandia.

Palabras clave: desempeño empresarial, multimodal, logística, relación, industria.

1. INTRODUCTION

Thailand maritime logistics industry serves as gateway for cross-border trade in terms of sea-freight forwarding (Chao, 2011). Being a manufacturing based country, Thailand sea-freight forwarding is growing in importance for economic and commercial growth. In order to improve cross-border trade through maritime seaports, Thailand have to elevate management expertise in terms of multimodal transport service, logistics service value and to understand the relationship quality among the multimodal operators in Thailand. Throughout the globe, sea-freight forwarding is the most popular mode of transporting cargo using containers. Transporting cargo in bulk is cost-effective way for operating cross-border trade but shipping transit time can be long. Cunha & Reis (2019) reveals on travel time that affects in logistics value. Road congestion and high cost of air transport making shipping relevant and inevitable. Sea-freight forwarding needs the land transport to reach final destination. With respect on movement charges, rail transport is a feasible choice as compared to trucking.

Abegaz (2017) refers to the challenges in multimodal transport operations in terms of logistics service value and business relationship among the multimodal transport operators. He also agrees with resolutions made by Association of Southeast Asian Nations (2011) on the requirements to establish sustainable human resource development for sustainable business performance. Cunha & Reis (2019) supported by Aziz (2017) on the important issues and challenges in facing global multimodal transport system especially relating to marine transport industry. Azizi et al (2019) reveals on the relationship between logistical support factors and effective contract management. It also relates to contract or agreement among the industry players during the changing mode of transport for the smooth movement in any assignments.

2. RESEARCH METHODOLOGY

This study adopts quantitative approach by using self-administered survey questionnaire with 5-point Likert scale on multi-items scales of validated questionnaires. Self-administered questionnaires were completed by respondents without any aid from the interviewer (Abaidullah, 2017). He said, the self-administered questionnaire is advantageous when dealing with large sample, geographically dispersed and convenient in terms of cost and time. Stratified sampling and cross-sectional designed research was used to sample multimodal transport operators located at Bangkok Port and Laem Chabang Port. These two ports are the main ports of Thailand. Multimodal transport operators were sampled from these two major seaports of Thailand. The questionnaire consists of five parts namely Service Value of Multimodal Transport, Service Value of Logistics, Business Relationships, Business Performance and General Background Information.

Respondents were players in multimodal transport as part of their business operations. Two lists are available for stratified sampling technique used for this research namely Department of Export Promotion (DEP) and Thai National Shippers Council (TNSC). However, this research had selected TNSC list for sampling because shippers are being regularly updated by the TNSC as compared to DEP. A total of 420 questionnaires have been distributed

3. DATA ANALYSIS METHOD

Data screening was conducted on the collected dataset for missing data and non-engaged respondents by transferring the dataset to Excel software and using Excel functions to detect missing data and non-engaged respondents. According to Abaidullah (2017), deleting missing data will increase the robustness of the dataset. Hence, missing data was deleted. Partial least square (PLS) structural equation modelling technique was used to test the hypotheses of this study. Data screening is the process of ensuring the dataset is clean and suitable for statistical analyses (Hassan et al., 2015). Data must be screened in order to ensure the data is reliable and valid for hypotheses testing. Hair et al., (2017), have listed data screening steps before conducting to PLS-SEM analysis. The steps are: (1) missing data, (2) non-engagement responses (3) outliers and (4) normality of data distribution.

4. RESULTS

The response rate was 408 questionnaires were returned out of 420 questionnaires. The response rate of 97.14% is high but almost similar to other studies using self-administered questionnaire approach. High response rate was due to interviewers waited for respondents to complete the questionnaires and immediately collect upon completion except for few cases where respondents requested to return the questionnaires later due to busy schedules.

Outliers in the dataset can be identified using Mahalanobis distance (D^2) in SPSS software because Mahalanobis distances is suitable for identifying outliers in multivariate statistics (Hair et al., 2017). The computed Mahalanobis distance values are then divided with the number of predictors involved for every case giving D^2/df values. The cut-off point for D^2/df value is less than 2.5 and if exceeds 2.5 then significant outliers (Hair et al., 2017). The outliers' detection is depicted in the Table 1, below.

Table 1: Summary of outliers' detections

No	Case ID	D^2/df
1	30	2.86
2	65	2.86
3	124	2.86
4	159	2.86
5	194	2.86
6	229	2.86
7	264	2.86
8	299	2.86

9	334	2.86
10	369	2.86
11	1	2.71
12	36	2.71
13	71	2.71
14	95	2.71
15	130	2.71
16	165	2.71
17	200	2.71
18	235	2.71
19	270	2.71
20	305	2.71
21	340	2.52
22	375	2.52

The outliers were deleted from the dataset making only 386 respondents in the dataset. Normality test being conducted using WebPower developed by Cunha & Reis (2019) because Webpower can compute skewness and kurtosis for both univariate and multivariate skewness and kurtosis. The results for skewness and kurtosis are depicted in the Table 2, below.

Table 2: Normality Test Results

Variables	**Skewness**		**Kurtosis**	
		z-score	**z-score**	

Business Performance (BP)		-5.6942	4.489513	
Service Value for Multimodal Transport (MSV)		0.0721	-3.25511	
Service Value for Logistic (LV)		-2.008	-3.45431	
Business Relationship (RQ)		0.9867	0.235868	
Multivariate Normality		300.526	-0.151	

Acceptable range of skewness z-scores for data with normal distribution is -3 to 3 (Hair et al., 2017). However, the skewness and kurtosis values were not within the acceptable range. Hence, non-parametric statistical analysis is more suitable for data not normally distributed. PLS-SEM is a non-parametric statistical analysis that capable of handling extremely non-normal data (Hair et al., 2017). Respondents' demography is depicted in the Table 3 and Table 4 shows on the Means and Standard Deviations of variables

Table 3: Respondents' Demography

Demography	**Frequency**	**Percentage (%)**
Years of working		
1-5 years	136	35.4
6-10 years	116	30.2
11-15 years	92	24.0
16-20 years	25	6.5
21 years above	15	3.9
Age of company		

1-5 years	58	16.0
6-10 years	65	17.9
11-15 years	78	21.5
16-20 years	87	24.0
21 years above	75	20.7
Type of ownership		
Local firm	112	26.6
Foreign-owned firm	147	35.0
Foreign-local firm	124	29.5
Others	37	8.80
Multimodal Transport Operator (MTO)		
Freight Forwarder	75	17.8
Logistics Company	124	29.5
Shipping Company	70	16.7
Shipping Agent	70	16.7
Others	81	19.3
Position		
CEO/ COO/ General Manager/ President	70	18.2
Vice president/ Deputy CEO	36	9.4
Director/ Head of Department	91	23.7
Manager/assistant manager	104	27.1
Other	83	21.6

Table 4: Means and Standard Deviations of variables

Variables	Mean	Standard Deviation
Business Performance (BP)	4.293	0.364
Service Value of Multimodal Transport (MSV)	3.102	0.497
Service Value of Logistic (LV)	3.874	0.402
Business Relationship (RQ)	4.153	0.288

Measurement model comprises of path model indicators and their relationships with the constructs or outer model in PLS-SEM (Hair et al., 2017). Measurement model comprises of evaluations of composite reliability (CR) to indicate internal consistency, outer loadings to specify individual indicator reliability, average variance extracted (AVE) to accomplish convergent validity, and discriminant validity using Hetereotrait-Monotrait (HTMT) ratio. This study employs Hierarchical Component Model (HCM) analysis using two stage approach. Two stage PLS is a technique to assess the validity of Higher Order Construct (HOC) in SmartPLS (Hair et al., 2017). Figure 2 depicts the first stage of measurement model with 10 latent variables. There are six Lower Order Constructs (LOCs) namely transportation, communication, facilities, functional, social, emotion and four higher order constructs (HOCs) namely MSV, LV, BP and RQ. LOCs represent the dimensions of HOCs.

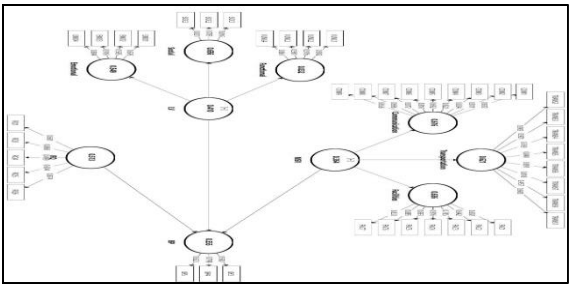

Figure 1: Stage 1 Measurement Model

Figure 3 depicts the second stage of measurement model, with four latent variables namely MSV, LV, RQ and BP. The dimensions of MSV namely transportation, communication, and facilities together with LV dimensions of functional, social and emotional have been transformed into indicators (items) using the latent variable scores of each dimension. Values appear on the arrows and constructs represent the same readings. Values noted on the arrows represent the outer loading (factor loading) while values inside the constructs indicate the AVE.

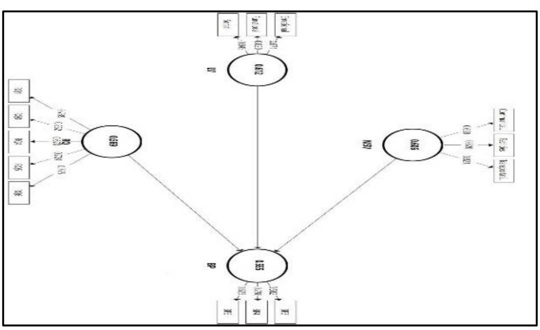

Figure 2: Stage 2 Measurement Model

Table 5: Measurement model analysis (unidimensional constructs)

Constructs	**Items**	**Loadings**	**CR**	**AVE**
Business Performance (BP)	BP3	.582	0.971	0.555
	BP4	.798		
	BP5	.623		
Relationship Quality (RQ)	RQ1	.661	0.864	0.513
	RQ3	.868		
	RQ4	.499		
	RQ5	.604		
	RQ6	.874		

Table 5 and Table 6 indicates that all constructs have passed the internal consistency reliability based on CR values where CR values of at least .70 are considered as satisfactory (Hair et al., 2017). All CR readings are above the threshold value, hence all constructs have been reliably measured with respect to validity test, all constructs have passed the convergent validity test by having AVE values ranging from 0.513 to 0.832. The minimum requirement for AVE value is 0.50 (Hair et al., 2017). According to Chu (2016), researchers may retain the items with factor loading as low as .50 as long as the construct it is measuring has achieved sufficient AVE (i.e. AVE ≥ .50). However, TRANS9 and RQ4 have factor loadings of .457 and .499 respectively with AVE almost 0.50, therefore, these items can be retained. With regards to Hetereotrait-Monotrait (HTMT) ratio, the mean of all correlations of indicators across constructs measuring different constructs relative to the mean of the average correlations of indicators measuring the same construct. Table 7 presents the HTMT result.

Table 6: Measurement model analysis (multi-dimensional constructs)

Constructs		**Items**	**Loadings**	**CR**	**AVE**
LOCs	**HOCs**				
Functional (FUNC)		FUNC1	.902	.952	.832
		FUNC2	.916		
		FUNC3	.961		
		FUNC4	.867		
Social (SOC)		SOC1	.816	.851	.656
		SOC2	.783		
		SOC3	.831		
Emotional (EMO)		EMO1	.626	.825	.549
		EMO2	.565		
		EMO3	.916		
		EMO4	.804		
	Logistics Value (LV)	FUNC	.820	.760	.612
		SOC	.845		
		EMO	.671		

Continued Table 6

Constructs		**Items**	**Loadings**	**CR**	**AVE**
LOCs	**HOCs**				
Transportation (TRANS)		TRANS1	.600	.927	.621
		TRANS2	.903		

		TRANS3	.901		
		TRANS4	.769		
		TRANS5	.848		
		TRANS6	.891		
		TRANS7	.818		
		TRANS9	.457		
Communication (COM)		COM1	.832	.935	.616
		COM2	.811		
		COM3	.834		
		COM4	.822		
		COM5	.692		
		COM6	.816		
		COM7	.872		
		COM8	.696		
		COM9	.656		
Facilities (FAC)		FAC1	.602	.923	.636
		FAC2	.642		
		FAC3	.785		
		FAC4	.916		
		FAC5	.863		
		FAC6	.885		
		FAC7	.833		
	Service Value of Multimodal	TRANS	.821	.821	.606
		COM	.688		
		FAC	.820		

	Transport (MSV)				

Table 7: HTMT ratio

Constructs	BP	MSV	TRANS	COM	FAC	LV	EMO	FUNC	SOC	RQ
BP										
MSV	.561									
TRANS	.380	-								
COM	.359	-	.453							
FAC	.581	-	.665	.271						
LV	.497	.890	.746	.839	.503					
EMO	.612	.575	.442	.476	.446	-				
FUNC	.256	.782	.701	.737	.414	-	.250			
SOC	.273	.778	.597	.847	.352	-	.388	.877		
RQ	.354	.778	.722	.558	.583	.899	.825	.586	.626	

According to Barney (1995), HTMT value that is greater than 0.90 indicates a problem of discriminant validity. Table 7 shows that all values are below 0.90 confirming that that there is no discriminant validity problem between all constructs in the model. Since all conditions of convergent validity and discriminant validity have been fulfilled, this study may proceed to structural model assessment to conduct hypothesis testing.

Moving forward is the construction of structural model of the construct. Figure 4 depicts the structural model of the construct which demonstrates the latent variables and their path relationships indicating the hypotheses to be tested. The arrows represent the relationships between latent variables with the values of path coefficient (β) and the empirical t-values (i.e. values inside brackets). Overall there are three latent variables with three of them are exogenous variables and one endogenous variable. From four exogenous variables, three latent variables work as independent variables and one endogenous variable pose as a dependent variable. The three independent variables are service value of multimodal transport (MSV), service value of Logistics (LV) and business relationship (RQ). The dependent variable is Business Performance (BP). Structural model assessment involves three systematic procedures which include the evaluation of collinearity issues, significance of structural model relationships, and coefficient of determination R^2 (Hair, et. al., 2017). Thus, this study presents the result of structural model assessment according to these procedures.

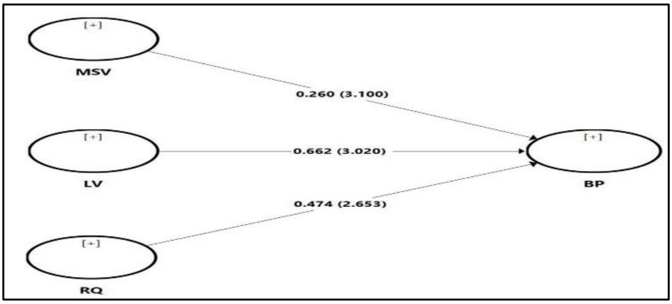

Figure 3: Structural Model

Firstly, collinearity issues occur when two independent variables are highly correlated thus causing estimated path coefficients to fluctuate widely and biasing the structural model (Hair et. al., 2017). In this study, collinearity assessment is done by evaluating the variance inflation factor (VIF) values as recommended by Hair et al. (2017). VIF is the statistic used to measure the severity of collinearity issues (Hair et al., 2017). Table 8 reveals the VIF values.

Table 8: Collinearity assessment results

Constructs	**VIF**
Service Value of Multimodal Transport (MLS)	2.521
Service Value of Logistics (LV)	3.207
Business Relationship (RQ)	2.372

Table 8 reveals that all VIF values are below than cut-off value 5. A VIF value below than 5 implies that collinearity issues among the independent variables are not severe (Hair et. al., 2017). Hence, this structural model is not bias and acceptable for hypotheses testing.

According to Hair et. al., (2017), structural model assessment can be conducted using path coefficient (β), empirical t-values (t statistics), and probability values (p-values). Path coefficient is the estimated path relationship between latent variables in a structural model which is identical to standardized beta (β) values in a regression model (Hair et al., 2017). Estimated path coefficients close to +1 represent a strong positive relationship and vice versa for negative values. The closer the estimated coefficients to 0, the weaker the relationship. Very low values close to 0 are usually non-significant (i.e., not significantly different from zero).

However, the significance of structural relationships is mainly demonstrated by empirical t-values. Commonly used benchmark of critical values in one-tailed tests are 2.33, 1.65, and 1.28, for $p < .10$, $p < .05$, and $p < .01$ respectively. Meanwhile, p value represents the probability of error for assuming that a path coefficient is significantly different from zero (Hair, et al., 2017). p values of 0.01, 0.05, and 0.10 are also implying the confidence levels of 99%, 95%, and 90% respectively. In addition to these basic measures, Hair et. al., (2017) posit to include confidence interval measures to provide a more rigorous reporting on significance testing. Hair et. al., (2017), confidence interval provides an estimated range of values that is likely to include an unknown population parameter. It is determined by its lower and upper bounds (i.e. upper limit –UL and lower limit – LL) which depend on predefined probability of error and the standard error of the estimation for a given set of sample data. Upper limit (UL) and lower limit (LL) values must be either both positive or both negative which indicates zero does not fall into the range of upper and lower bound values. Therefore, this study reports all these recommended measures as in Table 9.

Table 9: Results of hypotheses testing (direct relationships)

Note. One-tailed test

Relationships	**B**	**T statistics**	**P Values**	**Confidence Interval**		**Decision**
				LL	**UL**	
H1: MSV → BP	.260	3.100	.001	.357	.103	Accepted
H2: LV → BP	.662	3.020	.001	.340	.798	Accepted
H3: RQ → BP	.474	2.653	.004	.604	.077	Accepted

Table 9 presents the result of direct relationships between MSV, LV, and RQ with BP. These results serve as the answers for first to three research questions (RQ1 to RQ3) of this study. Results in Table 9 exhibits significant and positive relationships between; i) MSV and BP (β =.260, t = 3.100, p = .001, LL = .357, UL = .103), ii) LV and BP (β = .662, t = 3.020, $p < .001$, LL = .340, UL = .798), iii) RQ and BP (β = .474, t = 2.653, p .004, LL = .604, UL = .077). Thus, H1, H2, and H3 are accepted. These findings can be interpreted as Service Value of Multimodal Transport (MSV), Service Value of Logistics (LV), Business Relationship (RQ) are related towards Business Performance (BP) in a positive manner. In other words, as level of Service Value of Multimodal Transport (MSV), Service Value of Logistics (LV), and Business Relationship (RQ) are increased, the level of Business

Performance (BP) also increases. This finding is consistent to previous studies by Chao (2011).

R^2 value interprets the proportion or percentage of variance in dependent variable that is explained by independent variables. Generally, R^2 values of .67, .33, and .19 are regarded as substantial, moderate, and weak respectively (Hair et. al., 2017). BP has variance explained of 37.3% (i.e. R^2 = .373) (Figure 5). It means this research model has a moderate level of variance explained and indicates MSV, LV, and RQ as significant to BP.

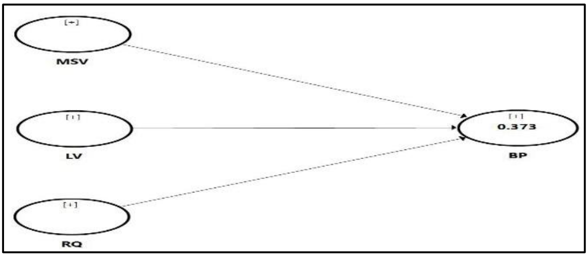

Figure 4: Path model with R^2

Note. Values on endogenous construct represent R^2

5. CONCLUSION

The objective of this research is to determine the independent variables that affect the performance of companies. The relationship between service value of multimodal transport, service value of logistics and business relationship is significant and has an impact on business performance based on the findings of this study. The purpose of the study is to measure business performance of maritime transport industry in Thailand by using the RBV (Resource-based View) model consisting of three independent variables (IVs) and one dependent variable (DV). This study is relevant in identifying issues affecting business performance and subsequently taking steps to improve business performance.

This study will contribute to the literature on multimodal transport with respect to maritime industry and the related logistics for cross-border trade activities especially for Thailand and the neighbouring countries. The construction of structural model using two-stage measurement model approach is actually another academic contribution of this research. In order to improve shipping business performance in Thailand maritime industry, stakeholders should take substantial effort to improve the service value of multimodal transportation, the service value of logistics, and improve business relation between shipping companies, multimodal transport operators and customers. There needs to improve cargo handling, adequate booking facilities, regular cargo scheduling, an active coverage of operation, flexible payment mode and quality information systems.

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