

Conducting Exploratory and Confirmatory Factor Analyses for Competency in Malaysia Logistics Companies

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ABSTRACT

The principal aim of this is to validate a model for Malaysian logistician competency. A survey of 223 logistics practitioners from Malaysia logistics companies participated in the study. The study consists of an exploratory factor analysis (EFA) to identify the salient success measures, followed by a confirmatory factor analysis (CFA). The final model has 5 items representing competency. The results in this study showed that with the aid of a modification indices, the model fits the data with the value of $\chi^2/df = 1.069$; GFI = 0.993; and RMSEA = 0.018. The findings are considered to have made a significant contributing to the literature, by using the Malaysian logisticians which enhances our understanding on the need to understand logistician competency for logistics educational needs.

Keywords: Competency, factor analysis, modification indices

INTRODUCTION

One of the challenges faced by Malaysia is to develop competent human resource, equipped with the right knowledge and right skills in logistics (Tenth Malaysia Plan 2011-2015, 2010; Third Industrial Master Plan 2006-2020, 2006). Competent and knowledgeable workforce is a key contributing to organization's competitive advantage (Teerajetgul & Charoenngam, 2006). The Malaysian Government needs to increase logistics programs at undergraduate levels, but it also needs to produce logistics graduates who have sufficient knowledge, skills and competency when they enter the job market (Third Industrial Master Plan 2006-2020, 2006). Even though there is a trend of growing demand for logistics programs at colleges and universities throughout the world (Lancioni, Forman & Smith, 2001), the world demand for competent logisticians still exceeds the supply provided by higher education institutions (Mangan & Christopher, 2005). Competency is therefore essential for a logistician to perform a job physically and intellectually (Myers, Griffith, Daugherty & Lusch, 2004).

Despite the substantial studies made by logistics researchers around the world in logistician competency, attempts to explore on the topic from Malaysian logistics perspective have been few (for examples, see Wu, 2007; Wu & Chou, 2007; Razaaque & Sirat, and 2001). The objective of this study is to explore the extent to which competency presented in the literature is being emphasized among logisticians in Malaysia. More specifically, this paper presents and validates a model for Malaysian logistician competency. A framework for examining competency requirements (Way, 2002) is adopted.

In order to reduce the gap between current logistician competency skills and that required in the future, higher education institutions (HEI) should provide a range of logistics programmes for both undergraduate and postgraduates (Mangan & Christopher, 2005). Mangan and Christopher further emphasized that HEIs should provide logistics programmes which elements of practical must relate to the current needs in logistics industry.

Furthermore, HEIs were required to provide fully integrated logistics and SCM programmes that could take account of the integration-oriented skills (Handfield, 2004).

This paper is organized into four parts. First, a literature review on the need for logistician competency is described to provide a theoretical foundation. Second, the research design and methods are outlined. Third, the results including the application of modification indices are discussed. Finally, discussion, conclusions and future directions arising from this research are presented.

LITERATURE REVIEW

Murphy and Poist (2007); Larson, Poist and Halldórsson (2007); Mangan and Christopher (2005); Richardson (2002); and Gammelgaard and Larson (2001) provided studies of issues related to the development and evaluation of logistician competency. For example, Murphy and Poist (2007) studied regarding the needs for logisticians competency based on the Business-Logistics-Management (BLM) Model.

However, the BLM Model has limitations. First, the target population in the previous studies was mainly focused on the top management in logistics firms (Murphy & Poist, 2007; 1998; 1996). Majority of items in the Business, Logistics and Management components are perceptions from the top logistics management samples except in the 2006 study. In the 2006 study, the target populations derived from senior and junior logistics managers (Murphy & Poist, 2006). Therefore, there is still lacking in terms of studies to capture perception from other managerial levels such as middle and low. As supported by Katz (2009), every manager required conceptual, human and technical skills but the amounts differ by their managerial levels.

Meanwhile, Larson, Poist and Halldórsson (2007) revealed 'the inadequate employee skills' as statistically significant for future barriers to logistics industry. The findings further supported theoretical discussions in the logistics and SCM literature, for examples, from Lambert, Cooper and Pagh (1998) on functional silos and from Gammelgaard and Larson (2001) on skills requirements.

In a qualitative research, Richardson (2002) showed a compilation of interviews being acquired from logistics practitioners. The results provided as evidence for their contention between logistics programmes at HEIs, and competency of logistics graduates. The study also emphasized the need for cooperation between logistics companies, logistics professional bodies and HEIs. This is to ensure a fundamental technology as well as broad business skills and knowledge available in logistics programmes in order to produce competent logisticians.

RESEARCH DESIGN AND METHODS

This paper was to discover the competency need for logisticians. The research method was to survey logistics practitioners to obtain perception of the importance of competencies in their current positions. Respondents were requested to rate the modified 13 competencies in terms of their importance in facilitating logisticians perform well in their jobs and tasks. These items were taken and modified from Way (2002) instrumentation. The study used a five-point Likert scale (1 = extremely unimportant; 5 = extremely important) to measure the 13 competencies.

The survey was mailed to the 889 Malaysian logistics firms based on the list from the listing of the Malaysia Logistics Directory (www.msialogistics.com). Of these, 223 questionnaires were returned. This is a response rate of 25.1 percent. Table 1 summarizes respondents' working experience, position, age, qualification, firm type and the firm size.

Respondents had an average of 11.5 years of working experience. More than 40 percent of the respondents were between 25 and 35 years of age. Majority (46.2 percent) of the respondents have a bachelor's degree. Respondents also hold positions of responsibility in their firms, with 28.7 percent were top and 52.5 percent were middle managers. A large portion of the respondents worked in a company size of 500 and above (37.2 percent). Majority of the respondents worked in local logistics firms (71.3 percent).

Table 1. Profiles of Respondents (n = 223)

<i>Characteristics</i>		<i>Frequency</i>	<i>Percentage</i>
<i>1. Position</i>	Low Management	42	18.8
	Middle Management	117	52.5
	Top Management	64	28.7
<i>2. Company Category</i>	Multinational	64	28.7
	Local	159	71.3
<i>3. Company Size</i>	1-10	18	8.1
	11-50	28	12.6
	51-100	19	8.5
	101-300	43	19.3
	301-500	32	14.3
	500 and above	83	37.2
<i>4. Age Group</i>	25-35	97	43.5
	36-45	80	35.9
	46-55	41	18.4
	56-65	3	1.3
	65 and over	2	0.9
<i>5. Education</i>	High School	22	9.9
	Diploma	46	20.6
	Degree	103	46.2
	Master	42	18.8
	Ph.D.	1	0.4
	Others	9	9.9
<i>6. Mean of working experience</i>		11.5 years	

An exploratory factor analysis (EFA) was conducted in order to group all the 13 measures into common underlying factors. Principal component analysis, varimax rotation, the latent root criterion of 1.0 for factor inclusion, communalities of .5 and a factor loading of .5 was used to include items in a factor (Hair, Black, Babin & Anderson, 2010).

A confirmatory factor analysis (CFA) was conducted for obtaining a valid model for logistician competency. All CFA procedures in conjunction with verifying the posited relationships of the observed indicators to the latent constructs were based on Anderson and Gerbing (1988) procedures. In addition, Anderson and Gerbing explained that confirmatory model should be evaluated and re-specified before measurement and structural equation models are examined simultaneously.

RESULTS

The results of EFA determined significantly correlated 1 factor with 5 strong representations of the data (see Table 2). 8 items were dropped due to weak representation of the data. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Cronbach’s Alpha values for all the 5 variables were .80 and .83 indicating the reliability of the data. All items had range of mean between 4.32 and 3.80 indicating as importance from logistics practitioners’ perceptions. The total variance explained was above 50 percent.

Table 2. The EFA Results for Competency

	<i>Factor</i>	<i>Mean</i>	<i>SD</i>	$\frac{CA}{.83}$	β
COMP9	Ability to approach problems professionally.	4.23	.64		.68
COMP10	Innovation and creativity	4.28	.66		.76
COMP11	Teamwork.	4.30	.62		.69
COMP12	Strategic focus.	4.24	.67		.73
COMP13	Negotiation skills.	4.32	.63		.68

Factor 1: eigenvalue (3.00), explained variance (60.0%)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) = .80; p < .001

Mean score: 1 = extremely unimportant, 5 = extremely important

SD = Standard Deviation; CA = Cronbach Alpha

The model yielded a good fit for the Goodness of Fit Index (GFI) (value = .931) but not for χ^2/df (value = 8.06) and the Root Mean Square Error of Approximation (RMSEA) (value = 0.18) (see Figure 1). In term of factor loadings, the model yielded loadings greater than .4, as suggested by Burney and Widener (2007). These high loadings verified the convergent validity of the study variables.

Modification indices (MI) technique was applied in the model in order to obtain a good fit for χ^2/df and RMSEA values. MI provided from AMOS revealed a parameter that could be released to significantly improve model fit (Arbuckle, 2007). It therefore, provides modifications for finding the fit model.

In this study, the MI in the model suggested an error covariance term between “ability to approach problems with clear perception” (COMP9) and “innovation and creativity”

(COMP10) (Figure 1 and Table 3). The analysis treated the covariance between COMP9 and COMP10 as a free parameter in this model, the discrepancy would full by at least 30.61 of MI. Furthermore, the estimated parameter change would become larger by approximately .10 between COMP9 and COMP10. In relation to the estimated correlation between errors 1 and 2, it contributed a β value of .43 ($p < .001$) significant at .001 level. The Chi-square values dropped from 40.28 to 4.28. GFI increased from .93 to .99 and RMSEA has dropped from .18 to .02. The final model for logistician competency is shown in Figure 2.

The Akaike Information Criterion (AIC) was used to compare measures between models with differing numbers of constructs (Cohen, Cohen, West & Aiken, 2003). According to Cohen et al. (2003), smaller positive values from the AIC indicate parsimony when compared between tested and alternative models. In this study, the AIC dropped from 60.28 to 26.28. Note that the application of MI can only be done when there is a theoretical basis to support the corresponding correlations (Hair et al., 2010).

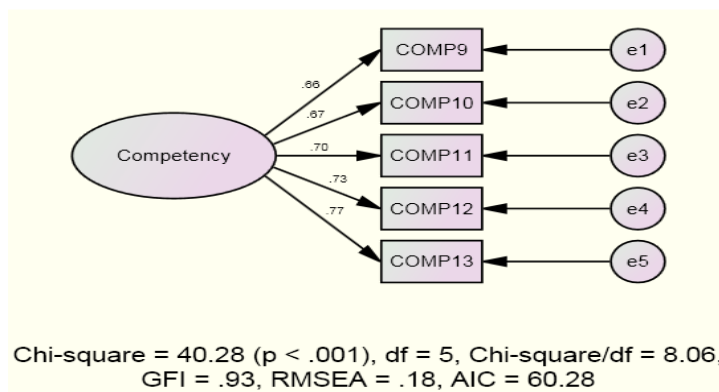


Figure 1. Model of Logistician Competency

Table 3. Modification Indices of Logistician Competency Model

Covariance	Modification Indices	Par Change
e1<--> e2	30.61	.10
Correlation	Estimate (β)	
e1<--> e2	.43	

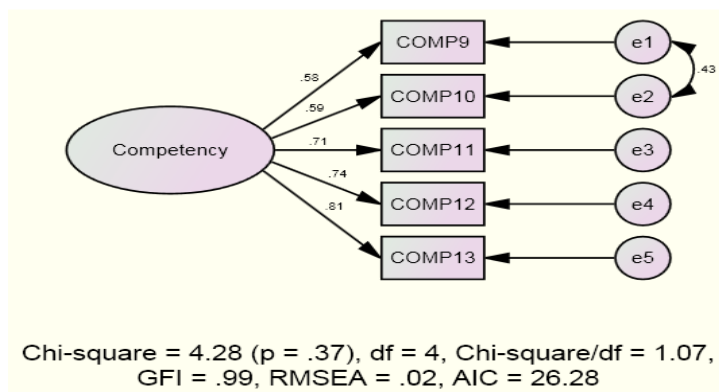


Figure 2. Final Model for Logistician Competency

DISCUSSION AND CONCLUSIONS

From the measurement of the logistician competency, the Structural Equation Modeling empirical result indicated ability to approach problems professionally, innovation and creativity, teamwork, strategic focus, and negotiation skills had high factor loadings (highest $\beta = .77$; lowest $\beta = .66$). Of these, negotiation skills are considered to be the most essential measure which is consistent with Murphy and Poist (2007, 1991) studies. The importance of negotiation skills for logistics managers had increased from “importance” (mean score = 3.45, rank = 13.5) in 1991 study to “maximum importance” (mean score = 3.65, rank = 7) in 2007 study (Murphy and Poist, 2007; 1991). In an EFA for logistician competencies, a study had indicated negotiation skills as one of the important factor identified that attributes to skills and attributes (Razzaque & Sirat, 2001).

The MI in the model suggested an error covariance term between “ability to approach problems with clear perception” and “innovation and creativity” measures. Previous studies have constantly indicated the need of innovation and creativity to manage problems at work setting (Flint, Larson, Gammelgaard & Mentzer, 2005; Soosay & Hyland, 2004) For example, Flint et al. (2005) believed that employees do practice innovation in order to create a work value which would lead to customer satisfaction. Therefore, innovation requires the capacity to create suitable and proper working conditions in order to deal with unexpected problems or opportunities (Zimmer, 2001).

The findings in this study have implication on higher education institutions (HEIs). HEIs which offering logistics programmes should consider modules and courses in their programmes able to provide elements of learning outcomes such as ability to approach problems professionally, innovation and creativity, teamwork, strategic focus, and negotiation skills. These learning outcomes must able to be learnt and applied by logistics graduates so that they can achieve competency.

As for employers, this study can be used as a guideline for the recruitment and development of logisticians. For example, in recruitment, employers may test candidates regarding the knowledge and skills pertaining to management, logistics and business in order to ensure they hire candidates who can acquire competency. As for the development function, the study’s findings provide employers with a check-list kit to conduct an audit for measuring their employees’ competency. A logistician with lack of competency tends to limit his or her career advancement opportunities. Employees in logistics firms therefore must have an ability to demonstrate their competency for effective and efficient work (Kim, Lim & Mitchell, 2004).

In conclusion, the presented model of logistician competency needs to be developed in conjunction with other dimensions such as knowledge and skills. Further, a longitudinal study in line with the approach of Murphy and Poist (2007) and with different data collection methods would give both input to theory-building and provide better support for the present model.

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