

Developing a Measurement Model for Undergraduate Program in Logistics

Dazmin Daud^{1,*} & Mohamed Syazwan Ab Talib²

¹Chartered Institute of Logistics and Transport Malaysia, Malaysia

²Faculty of Business & Information Science, UCSI University, Malaysia

*Corresponding author: Chartered Institute of Logistics and Transport Malaysia, Malaysia

E-mail: daazmin@yahoo.com

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Abstract

Dimensions for undergraduate degree program in logistics are very limited in literature, especially in the Malaysian scenario. This research explores the construction of measurement model on undergraduate degree program in logistics. Data on undergraduate program in logistics were gathered from 244 logistics managers using a self-administered questionnaire. Exploratory and Confirmatory Factor Analyses were used to analyze and set the dimensions. The findings show that there were three factors developed from the above analyses, namely logistics exposure, logistics curriculum, and logistician competency. Index values of $\chi^2/df = 2.203$; GFI = .954; CFI = .938; and RMSEA = .070 confirm that the data fit the measurement model. The results suggest that the dimensions for the Malaysian undergraduate program may be developed from working experience, logistics courses, and management skills. These findings should be considered as a starting point for those conducting research onto Malaysian logistics educational needs.

Keywords: logistics education; logistics exposure; logistics curriculum; logistician competency

1. Introduction

The era of globalization has seen the rapid advancement of the logistics industry. Malaysia, like other countries, has decided to focus on the logistics sector as part of its policies to meet global challenges (Tenth Malaysia Plan 2011-2015, 2010). This is because one of the challenges faced by Malaysia is to develop competent human resource, equipped with the right knowledge and right skills in logistics. A substantial amount of study has examined the importance of having validated dimensions of logistics program offered by higher education institutions (HEIs). Myers, Griffith, Daugherty and Lusch (2004) study has indicated a useful construct for studying dimensions of logistics program in Malaysia. Findings from Myers et al. study has demonstrated that jobs skills were found to be good predictors of logisticians' performance but not working experience and education. In a Malaysian context, studies have been done in the context of competency and talent required by logistics graduates (Lim, Dazmin & Jonathan, 2012; Dazmin, 2011).

In the context of Malaysian economy, the growth of Malaysian business activities locally and globally requires competent logistician workforce to manage logistics activities. There is a need to prepare local logisticians to pace with the development of business globalization in the 21st century (Department of Economic and Social Affairs of the United Nations Secretariat, 2007). A study from Wu (2007) indicated that HEIs need to provide competence and marketable logistics programs. In Malaysia, with the development of higher educational sector, more competent and marketable logistics programs need to be offered in order to meet this demand. A study from Mohamad Hanapi, Zahiruddin and Mohd Shah (2003) emphasized that it is importance for HEIs in Malaysia to cope with globalization so that the programs offered are marketable all over the world. The implementation of the Cabinet's Report in 1979, the new Private Higher Educational Act in 1996, the new Education Act 1996, and the upgrading of the National Accreditation Board to the Malaysian Qualifications Agency (MQA) in 2008, will lead to a high standard of logistics program.

While informative and intriguing, the literature still has shortcomings. Previous studies from Lim et al. (2012) and Dazmin (2011) were only focused on competency and talent needed by Malaysian logistics graduates. Studies closer to the problem were done by Wu (2007) and Myers et al. (2004) where they provide insights for developing dimensions for logistics program. However, their studies were based on the international perspectives for general logistics education.

In view of the research gap and the lack of information concerning undergraduate logistics program in Malaysia, more focus research attempts need to be carried out. One particularly interesting area would be to develop dimensions for the undergraduate logistics program offered by the Malaysian HEIs. In that, it seeks to make a first attempt in developing a measurement model indicating the dimensions that represent Malaysian undergraduate program as seen from the Malaysian logistician's perspective.

In an attempt to meet the objective of the study, specific research question that need to be addressed is identified as: what are the dimensions of Malaysian undergraduate program? For this purpose, the paper is structured as follows: a review of the literature related to

logistics program. Following that, the next section describes the research method adopted. Next, the paper provides the results of the empirical study. Finally, brief discussions, limitations and conclusion of the paper are presented.

2. Literature Review

2.1 Logistics Education Background in Malaysia

The Malaysian government has made countless efforts to increase, improve and promote Malaysia Higher Education system both locally and internationally. Efforts such as Malaysia's National Higher Education Action Plan (2007-2010) and National Higher Education Strategic Plan (NHESP) are some of the efforts to establish Malaysia as an international hub of excellence for higher education, thus in line with the nation's drive towards Vision 2020.

Among the various programs and courses offered in various public or private HEI in Malaysia, the field of logistics and supply chain is also a popular program and course, both in undergraduate and postgraduate level. According to Lancioni, Forman and Smith (2000), logistics programs in colleges and universities around the world are upward trends and increasing in demand. Logistics and transportation higher education program in Malaysia was establish more than 40 years ago, when the *Institut Teknologi MARA* (now known as Universiti Teknologi MARA, UiTM) introduced Advance Diploma in Business Administration (Transport) under the Faculty of Business Management and collaboration with the Chartered Institute of Logistics and Transport (CILT).

Logistics program offered by the Malaysian HEIs is driven by demand and supply of graduates in logistics industry. Gravier and Farris (2008) defined that logistics programs are based on defining curriculum, developing content and skills, and refining teaching methods in logistics education. The purpose of the logistics program designed by the Malaysian higher education institutions is to produce competent logisticians who are equipped with accurate knowledge and skills to help logistics industry be successful over the long term. The program consists of courses for undergraduates to select and learn, and it may take several years to complete before these undergraduates are entitled to obtain their diplomas or degrees in logistics. There are two types of courses related to logistics undergraduate programs: logistics courses and non logistics courses (Dazmin, 2009). Logistics courses are courses that provide contents directly to logistics activities. On the other hand, the non logistics courses are courses that provide contents related to non logistics functional issues such as marketing, accounting, quantitative analysis, human resource management, international business, business law, management, communication, marketing, economics, etc.

Higher education institutions should ensure that all logistics programs must be able to produce competent graduates in logistics, (Fawcett, Vellenga & Truitt, 1995) particularly when these logistics programs are related to the Supply Chain Management (SCM) (Aquino & Draper, 2008). In the beginning of the year 2000, logistics became a formal area of study in higher education institutions (Lancioni, Forman & Smith, 2001). In that, Lancioni, Forman

and Smith explored the challenges in logistics programs. These included the existence, levels, duration of the programs, types of higher education institutions offering the programs, and types of undergraduate logistics programs.

2.2 Logistics Exposure

As mentioned in the Introduction section, the study from Myers et al. (2004) has provided salient insights for the current study. In the study, when a logistician is having a situation called “educational gap” when a logistics graduate fail to apply what he has learnt from his university into working environment. The above view is supported by a study from Stevens, Gerber and Hendra (2010). Through survey, they had determined the degree to which a university approach to prior learning assessment (PLA) contributed to transformative learning. The outcomes of the study showed that respondents had developed a new sense of confidence and ability to make new meanings of experience.

Clinebell and Clinebell (2008) emphasized the need for critical courses offered to be thought by actual and experienced practitioners. They called these practitioners “executive professors” who can deliver knowledge in the course contents to match with the current educational needs of the industry. Meanwhile, Golicic, Bobbitt, Frankel and Clinton (2004) studied the gap between supply and demand of experienced logistics scholars teaching logistics courses. They concluded that there is a shortage of logistics Ph.D.s as academicians for logistics courses.

A study has been done to investigate the effects of knowledge, skills, and talent on logistics internship program within the context of Malaysian private HEIs (Lim et al., 2012). The proposed research framework and hypotheses were developed with the intention of examining the above relationship. Hierarchical regression analysis was employed to explore the relationship between knowledge, skills, talent and logistics internship program. The results revealed that talent was positively and significantly associated with logistics internship program. The study, however, has its limitation because the survey was conducted using convenience sampling and therefore, it did not represent the whole population of Malaysian undergraduate students.

2.3 Logistics Curriculum

A study regarding the development of logistics education can be traced back to the 1967 where there was a need to evaluate transport and logistics curricula (Cherington & Schneider, 1967). They identified that the undergraduate education in transportation was in a state of decline while the logistics and physical distribution management had become demanding. Furthermore, their findings were supported by studies from Ballou and Piercy (1974); and Collison and Bess (1987) where HEIs were offering more transportation and logistics courses for undergraduates.

The development and influence of SCM in logistics (Fawcett, Mangan & McCarter, 2008) show SCM programs and its courses are offered at higher education institutions. As argued by other researchers, a curriculum in logistics courses needs to be adjusted with the development of SCM (Sauber, McSurely & Tummala, 2008; Closs & Stank, 1999).

Courses in logistics programs must be adapted in accordance with the development of logistics globally. This can be examined through the perspectives from prominent logistics scholars regarding the conceptual evolution in logistics (Kent & Flint, 1997).

van Hoek (2000) argued that logistics practitioners prefer applied logistics courses at higher education institutions in their logistics programs. He emphasized that rapid changes in practice and developments of research in logistics force higher education institutions to upgrade courses in their logistics programs. van Hoek's argument was further supported by Gravier and Farris (2008). They discovered that close relationship between educators and logistics practitioners, changes of course requirements, and changes in teaching environment influence logistics educational programs in higher education institutions. In a related literature, Pteffer and Fong (2002) discussed the needs for business education to focus more on competitive programs. These programs must be able to convey knowledge that students could apply throughout their working lives.

2.4 Logistician Competency

There are longitudinal studies pertaining to the needs for management skills using the Business-Logistics-Management (BLM) Model (Thai, Cahoon & Tran, 2011; Murphy & Poist, 2007; 2006; 1998; 1994; 1991; Razzaque & Sirat, 2001). The model was limited to the skills required by logistics managers within the scopes of business, logistics and management functions. The BLM Model has limitations. First, the target population in the longitudinal studies from 1991 to 2007 was mainly focused on the top management in logistics firms (see Thai et al., 2011; Murphy & Poist, 2007; 1998; 1994; 1991).

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.

Meanwhile, studies from Esper, Defee and Mentzer (2010) and Mangan and Christopher (2005) have indicated these points. First, in order for supply chain and logistics organizations to have a competitive advantage, they need to hire employees with key SCM skills, implement leadership styles and create learning working environment. Second, there is a challenge for logistics firms to bridge the gap on the issues of managerial skills for logistics and SCM managers.

3. Methodology

The objective of this study is to develop dimensions for an undergraduate logistics degree program in Malaysia. The research method was to survey Malaysian logisticians to obtain perception of the importance of undergraduate logistics program in their current positions. A total of 244 Malaysian logisticians participated in the study. A questionnaire was developed based on several literature reviews (see Table 1). Respondents were requested to

rate the modified 12 items terms of their importance pertaining to undergraduate logistics program using a five-point Likert scale (1 = extremely unimportant; 5 = extremely important). An independent random sample of 900 Malaysian logistics firms were selected from the 2010 Malaysia Logistics Directory (www.msialogistics.com). Each respondent was sent a copy of the two-page questionnaire along with a cover letter. Two weeks later, a follow-up letter together with the same questionnaire was sent. Of these, 244 questionnaires were returned, representing 27.1 percent of the initial sample.

Table 1: Questionnaire items and their sources

Research focus	Author(s)
Actual work practice	Wu (2007)
Ph.D. holder	Golicic et al. (2004)
Delivery of knowledge and skills	Wu (2007); Cherington and Schneider (1967)
Multi discipline syllabus	Wu (2007); Cherington and Schneider (1967)
Internship program	Knemeyer and Murphy (2001; 2004)
Knowledge, skills and competency	Gravier and Farris (2008); Knemeyer and Murphy (2001; 2004)
Effectiveness	Knemeyer and Murphy (2001; 2004)
Efficiency	Knemeyer and Murphy (2001; 2004)
Skill requirements	Gravier and Farris (2008); Myers et al. (2004)
Change course	van Hoek (2000)
Efficiency orientation	Wu (2007); Knemeyer and Murphy (2001; 2004)
Customer relationship course	Christopher, Magrill and Wills (1998)

An exploratory factor analysis (EFA) was conducted in order to group all the 12 items of logistician competency 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 measurement model was conducted in order to verify the posited relationships of the factors formed from the EFA. Based on Hair et al. (2010) recommendations, a maximum likelihood method was applied in order to measure the fit values for the measurement model. Indexes such as comparative fit index (CFI), root mean square error of approximation (RMSEA), and the adjusted chi-square test ($X^2/\text{degrees of freedom}$) were applied to evaluate the goodness of fit for a measurement model (Anderson & Gerbing, 1998).

4. Analysis and Results

4.1 Respondent Profile

The results in Table 2 shows that all respondent have an average 11.4 years of working experience with large percentage are middle managers with 54.9 percent. Results also recorded that respondents come from local companies, 69.3 percent whereas 30.7 percent from multinational companies. In terms of company size, size of 500 and above recorded the largest respondent percentage with 36.5 percent.

Table 2: Respondents profile (n = 244)

Characteristics	Frequency	Percentage
Position		
Top Manager	43	17.6
Middle Manager	134	54.9
Low Level Manager	67	27.5
Company Category		
Multinational	75	30.7
Local	169	69.3
Company Size		
1-10	21	8.6
11-50	32	13.1
51-100	20	8.2
101-300	46	18.9
301-500	36	14.8
500 and above	89	36.5
Mean of working experience	11.4 years	

4.2 Reliability Test, Kaiser-Meyer-Olkin Measure and Bartlett's Test

The Cronbach's Alpha value for all the 12 items were .787 signifying the reliability of the data. The value of .787 for the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy shows that the proportion of variance in the variables is influenced by underlying factors. Therefore the KMO value permits for the application of factor analysis. The KMO value is supported by the Bartlett's test of sphericity value of .00 that is less than .05. It is therefore shows that the analysis in this study is significant (Table 3).

Table 3: KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.787
Bartlett's Test of Sphericity	Approx. Chi-Square	716.697
	df	66
	Sig.	.000

4.3 Communalities

Table 4 shows the proportion of variance accounted for in each item by the overall total of the 12 items. All values are above .4. This indicates that the extraction of communalities using the principal component analysis in this study is valid.

Table 4: Communalities

Item	Initial Solution	Extraction
LP1	1.000	.532
LP2	1.000	.416
LP3	1.000	.499
LP4	1.000	.608
LP5	1.000	.652
LP6	1.000	.524
LP7	1.000	.613
LP8	1.000	.495
LP9	1.000	.634
LP10	1.000	.592
LP11	1.000	.432
LP12	1.000	.608

Extraction Method: Principal Component Analysis.

4.4 Total Variance Explained

Table 5 shows the variance explained by the initial solution. Out of 12 items, only three factors demonstrated eigenvalues more than unity. In addition to that, they attributed for 55 percent for the cumulative variance. The cumulative percentage in the rotation sums of squared loadings also showed 55 percent. This shows that none of the variation explained by the initial solution is lost due to latent factors.

Table 5: Total variance explained

Item	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.682	30.686	30.686	3.682	30.686	30.686	2.446	20.381	20.381
2	1.815	15.125	45.810	1.815	15.125	45.810	2.320	19.332	39.713
3	1.106	9.220	55.031	1.106	9.220	55.031	1.838	15.318	55.031
4	.918	7.653	62.683						
5	.867	7.223	69.907						
6	.662	5.513	75.419						
7	.623	5.193	80.613						
8	.579	4.824	85.436						
9	.512	4.266	89.702						
10	.451	3.757	93.459						
11	.435	3.628	97.087						
12	.350	2.913	100.000						

Extraction Method: Principal Component Analysis.

4.5 Grouping Variables from Rotated Factor Matrix

All 12 items are loaded into 3 factors (see Table 6). The first factor is labeled as learning outcome and evolved these five items: working experience, actual work practice and application, logistics practitioners as lecturers, internship program, and marketable graduates. The second factor can be grouped as logistics educational needs and consists of the following items: logistics knowledge, non-logistics knowledge, competency, and logistics courses offered by the HEIs. The last factor consists of three components: skills development, change module, and efficiency orientation. The components can be classified as marketable logistics graduates.

Table 6: Factor loading structure matrix

Item	Factor		
	1	2	3
LP1	.724		
LP2	.586		
LP3	.648		
LP4	.756		
LP5			.775
LP6			.629
LP7			.756

LP8	.610
LP9	.783
LP10	.667
LP11	.609
LP12	.760

4.6 Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) of the measurement model verifying the posited relationships among the 3 factors was tested in order to measure a good fit of the model. 3 items were dropped due to the low value of standardized regression weight (less than .5). The measurement model for the three factors and the 12 items yielded a good fit to the data (CFI = .938, GFI = .954, RMSEA = .070, $X^2/\text{degrees of freedom} = 2.203$, $p = .001$) (Figure 1). Correlations among the three factors were moderate and positively correlated; with Factor 1 – Factor 2 ($r = .422$, $p < .001$), Factor 2 – Factor 3 ($r = .647$, $p < .001$), and Factor 1 – Factor 3 ($r = .428$, $p < .001$). The measurement model is shown in Figure 1

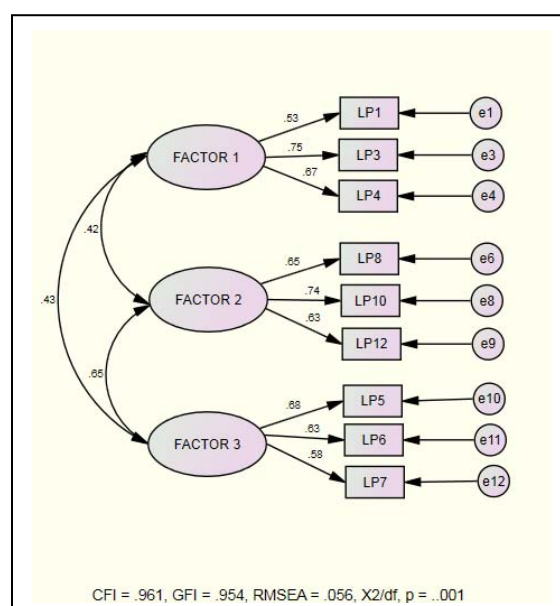


Figure 1: Measurement model for three factors of logistics program

5. Discussion and Conclusion

From this study, both theoretical and practical key contributions and implications can be drawn. Factor 1 labeled logistics exposure. According to Myers et al. (2004), it is crucial for logistics students to learn logistics not only in-class method but also from the actual industry. Successful learning outcome from logistics program can be achieved if major logistics subjects are thought by logistics practitioners (Golicic et al., 2004). These logistics practitioners can be hired as an adjunct lecturer or can be appointed as curriculum advisor by the Malaysian HEIs that offering logistics programs. As stated by Clinebell and Clinebell

(2008), experienced practitioners may be able to deliver relevant knowledge in academic match with the industrial current needs.

Another way to achieve a successful learning outcome from the logistics program is by emphasizing a specific duration of time for an internship program. A study from Lim et al. (2012) has demonstrated that logistics students can develop their talent during internship. This study however should be developed in a large scale in future in order to generalize the results. Caution should be noted in designing an effective internship program. A too short internship (such as 1 month) may not be able for the students to learn and acquire proper hands on knowledge and skills. Views from logistics practitioners can provide better insight pertaining to an ideal duration for the internship. In addition to that, they may suggest what kind of logistics firms are suitable for the students.

Factor 2 reflects on logistics curriculum and consists of logistics knowledge, non-logistics knowledge, competency and courses offered. Logistics curriculum is expected to produce learning outcomes that graduates in a logistics program will be able to understand business logistics (Thai et al., 2011; Wu, 2007). This is an important issue because the students must be able to apply knowledge when they work in logistics industry (van Hoek, 2000). In another view, Lancioni, Forman and Smith (2001) mentioned that there are HEIs that failed to design effective curriculum for logistics programs. The perspectives of these HEIs' logistics curriculum were more on local needs but were not designed for international setting.

In addition, logistics curriculum must also be equipped with non-logistics knowledge and capabilities for example finance, sales, marketing, customer service, information system and so forth, along with in-depth understanding in logistics (Thai et al., 2011, Busse & Wallenburr, 2011; Wu, 2007; Razzaque & Sirat, 2001). This is because, in order to face global challenges in a globalized market, logisticians are required to have an overall knowledge and skills.

Items forming Factor 3 view Malaysian logistician competency on skills development, change, and efficiency. Pohlen (2011) suggested that for logistics graduates to demonstrate a competent worker, they must be able to apply knowledge and skills from their HEIs in practical situation.

The importance of change management has been emphasized in the BLM studies (see Murphy & Poist, 2007; 2006; 1998; Razzaque & Sirat, 2001). Furthermore, findings from Heilmann (2007) indicated that changes in organizations such as new demanding duties and technological development require continuous training and updating of knowledge for workers.

This study has shown the importance of efficiency elements in logistics program. Respondents had emphasized that courses in logistics program must contribute to produce competent logistics graduates so that these graduates will perform their roles efficiently. The findings support previous studies regarding the importance of efficiency in logistics education (for examples see Burcher, Lee & Sohal, 2005; Rao, Stenger & Wu, 1998).

From this study it signifies the implication of higher education institutions (HEIs) and logistics education are logistics exposure, logistics curriculum, and logistician competency. In order for logistics graduates to achieve competency, the learning outcome must be able to be learnt and applied by the graduates.

Besides that, this study can be used as a general guideline for recruitment and development of logisticians among the employers. For instance, during recruitment process and to determine the level of competency, potential logistician may be tested on their exposure towards logistics industry, skills, business knowledge, and leadership skills. Plus, the findings from this study may be use as a check-list kit to conduct an audit for measuring employees' competency among the employers.

However, few limitations from this study need to be highlighted. Firstly, this study is only limited to managerial positions in logistics companies (top, middle and low managers) which limit the generalize ability of the findings. It is recommended that for future research, survey on logisticians who do not posed any managerial positions can also be included. Secondly, demographical factors such as working experience, managerial position, company category, and company size may have implication on how well the respondents may have understood and perceived the concept of "logistics education". A large sample size may improve generalize ability for future research on "logistics education". Finally, the study is a cross-sectional in nature where it limits one's ability to capture changes in perception over time. Perhaps a sugestion on longitudinal research design could provide more reliable on results for future research.

In conclusion, logistics exposure, logistics curriculum, and logistician competency are indicated by EFA and CFA results of Malaysian logistician education. These three dimensions provide salient inputs to Malaysian HEIs and also logistics managers for tapping competency in logistics programs, recruitment and development functions. Therefore the study confirms the determining factors that comtributes to undergraduate logistics program will be the major study in the Malaysian logistics industry.

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