THE EFFECT OF GREEN LOGISTICS SERVICE QUALITY ON THAI LOGISTICS SERVICE PROVIDER PERFORMANCE

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Abstract

Purpose: The emergence of environmental or green issues in global supply chains has made it an essential practice to measure the performance of organisations of not only from their financial and management perspectives but also their environmental performance, particularly logistics service providers (LSPs). There has been little work done linking the topics of green service quality (GSQ) and logistics service quality (LSQ), particularly in a developing economy such as Thailand. However, the Thai government has established a Thai logistics performance index (TLPI) for the logistics sector and is focussing more on environmental or green aspects related to transportation and logistics. Given this context, the purpose of this paper is to investigate issues pertaining to GSQ and LSQ, and their impact on the TLPI that will affect Thai LSPs.

Research approach: The empirical research for this paper was based on an extensive literature review in three key areas: LSP performance, LSQ, and GSQ. For this study, GSQ has been defined from perceptual service quality or SERVPERF constructs as the environmental initiatives crucial to operational service quality, particularly in logistics service provision. The empirical study used a rigorous three-phase methodological framework originally developed for the marketing discipline for item and scale development, and which has been applied more recently to logistics research. An interview and a survey from the perceptions of LSPs and LSP customers were used as appropriate methods for this explanatory study and were discussed at the LRN in 2013 and 2014 (Chaisurayakarn et al. 2013; 2014).

Findings and Originality: LSQ has a positive and significant effect on the TLPI, and that effect is more pronounced when GSQ measures are included. The findings also propose a final set of twenty-eight important GSQ and LSQ variables for LSP performance perceived by Thai LSPs and their customers and which are generally related to green safety, regulations and collaboration; time and services; order service quality; and order procedure competencies.

Research impact: This paper provides a contribution to the GSQ, LSQ and LSP debate by extending service quality theory in the logistics services sector in the context of GSQ and integrating GSQ competencies into extant LSQ frameworks. A limitation is that this paper only reports preliminary findings of an ongoing study.

Practical impact: A practical contribution for both LSPs and their customers is an understanding of how LSPs can focus on GSQ to perform better, which is important to customers, and hence better compete with rivals. Moreover, it explores that an area of the effects of green logistics service quality (GLSQ) on the LSP's performance.

Keywords: *Logistics service quality, green service quality, logistics service provider performance*

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Introduction

Effective and efficient logistics services can enhance the firm's competitive advantage. Therefore, logistics management can be considered as a key component of organisational effectiveness and success (Khan and Burnes, 2007). At the same time, environmental or green issues in logistics service offerings have attracted much managerial attention in the logistics industry for the future. One important objective is for logistics service providers (LSPs) to deliver their service offerings to customers in more environmentally friendly ways. The study is ongoing project and investigates variables and constructs of green service quality, logistics service quality and logistics performance index in Thailand. The purpose of this paper is to investigate issues pertaining to GSQ and LSQ, and their impact on the TLPI that will affect Thai LSPs.

Theoretical Background

The empirical research for this paper was based on an extensive literature review in three key areas: LSP performance, LSQ, and GSQ. For this study, GSQ has been defined from perceptual service quality or SERVPERF constructs as the environmental initiatives crucial to operational service quality, particularly in logistics service provision. Many studies have been conducted on the relative effectiveness of the service performance measurement (SERVPERF) and the SERVQUAL approach (Cronin and Taylor, 1994).

LSQ and LSP Performance

LSQ has been developed and studied by many researchers over the years, but the most widely recognised research was conducted by Mentzer et al. (2001), Grant (2004) and Rafiq and Jaafar (2007). They all proposed that LSQ consisted not only of the physical distribution aspects of services, but also included other customer service elements. To make clear the definition of LSQ for this study, LSQ is defined based on the study of Mentzer et al. (2001) as the customer's perception of LSQ which comprises order release quantities; ordering procedures; order accuracy; order condition; order quality; timeliness; personnel contact quality, information quality, and order discrepancy handling.

Several LSP-LSQ studies have been conducted (Mentzer et al., 1999; Wilding and Juriado, 2004; Rafele, 2004; Aktas and Ulengin, 2005; Rafiq and Jaafar, 2007; Banomyong and Supatn, 2011), but there is a lack of studies investigating the performance of an LSP's LSQ. Only nine items or variables of logistics service quality within the 20 articles reviewed in this study, either in discussions or as a result of empirical testing are considered (Chaisurayakarn et al., 2013; 2014). These items are Information Quality, Order Procedures, Order Release Quantities, Timeliness, Order Accuracy, Order Quality, Order Condition, Order Discrepancy Handling, and Personnel Contact Quality.

GSQ and LSP Performance

Environmental performance measurement can be a critical aspect in LSPs' environmental offering (Björklund et al., 2012). However, to be considered as having regards for environmental sustainability, companies need to focus on these bottom lines: social, economic, and environment (Elkington, 1998). Only nine items or variables of green service quality within the 20 articles

reviewed in this study, either in discussions or as a result of empirical testing, are considered as shown in Table 1.

Green service quality	Explanation
Alternative fuels	Bio fuels and renewable energy
Vehicle technologies	Replace existing fleets with modern vehicles that cause less emissions
Modal choice	Shift from road to rail; intermodal solutions
Behavioural aspects	Eco driving; driving behaviour which focuses on decreasing fuel consumption
Logistics system design	More direct transport; continuous improvement of distribution networks; decrease average handling factor and average length of haul
Transport management	Well planned routes; high fill-rates
Choice of partners	Cooperation with customers to help them reach their own environmental targets; choosing environmentally conscious transport providers
Environmental management system (EMS)	ISO14001, EMS certification
Externalities	CO_2 reports; energy consumption from external transports; energy consumption in warehouse; greenhouse gas emissions; safety for both driver/staff and other people

Table 1: Green Service Quality Items (Elkington, 1998; Martinsen & Bjorklund, 2012)

Thai Government's Logistics Performance Index (TLPI)

The World Bank Logistics Performance Index (LPI) has been set up for international trade by measuring the perceptions of foreign companies as either importers or exporters. That means this LPI doesn't represent the logistics status of countries at a micro level, it shows logistics performance status at a macro level. However, the Thai Ministry of Industry has established a Thai LPI (TLPI) specifically for the micro Thai context by focusing on nine logistics activities in the three dimensions of cost, time, and reliability to support and deploy their logistics master plan into action. The TLPI was informed by Banomyong and Supatn (2011), Grant (2004), and Grant et al. (2006) to establish the importance of academic theory to practice and policy. However, not all of the TLPI measures are of equal importance. Only nine TLPIs reflect overall logistics performance and as this thesis is focusing on road transport in Thailand, only five TLPIs have been used as the logistics performance index for this research: transport costs per sales ratio; average order cycle time; average delivery cycle time; DIFOT; and returned rates as shown in Table 2.

	Thai Government's Logistics Performance Index (TLPI)		
	Cost	Time	Reliability
1	*Transport costs per sales ratio (1)*	*Average order cycle time (2)*	*DIFOT (Delivered In-full On-time) (4)*
2	Warehouse costs per sales ratio	*Average delivery cycle time (3)*	Forecast accuracy
3	Inventory costs per sales ratio	Average inventory day (day)	*Returned rates (5)*

Table 2: TLPI (Thailand Ministry of Industry's Department of Primary Industries and Mines, 2010)

Methodology

This empirical study investigated evidence of these green/environmental issues in a specific logistics service context. Methodological triangulation was used to validate the findings of the quantitative research (questionnaire survey) with qualitative research (semi-structured and structured interviews). A three-phase methodological approach was employed to investigate how a Thai logistics service provider's overall performance is dependent upon LSQ and GSQ. Twenty-eight GSQ variables and twenty-four LSQ variables for investigation are developed from an extensive literature

review of 40 articles on green/environmental logistics, logistics service quality and performance obtained from the major logistics and marketing journal. Moreover, five Thai LPI variables shown in performance construct are developed from the Thailand Logistics Performance Index (Chaisurayakarn et al., 2013; 2014). The proposed conceptual model for the study addressed the three key constructs of GSQ, LSQ and Performance as shown in Figure 1.

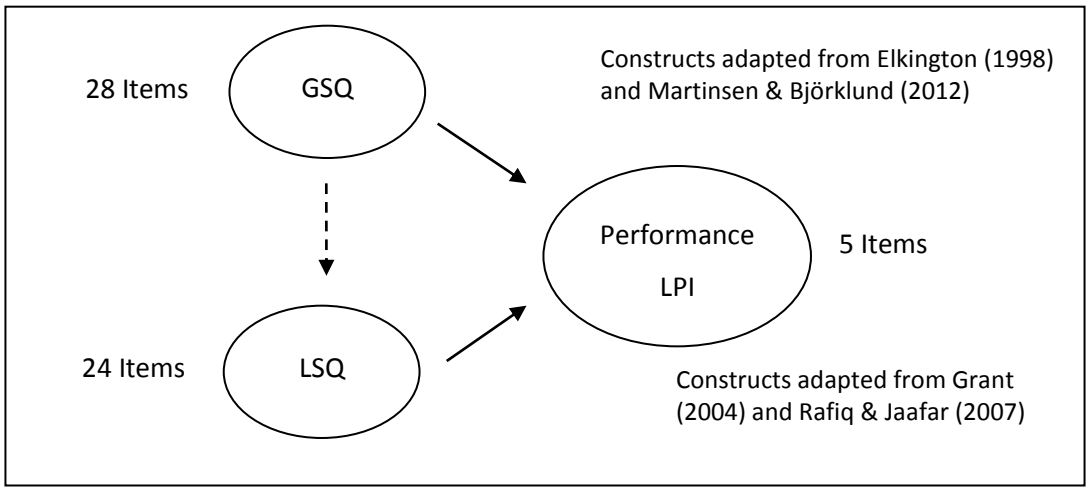

Figure 1: Proposed Conceptual Model

Findings

Preliminary interviews supplemented the literature to explore what GSQ and LSQ competencies are and also the importance of GSQ competencies related to LSQ competencies in the context of Thai LSPs what meaningful, logistics industry-recognised green service quality competencies are. Subsequently, a questionnaire survey was conducted to validate and confirm these competencies with two groups of respondents: LSPs providing transportation services and LSPs customers in five main industries: Food; Textile; Electronics and Parts; Automobile and Parts; and Plastic industries. Both two group respondents are located or provide their service within the areas of Bangkok, Central and Eastern Thailand.

Exploratory Factor Analysis

Exploratory factor analysis (EFA) derived significant constructs that consists primary of GSQ and LSQ variables. Regarding to two groups of respondents, EFA is used to analyse for separate in each respondent group and also combine group to consider what are difference and similarity. It is found that either the result from separate group or combine group, the number of factors and also variables in each factor are similar. The EFA result from combine group, thus, is used as a representative to explain in both GSQ and LSQ competencies including the importance of GSQ competencies relate to LSQ in the context of Thai LSPs. Considering only GSQ variables, 25 valid measures of GSQ which factor loading are greater than 0.4 (Hair et al., 2010) loaded on five factors (shown in Table 3 on the next page). Reliability is assessed by Cronbach's alpha. Value is normally between the range of 0 and 1 and generally agreed is greater than 0.7. However, it may decrease to 0.6 in the exploratory research as same as this study uses this value (Hair et al., 2010).

Coefficient alpha scores for the five factors are also presented in Table 3. Factors 6 and 7 do not have an alpha score since they consist of only two measures – the inter-item correlation is shown instead. Scores for factors 1, 2, 3, 4, 5 and 7 were .929, .877, .860, .813, .666 and .736 respectively. Since they greatly meet or exceed 0.60 they were considered internally reliable as noted above and thus are considered to underlie constructs of green service quality and logistics service quality for this sample. The correlation for factor 6 did not meet the 0.60 threshold and was deleted. Table 4 presents revised factor (or construct) names and variable codes and names resulting from the EFA.

Factor	Factor Loading	h^2	Initial Eigenvalue	Cumulative Variance	Alpha
Factor 1: Green Safety, Regulations and Collaboration (GSRC)			13.090	34.4%	.929
GS27 - Externalities - environmental aspects changes	.764	.686			
GS28 - Externalities - LSP stakeholders'' green awareness	.748	.617			
GS12 - Behavioural aspects - CO_2 emission	.742	.656			
GS26 - Externalities - CO_2 emission from awareness of LSP stakeholders	.732	.717			
GS4 - Vehicle technology - CO_2 emissions	.686	.591			
GS20 - Partners choice - environmental targets achievement	.685	.597			
GS25 - EMS - operational efficiency	.684	.537			
GS10 - Behavioural aspects - staff fully trained on environment and safety	.663	.560			
GS21 - Partners choice - environmental collaboration enhancement	.661	.577			
GS11 - Behavioural aspects - accident rate reduction	.636	.608			
GS13 - Logistics system design - distribution network improvement	.613	.546			
GS19 - Partners choice - knowledge sharing	.600	.543			
GS24 - EMS - environmental regulations	.544	.535			
GS16 - Transport management - high fill rates	.424	.496			
GS17 - Transport management - product consolidation	.423	.484			
Factor 2: Time and Services (TS)			3.470	43.6%	.877
LS23 - Timeliness - placing & receiving time shortly	.746	.638			
LS21 - Order discrepancy handling - satisfaction on the quality reports	.712	.650			
LS24 - Timeliness - back-order is short	.686	.656			
LS22 - Timeliness - arrive on the date promised	.681	.666			
LS20 - Order discrepancy handling - reporting process adequately	.652	.590			
LS19 - Order discrepancy handling - satisfactory	.623	.576			
Factor 3: Order Service Quality (OSQ)			1.695	48.0%	.860
LS4 - Order accuracy - wrong quantities	.742	.688			
LS3 - Order accuracy - wrong items	.700	.728			
LS6 - Order quality - substitute items	.671	.615			
LS5 - Order accuracy - substituted items	.663	.602			
LS2 - Order release quantities - failure to deliver required quantities	.615	.673			
Factor 4: Order Procedures (OP)			1.334	51.6%	.813
LS15 - Ordering procedures - easy to use	.813	.763			
LS16 - Ordering procedures - flexible	.749	.763			
LS14 - Ordering procedures - effective	.707	.710			
Factor 5: Green Technology and Transport Management (GTTM)			1.323	55.0%	.666
GS6 - Vehicle technology - fixed cost	.623	.535			
GS7 - Transport modal choice - product availability	.589	.462			
GS8 - Transport modal choice - product size flexibility	.568	.520			
GS9 - Transport modal choice - transport cost	.509	.492			
GS3 - Alternative fuel - product availability	.459	.398			
Factor 6: Green Cost and In-process Waste (GCW)			1.143	58.0%	**.413**
GS23 - EMS - waste decrease within operations & processes	.667	.645			
GS1 - Alternative fuel - fuel cost	.544	.537			

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Factor 7: Information Quality (IQ)			1.048	60.8%	.736
LS11 - Information quality - accurate	.693	.754			
LS12 - Information quality - adequate	.689	.748			
KMO measure	.936				
Bartlett's X^2	8693.06				

Table 3: Exploratory Factor Analysis for GSQ-LSQ Variables

Construct	Initial Variable	Revised Variable	Variable's Name
Green Safety, Regulations and Collaboration (GSRC)	GS-27	GSRC1	Environmental aspects changes
	GS-28	GSRC2	LSP stakeholders'' green awareness
	GS-12	GSRC3	CO_2 emission by behavioural aspects
	GS-26	GSRC4	CO_2 emission from awareness of LSP stakeholders
	GS-4	GSRC5	CO_2 emissions by vehicle technology
	GS-20	GSRC6	Environmental targets achievement
	GS-25	GSRC7	Operational efficiency
	GS-10	GSRC8	Staff fully trained on environment and safety
	GS-21	GSRC9	Environmental collaboration enhancement
	GS-11	GSRC10	Accident rate reduction
	GS-13	GSRC11	Distribution network improvement
	GS-19	GSRC12	Knowledge sharing on environmental
	GS-24	GSRC13	Environmental regulations
	GS-16	GSRC14	High fill rates by transport management
	GS-17	GSRC15	Product consolidation by transport management
Time and Services (TS)	LS-23	TS1	Placing & receiving time shortly
	LS-21	TS2	Satisfaction on the quality reports
	LS-24	TS3	Back-order is short
	LS-22	TS4	Arrive on the date promised
	LS-20	TS5	Reporting process adequately
	LS-19	TS6	Order discrepancy handling – satisfactory
Order Service Quality (OSQ)	LS-4	OSQ1	Right quantities
	LS-3	OSQ2	Right items
	LS-6	OSQ3	Order quality – substitute items
	LS-5	OSQ4	Right items on substituted
	LS-2	OSQ5	Failure to deliver required quantities
Order Procedures (OP)	LS-15	OP1	Ordering procedures – easy to use
	LS-16	OP2	Ordering procedures – flexible
	LS-14	OP3	Ordering procedures – effective
Green Technology and Transport Management (GTTM)	GS-6	GTTM1	Fixed cost by vehicle technology
	GS-7	GTTM2	Product availability by transport modal choice
	GS-8	GTTM3	Product size flexibility by transport modal choice
	GS-9	GTTM4	Transport modal choice – transport cost
	GS-3	GTTM5	Product availability by alternative fuel
Green Cost and In-process Waste (GCW)	GS-23	GCW1	Waste decrease within operations and processes
	GS-1	GCW2	Fuel cost by alternative fuel
Information Quality (IQ)	LS-11	IQ1	Information quality – accurate
	LS-12	IQ2	Information quality – adequate

Table 4: Names of Construct and Variable with EFA

In the questionnaire survey instrument the GSQ construct consisted of nine dimensions or constructs, however following validation of green technology and transport management (GTTM), and green cost and in-process waste (GCW) were removed from further analysis due to a low correlation or loading relative to other constructs that impacted the validation of the GSQ construct.

Additionally, the dimensions of information quality (IQ), and time and services (TS) loaded on a single construct and thus they were merged into one second-order construct named time and services (TS). Standardised loading, R2, and measures of composite reliability and average variance extracted (AVE) were recalculated for the revised and smaller LSQ and GSQ constructs. The values are shown in Table 5 and better meet the assessment thresholds, particularly the AVE threshold. Thus, the remaining 28 manifest variables and four second-order constructs of GSRC, TS, OSQ, and OP all exhibit unidimensionality, reliability and convergent validity (Hair et al., 2010).

Variable	Loading (>.50)	R^2 (<.25)	Alpha (>.70)	CR (>.70)	AVE (>.40)
GSRC1 Environmental aspects changes	.78	.579	.926	0.919	0.468
GSRC2 LSP stakeholders' green awareness	.74	.523			
GSRC3 CO_2 emission by behavioural aspects	.76	.545			
GSRC4 CO_2 emission from awareness of LSP stakeholders	.71	.462			
GSRC5 CO_2 emissions by vehicle technology	.75	.545			
GSRC6 Environmental targets achievement	.70	.489			
GSRC7 Operational efficiency	.51	.503			
GSRC8 Staff fully trained on environment and safety	.72	.455			
GSRC9 Environmental collaboration enhancement	.68	.468			
GSRC10 Accident rate reduction	.69	.435			
GSRC11 Distribution network improvement	.65	.407			
GSRC12 Knowledge sharing on environmental	.63	.402			
GSRC13 Environmental regulations	.61	.387			
TS1 Placing & receiving time shortly	.72	.456	.882	0.859	0.423
TS2 Satisfaction on the quality reports	.78	.593			
TS3 Back-order is short	.75	.495			
TS4 Arrive on the date promised	.77	.574			
TS5 Reporting process adequately	.72	.484			
TS6 Order discrepancy handling – satisfactory	.73	.492			
IQ1 Information quality - accurate	.60	.352			
IQ2 Information quality - adequate	.63	.333			
OSQ1 Right quantities	.82	.680	.823	0.821	0.540
OSQ2 Right items	.82	.703			
OSQ3 Order quality - substitute items	.65	.332			
OSQ4 Right items on substituted	.73	.445			
OP1 Ordering procedures - easy to use	.78	.589	.813	0.814	0.593
OP2 Ordering procedures - flexible	.79	.607			
OP3 Ordering procedures - effective	.81	.583			

Table 5: Final Measurement Model Assessment with CFA

The three hypotheses pertaining to structural relationships in the conceptual main study model presented as Figure 1 were tested using structural equation modelling. GSRC was the resulting but second-order construct of GSQ, thus GSRC was used as the primary construct to assess the direct effect LSQ and TLPI. GSRC positively affected LSQ with a coefficient of 0.75, LSQ positively affected TLPI with a coefficient of 0.48, but the effect of GSRC on TLPI was -0.39. Hence, hypotheses 2 and 3 were supported while hypothesis 1 was not supported. The effect of the LSQ constructs on TLPI directly and indirectly through GSRC was also tested however the results were not as robust. Figure 2 provides the final structural model and measures.

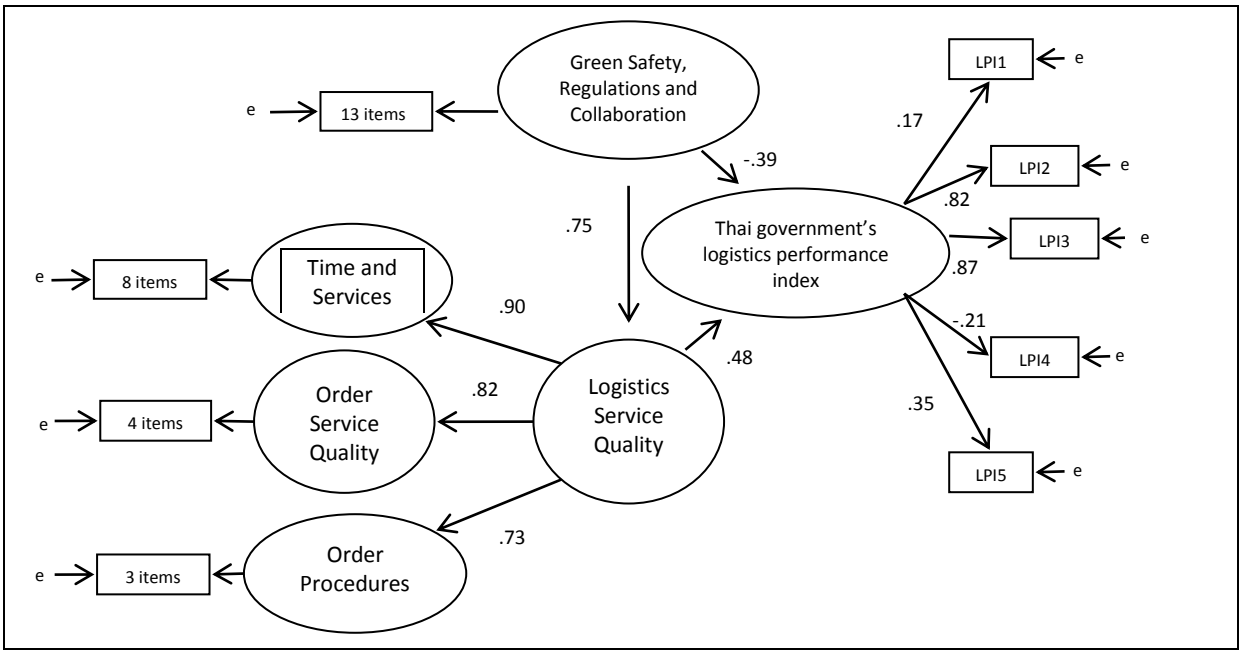

Figure 2: Final Structural Model and Measures

Conclusions

Environmental or green issues in logistics service offerings have attracted much managerial attention in the logistics industry sector. One important opportunity is for logistics service providers (LSPs) to deliver their service offerings to customers in more environmentally friendly ways. While this topic has been fairly well-researched in UK and European settings, it remains under-researched in developing countries such as Thailand.

A practical contribution for both LSPs and their customers is an understanding of how LSPs can focus on GSQ to perform better, which is important to customers, and hence better compete with rivals. Thirteen GSQ competencies and 15 LSQ competencies were confirmed. These 13 GSRC competencies indirectly affect TLPI through LSQ competencies, which represent the tangible and reliability dimensions of the service quality (Parasuraman et al., 1988) and six logistics service attributes of order quality, timeliness, order procedure, order accuracy, information quality, and order discrepancy handling (Mentzer et al., 2001). Further, the use of GSRC competencies provide a more positive result when moderated through LSQ than the effect of LSQ alone on TLPI. Hence, it is better for firms to incorporate GSRC competencies as opposed to not doing so.

The academic and practitioner literature is replete with discussions about added-value benefits for service providers from serving with superior customer service. Customers who are satisfied when their needs are met develop loyalty to their service providers that translates into additional revenue and profit. However, the cost of providing extra customer service features, in particular green issues, not desired by customers can outweigh the benefits received by providers. The findings of this thesis confirm service providers should first determine which green service competencies and logistics service competency features their customers require, and then provide only these service competency features. This process should enhance an LSP's ability to satisfactorily manage cost trade-off with service quality.

References

- Aktas, E. & Ulengin, F. (2005), "Outsourcing logistics activities in Turkey", *Journal of Enterprise Information Management,* Vol 18, pp 316-329.
- Banomyong, R. & Supatn, N. (2011), "Selecting logistics providers in Thailand: a shippers' perspective", *European Journal of Marketing,* Vol 45, pp 419-437.

- Björklund, M., Martinsen, U. & Abrahamsson, M. (2012), "Performance measurements in the greening of supply chains", *International Journal of Supply Chain Management*, Vol 1, Issue 1, pp 29-39.
- Chaisurayakarn, S., Grant, D.B. & Talas, R. (2013), "Investigating Green Logistics Service Quality Competencies in Thailand", *Logistics Research Network (LRN) Conference,* Aston University, September.
- Chaisurayakarn, S., Grant, D.B. & Talas, R. (2014), "The Impact of Green Logistics Service Quality on Logistics Service Provider Performance", *Logistics Research Network (LRN) Conference,* University of Hudderfields, September.
- Cronin, J. & Taylor, S. (1994), "SERVPERF versus SERVQUAL: reconciling performance based and perceptions minus expectations measurement of service quality", *Journal of Marketing*, Vol 58 pp 125-131.
- Elkington, J. (1998), "Accounting for the triple bottom line", *Measuring Business Excellence,* Vol 2, pp 18-22.
- Grant, D.B. (2004), "UK and US management styles in logistics: Different strokes for different folks?" *International Journal of Logistics: Research and Applications,* Vol 7 pp 181-197.
- Grant, D.B., Lambert, D.M., Stock, J.R. & Ellram, L.M. (2006), *Fundamentals of Logistics Management,* Maidenhead: McGraw-Hill.
- Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E. (2010) *Multivariate Data Analysis: A Global Perspective,* New Jersey: Pearson Education Inc.
- Khan, O. & Burnes, B. (2007), "Risk and supply chain management: Creating a research agenda", *International Journal of Logistics Management*, Vol 18 pp 197-216.
- Martinsen, U. & Björlund, M. (2012), "Matches and gaps in the green logistics market", *International Journal of Physical Distribution & Logistics Management,* Vol 42 pp 562-583.
- Mentzer, J., Flint, D. & Hult, T. (2001), "Logistics service quality as a segment-customized process", *Journal of Marketing*, Vol 65 Issue 4, pp 82-104.
- Mentzer, J., Flint, D. & Kent, J. (1999), "Developing A Logistics Service Quality Scale", *Journal of Business Logistics*, Vol 20 pp 9-32.
- Mentzer, J., Gomes, R. & Krapfel, R. (1989), "Physical Distribution Service: A Fundamental Marketing Concept?", *Journal of the Academy of Marketing Science*, Vol 17 pp 53-62.
- Parasuraman, A., Berry, L. & Zeithaml, V. (1988), "SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality", *Journal of Retailing*, Vol 64 Issue 1, pp 12-40.
- Rafele, C. (2004), "Logistics service measurement: A reference framework", *Journal of Manufacturing Technology Management,* Vol 15 pp 280-290.
- Rafiq, M. & Jaafar, H. (2007), "Measuring customers' perceptions of logistics service quality of 3PL service providers", *Journal of Business Logistics,* Vol 28 pp 159-175.
- Thailand Ministry of Industry's Department of Primary Industries and Mines (2010), *Thailand Logistics Performance Index*, Bangkok.
- Wilding, R. & Juriado, R. (2004), "Customer perceptions on logistics outsourcing in the European consumer goods industry", *International Journal of Physical Distribution & Logistics Management,* Vol 34 pp 628-644.