THE IMPACT OF GREEN LOGISTICS SERVICE QUALITY ON 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 report on an ongoing study of the importance and relationship of green service quality (GSQ) competencies relative to logistics service quality (LSQ) competencies in the context of 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 but the recognised research was done by Mentzer et al. (1989). They proposed that LSQ consisted not only in the physical distribution aspects of services, but also included other customer service elements. Mentzer et al. (1989) proposed that the logistics service quality scale should be composed of nine dimensions as follows information quality, ordering procedure, ordering release quantity, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personnel contact quality.

Several LSP-LSQ studies have been conducted (Millen et al., 1997; Mentzer et al., 1999; Wilding & Juriado, 2004; Rafele, 2004; Aktas & Ulengin, 2005; Rafiq & Jaafar, 2007; Banomyong & 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). 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)

Methodology

This empirical study found evidence of these green/environmental issues in a specific logistics service context. The paper is based on empirical data collected via a survey delivered to logistics managers working in LSPs and LSP customers companies. An Interview and a survey were used as appropriate methods for this study as discussed at the LRN in 2013 (Chaisurayakarn et al., 2013).

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). The main study model addresses three key constructs as GSQ, LSQ and Performance shown in Figure 1.
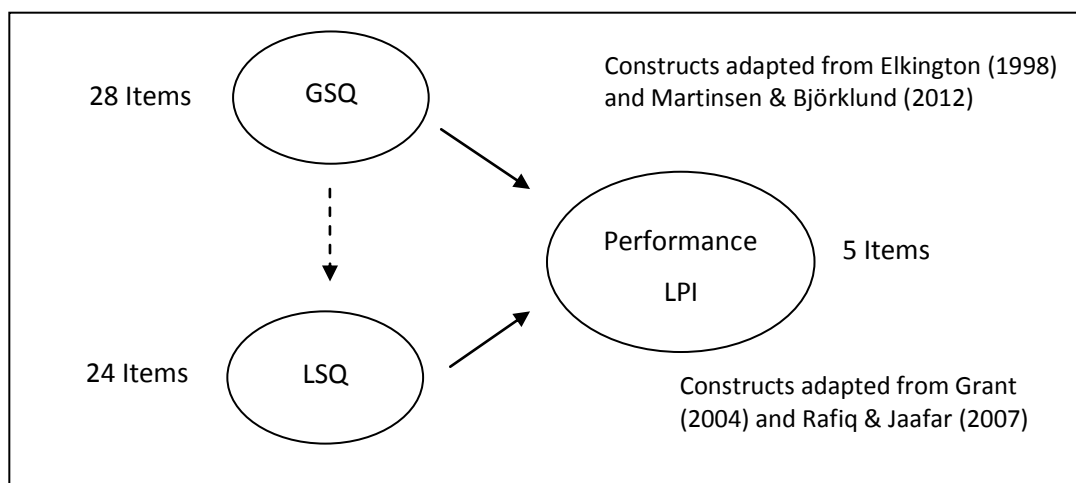

Figure 1: Proposed Main Study Model

Findings

The questionnaire survey is selected in this stage to find what are GSQ and LSQ competencies and also the importance of GSQ competencies relate to LSQ competencies in the context of Thai LSPs.

After interview step to explore what meaningful, logistics industry-recognised green service quality competencies are, the survey is conducted in 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.

Differences of the importance of GSQ and LSQ in the Perceptions of LSPs and LSP Customers
The mean and standard deviations from the perception of LSPs and LSP customers to the importance of GSQ and LSQ variables are calculated for each variable. The LSPs-GSQ perception sum of means of 163.3 marginally exceeded the LSP customers-GSQ perception sum of means of 160.88 as shown in Table 2. The +2.5 difference indicates LSPs' perceptions in GSQ importance exceeded LSP customers' perceptions. Seven variables have absolute t-test values greater than 1.96 that indicate significant differences between means and all variables have positive t-test values. That means LSPs exceed perceptions for these variables and respondents rate the importance level of GSQ variables.

GSQ variables	LSPs Mean	σ	Customers Mean	σ	t-test	Sig (2 tail)
GS1 - Alternative fuel - fuel cost	6.11	.757	5.89	.794	2.905	.004
GS2 - Alternative fuel – corporate image improvement	5.83	.843	5.53	1.106	3.074	.002
GS15 - Logistics system design - product availability	5.77	.798	5.55	.800	2.761	.006
GS18 - Transport management - back haul reduction	6.14	.804	5.97	.854	2.124	.034
GS20 - Partners choice - environmental targets achievement	5.90	1.021	5.68	1.060	2.266	.024
GS21 - Partners choice - environmental collaboration enhancement	5.91	.908	5.68	1.014	2.497	.013
GS23 - EMS - waste decrease within operations & processes	6.13	.824	5.92	.931	2.437	.015
Sum of Means (all GSQ items)	163.30		160.88			

Table 2: Difference of Green Service Quality Variables in the Perceptions of LSPs and LSP Customers

The LSP-LSQ perception sum of means of 148.71 marginally exceeded the LSP customer-GSQ perception sum of means of 146.91 as shown in Table 3. The +1.8 difference indicates LSPs' perceptions in LSQ importance exceeded LSP customers' perceptions. Three variables have absolute t-test values greater than 1.96 that indicate significant differences between means and all variables have positive t-test values. That means LSPs exceed perceptions for these variables and respondents rate the importance level of LSQ variables.

LSQ Variables	LSPs Mean	σ	Customers Mean	σ	t-test	Sig (2 tail)
LS1 - Order release quantities - flexibility to deliver	6.06	.755	5.86	.814	2.602	.010
LS9 - Personnel contact quality - problem resolved	6.11	.898	5.93	.884	2.083	.038
LS10 - Personnel contact quality - knowledge/experience	6.19	.794	5.97	.911	2.611	.009
Sum of Means (all LSQ items)	148.71		146.96			

Table 3: Difference of Logistics Service Quality Variables in the Perceptions of LSPs and LSP Customers

However, when looking at the importance of GSQ competencies related to LSP competencies, it seems that both LSPs and LSP customers perceive the importance of these two main competencies.

LSP customers, more than LSPs, perceive GSQ is important to LSP performance. However, both similarly perceive the importance of LSQ to LSP performance. In summary, LSPs respondents marginally report perceptions exceed LSP customers for the important variables. However, they report perceptions less LSP customer for the importance of GSQ competencies relate to LSQ competencies in Thai LSPs.

Variables	LSPs Mean	σ	Customers Mean	σ	t-test	Sig (2 tail)
Importance of GSQ relate to LSQ	5.46	1.406	5.81	1.136	-2.844	.005

Table 4: Importance of GSQ relate to LSP in the Perceptions of LSPs and LSP Customers

Exploratory Factor Analysis
Exploratory factor analysis (EFA) derives 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 5). 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).

Factor	Factor Loading	h^2	Initial Eigenvalues	Cumulative Variance	Alpha
Factor 1:			9.554	38.218%	0.886
GS20 - Partners choice - environmental targets achievement	.720	.640			
GS27 - Externalities - environmental aspects changes	.698	.678			
GS19 - Partners choice - knowledge sharing	.694	.627			
GS26 - Externalities - CO_2 emission from awareness of LSP stakeholders	.688	.663			
GS21 - Partners choice - back haul reduction	.633	.587			
GS28 - Externalities - LSP stakeholders' green awareness	.617	.615			
GS25 - EMS - operational efficiency	.602	.548			
Factor 2:			1.683	44.950%	.857
GS11 - Behavioural aspects - accident rate reduction	.675	.639			
GS10 - Behavioural aspects - staff fully trained on environment and safety	.628	.611			
GS4 - Vehicle technology - CO_2 emissions	.580	.674			
GS12 - Behavioural aspects - CO_2 emission	.574	.644			
GS13 - Logistics system design - distribution network improvement	.564	.541			
GS14 - Logistics system design - lead times reduction	.469	.424			
Factor 3:			1.341	50.316%	.732
GS23 - EMS - waste decrease within operations & processes	.748	.656			
GS18 - Transport management - back haul reduction	.672	.519			
GS1 - Alternative fuel - fuel cost	.550	.502			
GS24 - EMS - environmental regulations	.523	.585			
GS22 - Partners choice - back haul reduction	.456	.448			
Factor 4:			1.067	54.584%	.654
GS2 - Alternative fuel - corporate image improvement	.735	.639			
GS3 - Alternative fuel - product availability	.689	.586			

Factor	Factor Loading	h^2	Initial Eigenvalues	Cumulative Variance	Alpha
GS5 - Technology innovation	.543	.601			
Factor 5:			1.039	58.741%	.639
GS8 - Transport modal choice - product size flexibility	.646	.585			
GS7 - Transport modal choice - product availability	.633	.524			
GS9 - Transport modal choice - transport cost	.608	.610			
GS6 - Vehicle technology - fixed cost	.473	.539			
KMO measure	.939				
Bartlett's X²	4831.86				

Table 5: Exploratory Factor Analysis for GSQ Variables

Moreover, analysing the LSQ variables, 23 valid measures of LSQ which factor loading are greater than 0.4 (Hair et al., 2010) loaded on four factors (shown in Table 6). Reliability assessed by Cronbach's alpha is quite good as all factors values greatly meet or exceed 0.60. Thus, factor 1, 2, 3 and 4 are considered to underline constructs of logistics service quality for this sample; only the variable LS1 is deleted in the EFA process.

Factor	Factor Loading	h^2	Initial Eigenvalues	Cumulative Variance	Alpha
Factor 1:			10.617	46.163%	.902
LS21 - Order discrepancy handling - satisfaction on the quality reports	.731	.655			
LS23 - Timeliness - placing & receiving time shortly	.727	.606			
LS22 - Timeliness - arrive on the date promised	.700	.674			
LS20 - Order discrepancy handling - reporting process adequately	.682	.594			
LS24 - Timeliness - back-order is short	.681	.607			
LS18 - Order condition - rarely damage from carrier	.625	.625			
LS19 - Order discrepancy handling - satisfactory	.625	.561			
LS17 - Order condition - undamaged product from warehouse	.511	.533			
Factor 2:			1.458	52.503%	.866
LS3 - Order accuracy - wrong items	.786	.710			
LS4 - Order accuracy - wrong quantities	.742	.722			
LS5 - Order accuracy - substituted items	.690	.607			
LS2 - Order release quantities - failure to deliver required quantities	.677	.690			
LS6 - Order quality - substitute items	.647	.549			
LS7 - Order quality - product specification	.429	.463			
Factor 3:			1.253	57.951%	.864
LS11 - Information quality - accurate	.811	.750			
LS12 - Information quality - adequate	.770	.699			
LS13 - Information quality - complete	.579	.559			
LS10 - Personnel contact quality - knowledge/experience	.569	.565			
LS9 - Personnel contact quality - problem resolved	.530	.579			
LS8 - Personnel contact quality - understand situation	.509	.496			
Factor 4:			1.081	62.652%	.813
LS14 - Ordering procedures - effective	.834	.770			
LS15 - Ordering procedures - easy to use	.772	.715			
LS16 - Ordering procedures - flexible	.706	.681			
KMO measure	.944				
Bartlett's X²	5790.75				

Table 6: Exploratory Factor Analysis for LSQ Variables

As mentioned in Table 4, LSP customers, more than LSPs, perceive GSQ is important to LSP performance. However, both similarly perceive the importance of LSQ to LSP performance. The

model in Figure 1 re-undertook an EFA of all 52 GSQ and LSQ variables to investigate other relationships amongst them that may indicate different constructs. The EFA result is shown in Table 7 and is statistically significant. The first two-order factors of EFA GSQ variables are reduced to one construct (factor 1) that share almost all of the resultant variables in Table 5. The variable GS2, GS5, GS14, GS22, LS7-10, LS13 and LS17-18 are deleted in the EFA process as same as the variable GS16-17 are added. Although Cronbach's alpha of factor 6 is smaller than 0.6, these two variables GS23 and GS1 are in the CFA process which will be the next step of analysis. Factor 1, 5 and 6 are considered to underline constructs of green service quality whereas factor 2, 3, 4 and 7 are considered to underline constructs of logistics service quality for this sample.

Factor	Factor Loading	h^2	Initial Eigenvalues	Cumulative Variance	Alpha
Factor 1:			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:			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:			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:			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:			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:			1.143	58.0%	.485
GS23 - EMS - waste decrease within operations & processes	.667	.645			
GS1 - Alternative fuel - fuel cost	.544	.537			
Factor 7:			1.048	60.8%	.848
LS11 - Information quality - accurate	.693	.754			
LS12 - Information quality - adequate	.689	.748			
KMO measure	.936				
Bartlett's X^2	8693.06				

Table 7: Exploratory Factor Analysis for GSQ-LSQ Variables

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. Similarities and differences in expectations and perceptions of the main relationships also provide guidance for LSPs to reduce their LSQ gap with customers and increase their capabilities to achieve higher customer satisfaction.

From the EFA result, seven factors from GSQ-LSQ variables are statistically sound and reliable. Three factors (constructs) from GSQ competencies and four factors (constructs) from LSQ competencies represent GSQ and LSQ competencies that have the importance to LSPs' performance in Thailand. A limitation is that this paper only reports preliminary findings of an ongoing study. The next step of this research will assign a name or label affecting to the meaning of factors (Hair et al., 2010). Confirmatory (CFA) and structural equation modelling (SEM) will be conducted in the next step.

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