

AN INVESTIGATION INTO THE COMPETENCE AND QUALITY OF THE LOGISTICS SERVICES DIMENSION OF THE LOGISTICS PERFORMANCE INDEX (LPI) IN SRI LANKA

Sri Lanka Journal of
Economic Research
Volume 13(1) December 2025
SLJER 13.01.03: pp. 45-64
Sri Lanka Forum of
University Economists
DOI: <https://doi.org/10.4038/sljer.v13i1.252>

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Abstract

Logistics Performance Index (LPI) helps countries to identify logistics bottlenecks and to seek remedies. LPI is measured in terms of six key dimensions, among which “Competence and Quality of Logistics Services” is a vital factor determining international competitiveness. Sri Lanka’s logistics performance in terms of the above dimension has been declining over the past years, and this has given rise to the importance of exploring the factors contributing to such low performance. This study aimed to critically analyse this dimension of “Competence and Quality of Logistics Services” in the Sri Lankan context, and to identify the factors contributing to it using Exploratory Factor Analysis (EFA). The results revealed that the twenty-four variables used in the analysis were extracted into seven factors, and these seven factors would explain almost 60% of the total variance of the model. According to the findings of the study, the Sri Lankan logistics sector should give higher prominence to factors such as logistics inputs, regulatory compliance, and freight mode, which appear to have a higher contribution to the logistics competence dimension, while collaboration, port efficiency, infrastructure, and stakeholders indicate less significant contributions towards logistics competence in Sri Lanka. Thus, reforms at the industry and policy-level focusing on the Competence and Quality of Logistics Services dimension appear imperative for Sri Lanka to enhance the country’s LPI ranking.

JEL: L91, L87, L93, L23, C38

Keywords: Logistics Performance Index, Competence and Quality, Logistics Services, Logistics Management, Exploratory Factor Analysis

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INTRODUCTION

The recent performance of Sri Lanka's logistics sector and the trade prospects have highlighted the importance of converting Sri Lanka into a 'Logistics Hub'. As an island situated in proximity to the Indian Ocean, Sri Lanka has always had a competitive advantage in developing itself as a major Logistics Hub in the Asian sub-continent. The strategic location and appropriate environmental conditions have always been advantageous for the Sri Lankan economy, whereas the recent infrastructure development projects have greatly supported the required infrastructure needed for it to become a major Logistics Hub, connecting especially the east-west shipping routes, with the sole objective of facilitating international trade. In this manner, the performance of the logistics sector in Sri Lanka would surely become a decisive factor in capturing the international markets as well as in achieving its development prospects.

When assessing any country's logistics performance in the international sphere, there arises the need for an index of measurement. To evaluate the logistics sector performance of a country and to support the domestic economy in policy making in terms of achieving qualitative logistics services, the World Bank introduced a multi-dimensional evaluation index, the Logistics Performance Index (LPI). It acts as a benchmark for the countries to identify the challenges and opportunities within their logistics sector, and the pathways to improve and develop the sector (The World Bank, 2018). The LPI is built utilising a worldwide survey carried out on companies engaged in goods transport and facilitating trade globally. As highlighted by Arvis, et al. (2018), "The LPI summarizes the logistics performance of a country through six major dimensions: (i) *Customs*: Efficiency of the Customs clearance process, (ii) *Infrastructure*: Quality of trade and transport-related infrastructure, (iii) *International Shipments*: Ease of arranging competitively priced shipments, (iv) *Logistics Competence*: Competence and quality of logistics services, (v) *Tracking and Tracing*: Ability to track and trace consignments, and (vi) *Timeliness*: Frequency with which shipments reach the consignee within the scheduled or expected time".

According to the World Bank (2018), LPI measures the competence and quality of logistics services, and it has two types: International LPI and Domestic LPI. The Domestic LPI evaluates a much more detailed logistics environment, along with constraints, institutional performance, core logistics processes, costs, and time. The International LPI performs from a different angle and evaluates the overall logistics performance with the weighted average of the country's scores on six key dimensions. Therefore, the International LPI illustrates the comparative logistics performance of the countries on a scale from the lowest score of 1 to the highest score of 5.

With relevance to the Sri Lankan logistics sector performance, the overall international LPI score of the country has been worsening since 2007, when the LPI was introduced as per the data released by the World Bank in the biannual report "*Connecting to Compete*:"

Trade Logistics in the Global Economy” published from 2007 to date. In the scorecards given to Sri Lanka, it is obvious that the country’s performance in terms of all the LPI dimensions reached a reasonable position in 2012, but after 2012, it has been declining owing to a number of logistics bottlenecks the country has been facing.

Table 1 summarises the International LPI scores for Sri Lanka in six dimensions and the overall LPI with the corresponding ranks, for the period from 2007 to 2018.

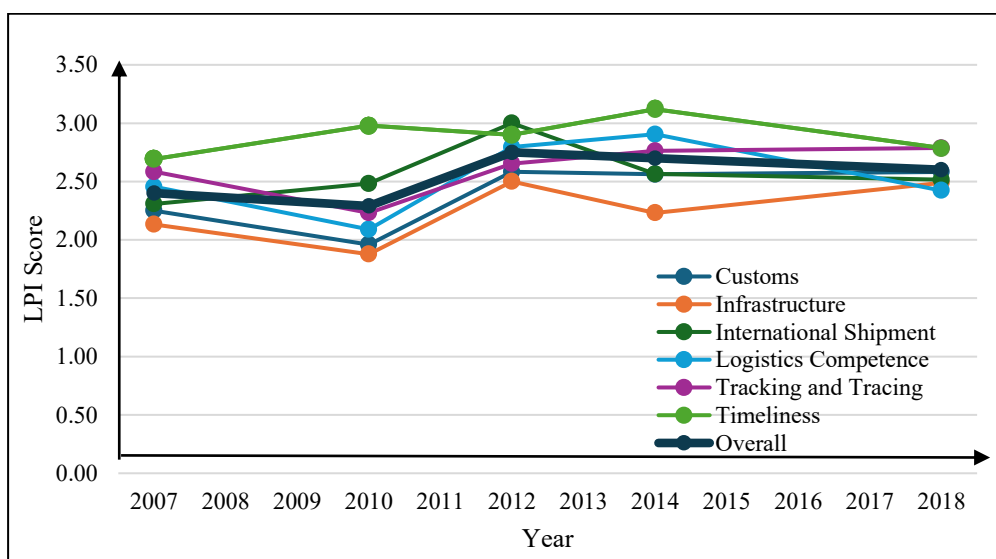
Table 1: International LPI scores of Sri Lanka from 2007 to 2018

Year	2007	2010	2012	2014	2018
Customs	2.25	1.96	2.58	2.56	2.58
Rank	91	143	71	84	79
Infrastructure	2.13	1.88	2.5	2.23	2.49
Rank	105	138	89	126	85
International Shipment	2.31	2.48	3	2.56	2.51
Rank	112	117	50	115	112
Logistics Competence	2.45	2.09	2.8	2.91	2.42
Rank	84	142	68	66	109
Tracking and Tracing	2.58	2.23	2.65	2.76	2.79
Rank	75	142	86	85	78
Timeliness	2.69	2.98	2.9	3.12	2.79
Rank	113	125	110	85	122
Overall LPI	2.4	2.29	2.75	2.7	2.6
Rank	92	137	81	89	94

Source: World Bank LPI Data (2022)

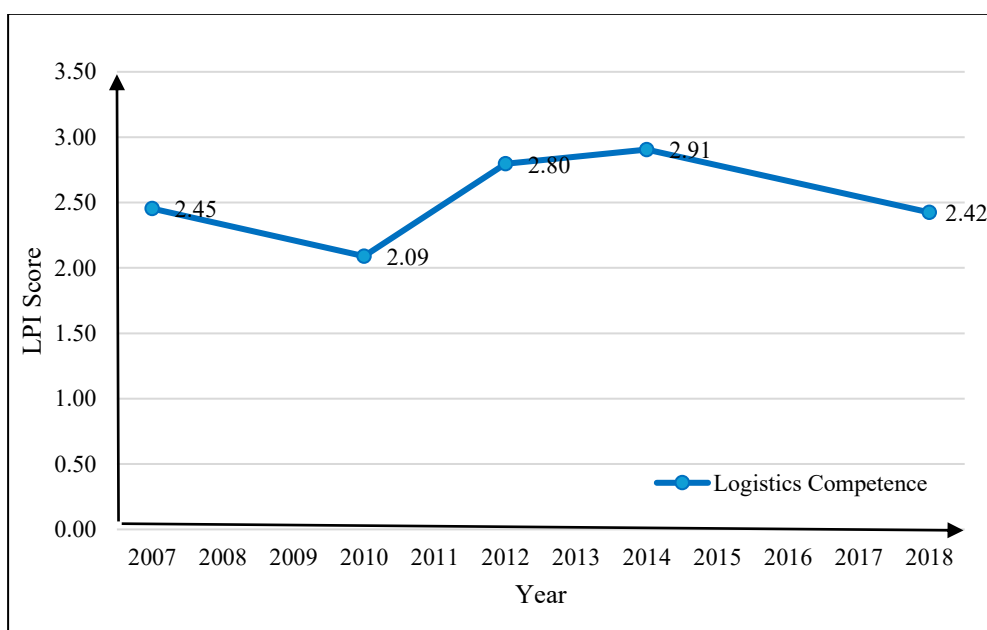
The overall LPI scores and international ranks of Sri Lanka have seen a declining trend from 2012 to 2018, and in 2018, the LPI score further worsened because of declining performance in terms of international shipments, logistics competence, and timeliness dimensions. However, in 2018, the lowest performance was recorded in the logistics competence dimension, since it had the lowest score among the six LPI dimensions.

These patterns of evolution of Sri Lanka’s LPI are graphically depicted in Figure 1.

Figure 1: LPI Scores of Sri Lanka under the Six Dimensions of LPI (2007 – 2018)

Source: World Bank LPI Data (2022)

Apart from 2010, the logistics sector competence and service quality showed reasonable performance in terms of international LPI. However, the LPI rank in terms of logistics service quality and competence has fallen drastically from 66th to 109th, from 2014 to 2018. This dimension shows the largest deviation from its earlier ranking in the LPI country scorecard. This is demonstrated in Figure 2.

Figure 2: LPI Scores of Sri Lanka in Competence and Quality of Logistics Services

Source: World Bank LPI Data (2022)

Abeyratne & Abeysinghe (2017) highlighted that Sri Lanka's progress in logistics service has been slow, as in the case of many countries, calling for reforms to accelerate growth and improve international competitiveness. Besides, Sri Lanka's importance as an international logistics hub has been declining with the drawbacks in development resulting from the ethnic conflicts that lasted until 2009, inward-oriented trade policies, and infrastructure limitations.

Therefore, it is important to investigate the causes of the weak performance of the Sri Lankan logistics sector in terms of the LPI dimension "Competence and Quality of Logistics Services". To find the causes behind such problems, it is first important to identify the determinants or factors that contribute to Sri Lanka's competence and quality of logistics services. Thus, this research investigates the factors influencing the competence and quality of logistics services with reference to the Logistics Performance Index of Sri Lanka.

LITERATURE REVIEW

The Logistics Sector is identified in the modern world as a service sector without which countries and economies cannot effectively function. Lu & Lin (2012) elaborated on two important aspects of Logistics as a service sector: (1) Logistics is one of the largest costs involved in international business. Therefore, it is affected by other economic activities, and (2) Logistics supports many economic activities. Therefore, it is an important aspect of assisting sales of goods and services. Further, logistics services have become an important part of manufacturing globally. Therefore, it is a significant determinant of manufacturing and trade competitiveness (Abeyratne & Abeysinghe, 2017).

Different authors have utilised several criteria to evaluate the 'Logistics Competence', i.e., the competence and quality of logistics services. Banolyong et. al. (2008) proposed several factors to assess the logistics competence for the Association of Southeast Asian Nations (ASEAN). These include; improving logistics communication and trade systems to facilitate the integration of logistics systems, liberalization of the logistics service provision to increase competitive advantage, increasing the investments in enhancing the transport related logistics facilities, encouraging investments in human capital to improve logistics capabilities, providing the logistics service providers the opportunities to engaged in public logistics activities, and developing inter-modal transportation capability especially in container shipping. In the same way, Kauppinen & Lindqvist (2006) emphasised eight major criteria for logistics competence: establishing seamless transport infrastructure, encouraging investments in Research & Development, training and human capital, improving enterprise operation mechanism, amendment of regulations, cost efficiency, sustainability, collaboration, and public-private partnership in logistics services.

On the other hand, the ‘quality’ of logistics services is also discussed by several authors in terms of ‘service quality’ of the logistics sector. Following several scholarly ideas, Kavaliauskienė, Aranskis & Litvinenko (2014) point out that quality is the basis for the functioning of the service sector, and one of the main tasks of the rapidly growing service sector is to ensure the quality of services to the customers. Therefore, as a service sector that is essential for the survival of the supply chains, the logistics sector should deliver quality services to the customers. Considering this, it is worth acknowledging that one of the most important success guarantors of the current logistics business is the quality of the logistics services provided by them, especially knowing that a service is an intangible act or process, and therefore it is closely related to customer satisfaction.

In the Sri Lankan context, there is much evidence to prove that the competence and quality of logistics services dimension in Sri Lanka is not showing better performance, in terms of the LPI rankings. Although the LPI proposes twelve different areas that are assessed in framing this dimension of LPI, there is no particular qualitative evidence to measure and evaluate the logistics performance in terms of these twelve areas. However, various scholars have presented their ideas that go hand in hand with the concept of Competence and Quality of Logistics Services in the Sri Lankan context.

Analysing the gaps in transport networks in Sri Lanka, Kumarage (2012) highlighted that the inefficiencies of the current freight and logistics networks can be observed especially around the commercial capital of Colombo, where warehousing, port activity, railway, and bus passenger activity are interconnected with each other. The cost of congestion, delays, and damage in such an outdated transport centre has not been estimated. Though attention has been paid to taking some of these activities away from the Central Business District, no proposal has been made to determine alternative locations.

According to Jayaratne, Premaratne, and Wijayasiri (2016), the utilisation of railway for freight transportation is minimal in the context of Sri Lanka, despite its high potential to enhance its services both in passenger and freight transportation. Further, they show that the utilisation of rail transport for freight transport has drastically fallen in the past few years. According to Abeyratne & Abeysinghe (2017), on the other hand, the absence of central collection/distribution centres for access by rail results in double handling of cargo, thereby increasing the cost of transporting cargo via rail. Even the lack of rail linkages to new port terminals at the Port of Colombo remains a major drawback in the transport system. All these factors ultimately affect the delivery of competitive and quality road, rail, air, and maritime transport logistics services and result in lower logistics competence and service quality.

Silva (2017) identified that there have been developments in terms of infrastructure, which is the ‘tangible’ factor needed for Sri Lanka to transform into a logistics hub, but Sri Lanka is faced with challenges in terms of ‘intangible’ factors including sufficient numbers of qualified personnel and international participants in the logistics industry, leading to a

poorer performance compared to regional leaders. Such poorer performance reflects the lower levels of service quality and competence in the service providers attached to the logistics sector.

Table 2: Factors / Variables influencing the competence and Quality of Logistics Services in Sri Lanka

Variable / Factor	Source
Quality of road transport services supporting logistics	Arvis et al. (2007)
Efficiency of the railway in freight transport	Arvis et al. (2007)
Freight and logistics network throughout the country	Kumarage (2012)
Congestion around the Central Business District and congested access to Colombo Port	Kumarage (2012), Abeyratne & Abeyasinghe (2017)
Rail linkages to terminals at Colombo Port	Abeyratne & Abeyasinghe (2017)
Quality of maritime transport service providers	Arvis et al. (2007),
Quality of air freight transport service providers	Arvis et al. (2007)
Enhancing the infrastructure, including ports, roads, and railways	Silva (2017)
Quality of warehousing, transloading, and distribution operators	Arvis et al. (2007)
Concentration of warehouses and distribution centres in and around Colombo Port	Kumarage (2012)
Investments in warehousing and transloading infrastructure	Jayaweera (2011)
Competence and quality of freight forwarders	Arvis et al. (2007)
Quality of the services offered by the Customs agencies	Arvis et al. (2007)
Role of quality / standard inspection agencies in clearance processes	Arvis et al. (2007)
Service quality of health / SPS (sanitary and phytosanitary) agencies	Arvis et al. (2007)
Competence and quality of Customs brokers and their services	Arvis et al. (2007)
Efficiency in border management and border clearance processes	Korinek & Sourdin (2011)
Collaboration among standards, sanitary, SPS, and transport agencies	Edirisinghe (2013)
Role of trade and transport-related associations in promoting competent and quality logistics services	Arvis et al. (2007)
Quality of the services provided by the consignees and shippers	Arvis et al. (2007)
Availability of both physical and human resources in the logistics sector, and their quality	McKinnon et al. (2017), Silva (2017)
Ability of the logistics service providers to provide the services at the lowest possible logistics cost	Korinek & Sourdin (2011)
A sufficient number of qualified logistics professionals and international participants	Silva (2017)
Maritime sector policy, regulatory aspects, and reforms in the logistics sector	Abeyratne and Abeyasinghe (2017)

Source: Constructed by the Authors

Table 2 (above) depicts the twenty-four variables/factors that were recognized by the authors as determinants of “competence and quality of logistics services” in the Sri Lankan context, based on the twelve criteria used by the World Bank to assess the competence and quality of logistics services internationally, and also on the criteria proposed by the local researchers to evaluate the logistics competence in Sri Lanka that were revealed from literature.

MATERIALS AND METHODS

To identify and examine factors that may have influenced the competence and quality of logistics services in Sri Lanka, the research adopted the Exploratory Factor Analysis (EFA). The study used both primary and secondary data collection methods to gather necessary data for the analysis.

Secondary data were gathered from the World Bank website, especially regarding the LPI scores of Sri Lanka, and other sources like research articles, reports, journals, magazines, and other research-related articles related to LPI.

Primary data were collected through a questionnaire survey that was administered among the logistics companies registered under the Sri Lanka Freight Forwarders’ Association (SLFFA) in Sri Lanka. The population of this study consisted of logistics officials and employees working in 136 logistics (including freight forwarding) companies registered with the Sri Lanka Freight Forwarders Association (SLFFA). However, the researchers found that there were not enough sources to derive the number of employees working in freight forwarding companies in Sri Lanka. Therefore, the population was assumed to be unknown.

The snowball sampling technique was adopted in surveying because it would be the most appropriate sampling method when the population is unknown. The researchers were able to gather 181 responses for the online questionnaire distributed to gather primary data for the research. The gathered data were first screened before conducting the analysis. Then, the codification of data was done to facilitate the descriptive analysis and the Factor Analysis. There were no missing values and no unengaged respondents, and the screened data were directly used for analysis.

The data collected were analysed using the Statistical Package for the Social Sciences (IBM SPSS Statistics). The reliability of the survey data was tested using Cronbach’s Alpha reliability test. Kaiser-Meyer-Olkin (KMO) Test and Bartlett Test of Sphericity were used to examine the adequacy and the appropriateness of the sample. Those test results (KMO = 0.752 and P-value = 0.000) confirmed that the data were suitable for Factor Analysis.

Also, descriptive statistics and frequency analysis were performed to investigate the background / demographic data of the survey respondents. Frequencies and percentages of each background / demographic factor were used in frequency analysis.

ANALYSIS AND RESULTS

Out of the 181 respondents, 59.12% were males and 40.88% were females working in the SLFFA-registered logistics companies in Sri Lanka. At the outset, the results revealed that most of the employees and officials working in freight forwarding companies were males, and there were comparatively fewer female employees. The reason for this could be the labour-intensive nature of most of the industrial tasks and professions, leading to male candidates being given higher priority in recruitment.

The primary objective of this research is to critically analyse the Logistics Competence dimension of LPI in Sri Lanka by considering the factors that contribute to this dimension in the Sri Lankan context. To address this objective, Exploratory Factor Analysis was conducted for recognising the dimensions related to the twenty-four variables (Table 2) that were identified from the World Bank's LPI sub-index – Competence and Quality of Logistics Services - and based on the literature that discusses the issues related to this dimension.

Table 3 depicts the KMO measure for sample adequacy and the results of Bartlett's Test for sphericity.

Table 3: KMO and Bartlett's Tests for sample adequacy and sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.752
Bartlett's Test of Sphericity	Approx. Chi-Square	1160.415
	DF	276
	Sig.	0.000

Source: Survey results based on SPSS

According to the results presented in Table 3, the KMO value is 0.752, which is greater than 0.5¹, and the significance value of Bartlett's Test is lower than 0.05 ($P < 0.05$). The adequacy of sample data for Factor Analysis is thus indicated (Netemeyer et al., 2003)². The Bartlett's Test results also show that the study is highly significant with a P-value of 0.000. This indicates that the item correlation matrix is not an identity matrix, and accordingly, it is significant, so that the researchers can move forward with factor analysis.

¹ Tabachnick & Fidell (2001) considered 0.5 as the minimum KMO value acceptable to proceed with Factor Analysis.

² Netemeyer et al. (2003) emphasized that a KMO value above 0.60 - 0.70 would be adequate for analyzing an EFA output.

Table 4 (below) summarises the output related to the total variance explained by Factor Analysis.

Table 4: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var	Cumu %	Total	% of Var	Cumu %	Total	% of Var	Cumu %
1	4.089	17.039	17.039	4.089	17.039	17.039	3.176	13.233	13.233
2	3.413	14.223	31.261	3.413	14.223	31.261	2.301	9.588	22.821
3	1.783	7.429	38.690	1.783	7.429	38.690	2.091	8.713	31.534
4	1.508	6.283	44.973	1.508	6.283	44.973	1.821	7.588	39.122
5	1.301	5.419	50.392	1.301	5.419	50.392	1.805	7.522	46.644
6	1.191	4.961	55.353	1.191	4.961	55.353	1.582	6.593	53.237
7	1.017	4.238	59.592	1.017	4.238	59.592	1.525	6.355	59.592
8	.988	4.117	63.709						
9	.948	3.949	67.658						
10	.840	3.499	71.157						
11	.782	3.258	74.415						
12	.703	2.928	77.343						
13	.644	2.682	80.025						
14	.592	2.466	82.491						
15	.580	2.416	84.907						
16	.555	2.314	87.222						
17	.501	2.089	89.311						
18	.484	2.015	91.327						
19	.459	1.913	93.239						
20	.443	1.846	95.086						
21	.353	1.469	96.555						
22	.292	1.217	97.772						
23	.278	1.159	98.931						
24	.256	1.069	100.000						

Note: Extraction Method = Principal Component Analysis (PCA), Var = Variance, and Cumu = Cumulative

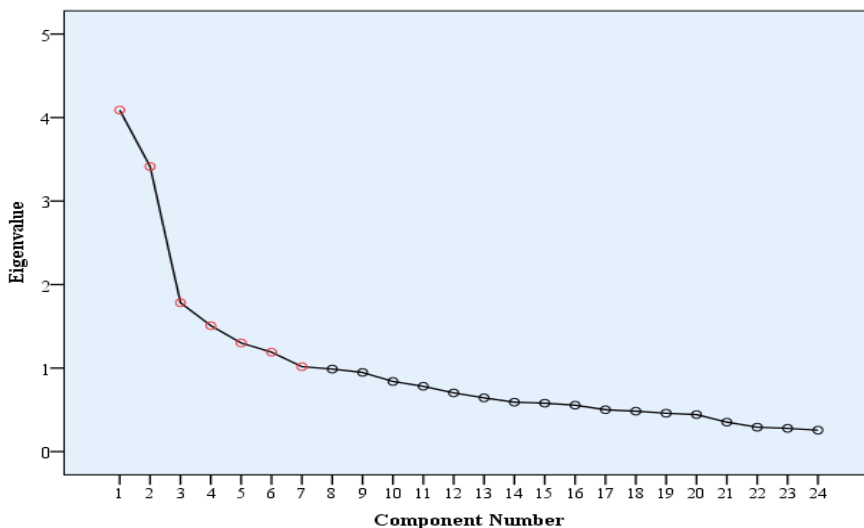
Source: Survey results based on SPSS

After this extraction phase, the researchers had to decide how many constructs should be retained for rotation. Several criteria are available to assist factor retention decisions: (a) Cumulative percentage of variance extracted, (b) Kaiser's criteria (Eigenvalue > 1 rule), (c) Scree Plot, and (d) other criteria such as Minimum Average Partial and Parallel

Analysis. Some of these results were generated as part of the output of the Factor Analysis and could be explained using Table 4.

- (a) *Cumulative Percentage of Variance*³: In this study, all twenty-four variables have been reduced to only seven components. These seven components contributed to 59.592% of the overall variance explained (Cumulative Percentage). This means that these seven components explain as much as around 60% of the total variance of the model. It is accepted that in social sciences, the explained variance is generally around 50-60% (Taherdoost, Sahibuddin, & Jalaliyoon, 2020).
- (b) *Kaiser's Criteria*: According to Kaiser's method, only constructs that have Eigenvalues greater than 1 should be retained for interpretation (Taherdoost, Sahibuddin, & Jalaliyoon, 2020). As Table 4 shows, Principal Component Analysis (PCA) suggested seven components with eigenvalues exceeding 1. Therefore, under the factor retention, only seven components could be retained as factors in conducting this study.
- (c) *Scree Plot*: This can be used to determine the number of factors to retain (Taherdoost, Sahibuddin, & Jalaliyoon, 2020). Figure 3 demonstrates the Scree Plot for the data set. Accordingly, seven components have an Eigenvalue greater than one. These seven factors contribute greatly to the overall changes in the variances of the competence and quality of logistics service in Sri Lanka.

Figure 3: Scree Plot



Source: Survey results based on SPSS

³ Taherdoost, Sahibuddin, & Jalaliyoon (2020) highlighted that there is evidence to suggest that the results of EFA are more accurate when each common factor is represented by multiple variables in the analysis.

The Rotated Component Matrix was utilised to analyse how the variables are related to one or more extracted components or factors. Factor rotation maximises high item loadings and minimises low item loadings. Table 5 presents the extracted components/factors related to the Competence and Quality of Logistics Services in Sri Lanka.

Table 5: Rotated Component Matrix

	Component						
	1	2	3	4	5	6	7
Logistics Cost	.817						
Logistics Sector Policy and Reforms	.722						
Number of Logistics Professionals	.716						
Availability of Human & Physical Resources	.637						
Quality of Warehousing and Distribution	.558						
Role of Quality/Standard Inspection Agencies		.743					
Service quality of health / SPS Agencies		.718					
Custom Brokers' Competence and Quality		.595					
Custom Agencies' Service Quality		.515					
Border Management & Clearance Efficiency			.643				
Road Transport Service Quality			.620				
Collaboration among Regulatory Agencies			.619				
Rail Transport Service Quality			.585				
Air Transport Service Quality				.842			
Maritime Transport Service Quality				.784			
Congestion around the CBD and Colombo Port					.748		
Rail to Port Linkages					.702		
Role of Trade and Transport Associations						.757	
Service Quality of Consignees and Shippers						.588	
Transport Infrastructure							.688
Service Quality of Freight Forwarders							.599

Notes: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalisation, Rotation converged in 11 iterations.

Source: Survey results based on SPSS

In this research, only the variables with a factor loading value greater than 0.45 were considered in factor rotation. Therefore, the rotated factors with a loading less than 0.45 were omitted. This helped the researchers to improve clarity in the factors contributing to “competence and quality of logistics services.” Therefore, as depicted in Table 5 (above), the twenty-four variables were grouped under seven components/factors using the Varimax Rotation method. Two variables, Freight and Logistics Network (Var3) and Concentration of Warehouses around Colombo Port (Var10), had to be omitted since their factor loading scores figured below 0.45.

According to EFA results, the Component/Factor 1 emerged loaded with six variables based on their variance levels, and their factor loadings ranging between 0.487 and 0.817; these variables loaded as affecting logistics competence being, (1.a) Logistics Cost (0.817), (1.b) Logistics Sector Policy and Reforms (0.722), (1.c) Number of Logistics Professionals (0.716), (1.d) Availability of Human & Physical Resources (0.637), (1.e) Quality of Warehousing and Distribution (0.558), and (1.f) Investments in Warehousing Infrastructure (0.487). These variables represent direct inputs to the logistics industry. Therefore, the researchers named Component 1 as ‘Logistics Inputs Factor’.

Component 2 encompassed the four variables, namely (2.a) Role of Quality/Standard Inspection Agencies (0.743), (2.b) Service Quality of health / SPS Agencies (0.718), (2.c) Custom Brokers’ Competence and Quality (0.595), and (2.d) Custom Agencies’ Service Quality (0.515). These four variables being applicable in terms of regulatory aspects in the logistics sector, Component 2 was named ‘Regulatory Compliance Factor’.

Component 3 emerged with four variables loaded into it: (3.a) Border Management & Clearance Efficiency (0.643), (3.b) Road Transport Service Quality (0.620), (3.c) Collaboration among Regulatory Agencies (0.619), and (3.d) Rail Transport Service Quality (0.585). This component, having recorded higher factor loadings from the Border Management & Clearance Efficiency (0.643) and Collaboration among Regulatory Agencies (0.619), appeared related to the collaborative efforts in the clearance processes, and was thus named ‘Collaboration Factor’.

Only two variables loaded into Component 4, namely, (4.a) Air Transport Service Quality (0.842) and (4.b) Maritime Transport Service Quality (0.784). Being implicitly connected to the service quality of the modes of freight transport, this Component 4 was labelled as ‘Freight Mode Factor’.

Component 5 also ended up with just two variables, namely, (5.a) Congestion around CBD and Colombo Port (0.748) and (5.b) Rail to Port Linkages (0.702). Recognising that these variables address the port efficiency, Component 5 was named “Port Efficiency Factor.

Component 6 had two variables loaded into it: (6.a) Role of Trade and Transport-related Associations (0.757) and (6.b) Service Quality of Consignees and Shippers (0.588).

Given that these variables are directly related to the logistics industry stakeholders, Component 6 could be named ‘Stakeholders Factor’.

Finally, two variables loaded into Component 7, namely, (7.a) Transport Infrastructure (0.688) and (7.b) Service Quality of Freight Forwarders (0.599). This component was given the name “Infrastructure Factor” owing to the fact that the transport infrastructure variable emerged with the highest loading.

In order to fathom the reliability of each factor contributing to the Competence and Quality of Logistics Services in Sri Lanka, Cronbach’s Alpha Reliability Test was performed in line with the theoretical construct using the corresponding statistical results generated by SPSS for each of the factors; the outcome is summarised in Table 6.

Table 6: Cronbach’s Alpha Reliability Test Statistic for each Factor

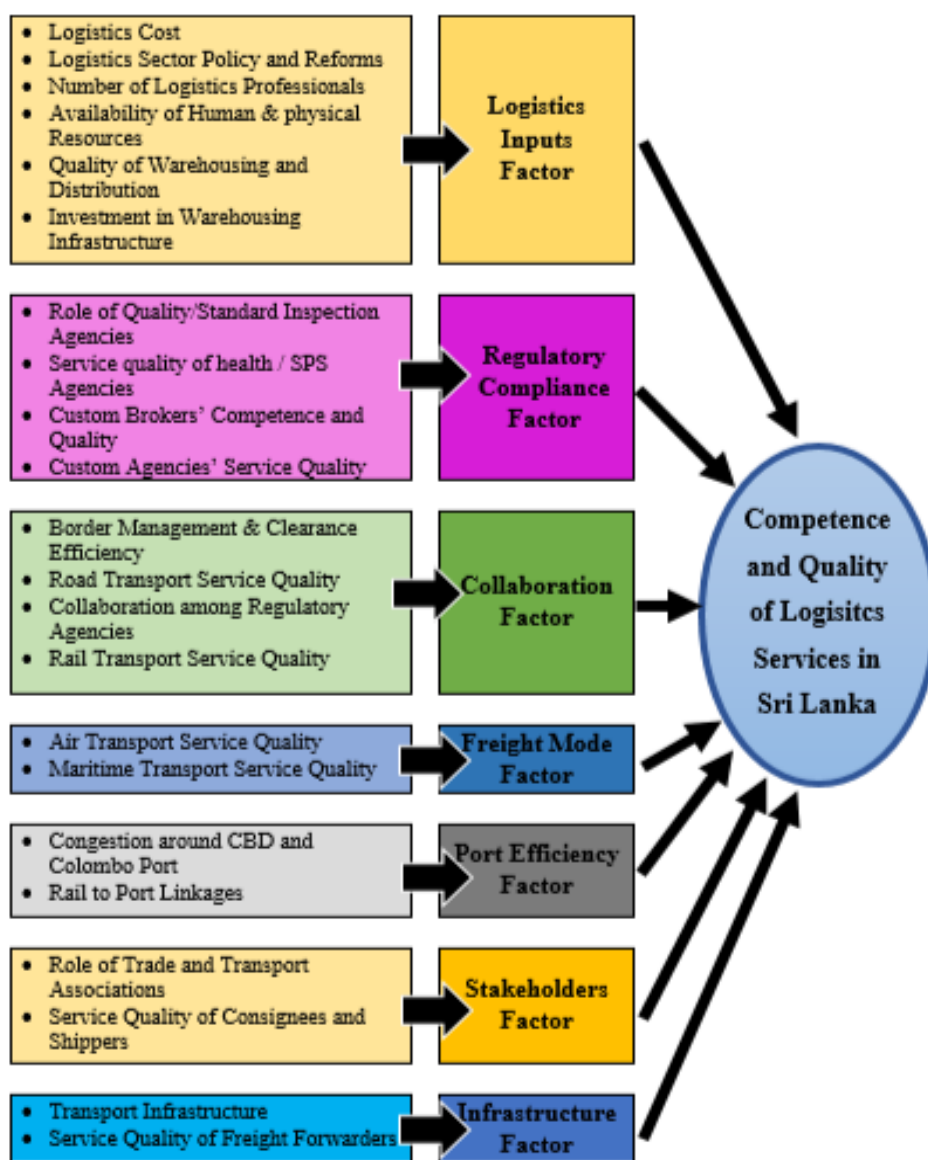
Name of the Factor / Component	Number of Variables	Cronbach’s Alpha Value
Logistics Inputs Factor	6	0.781
Regulatory Compliance Factor	4	0.713
Collaboration Factor	4	0.598
Freight Mode Factor	2	0.752
Port Efficiency Factor	2	0.477
Stakeholders Factor	2	0.460
Infrastructure Factor	2	0.452

Source: Survey results based on SPSS

It could be perceived from these results that Cronbach’s Alpha statistics emerged greater than 0.7 only for three factors identified in the Exploratory Factor Analysis, namely, (i) Logistics Inputs Factor (0.781), (ii) Regulatory Compliance Factor (0.713), and (iii) Freight Mode Factor (0.752). These three factors could therefore be identified and considered as reliable and consistent measures to interpret the influence on Sri Lanka’s Logistics Competence and Quality. The remaining factors (Collaboration Factor, Port Efficiency Factor, Stakeholders Factor, and Infrastructure Factor) yielded Cronbach’s Alpha values below 0.7, and therefore, could not be considered as consistent and reliable.

The outcomes of the research thus enabled the development of a conceptual model to illustrate the most influential factors, as well as constituent variables that are included in such factors, relating to competence and quality of logistics services in Sri Lanka, as depicted in Figure 4.

Figure 4: The Proposed Conceptual Model



Source: Constructed by the Authors

POLICY AND STRATEGY-RELEVANT INSIGHTS

Based on the results obtained from the analysis and the conceptual model developed thereon, several policy and strategy-relevant insights could be derived, particularly in relation to improving the Competence and Quality of Logistics Services in Sri Lanka.

- Firstly, it could be perceived that Sri Lanka's competence and quality of logistics services are highly influenced by the quality and sufficiency of inputs to the

logistics industry. The fact that the logistics cost variable emerged as that with the highest factor loading in the ‘Logistics Inputs’ factor suggests that Sri Lanka’s logistics competence is likely to be highly dependent on the logistics cost. It is believed that Sri Lanka’s logistics cost is much higher due to various bottlenecks and pressures exerted by intermediate parties, and therefore, it could be hypothesised that the Sri Lankan logistics sector is possibly in need of a competitive environment enabling large stakeholders to be involved, leading to a reduction of logistics cost.

- Secondly, the results of this study revealed that the two variables, namely, the number of logistics professionals and the availability of quality human and physical resources, could also have sufficient contributions to the ‘Logistics Inputs’ factor. The lack of sufficient logistics professionals and the limited availability of physical and human resources in the logistics sector in Sri Lanka remain a continuous problem, as there are very few institutions that provide formal logistics education. It is important to establish state-level institutions for providing academic programs and formal training in the sector to develop professionalism in the logistics sector in Sri Lanka. This could enhance the competencies of the logistics professionals in the country, leading to improved competence and quality of logistics services as well.
- On the other hand, the variables, warehousing quality and investments in warehousing infrastructure, also appeared influential in determining the ‘Logistics Inputs’ factor. The Sri Lankan logistics industry is almost entirely run by third-party logistics (3PL) service providers, and therefore, the warehousing is confined to an outsourced activity. This poses problems in terms of service quality. Therefore, it is important that the warehousing sector is competent enough to provide internationally standardised warehousing services, which are essential for the entire industry to function properly.
- Logistics sector policy and reforms variables also have a higher factor loading under the ‘Logistics Inputs’ factor. Sri Lanka’s Logistics sector has a major problem with a lack of a formal logistics sector policy that combines all the trade and transport-related areas in the country. The industry needs proper oversight and regulations that are fair to the country and businesses operating in the sector. This could also facilitate the quality service provision by these competent businesses in the sector, leading to an enhancement of Sri Lanka’s performance in the LPI dimension of Logistics competence.
- The entire logistics process is highly influenced by the legal and regulatory aspects connected with different stages of the supply chain. In that sense, the ‘Regulatory Compliance’ factor also has a sufficient contribution to the competence and quality of Logistics services in Sri Lanka. This factor captured

the variables related to the role of quality/standard inspection agencies, service quality of health / Sanitary and Phytosanitary (SPS) agencies, Customs Brokers' competence, and Customs Agencies' service quality. In this case, many agencies and intermediaries facilitate border clearance and management processes. These intermediary agencies must be highly regulated and monitored to eliminate corruption and processing delays. Also, they must be highly interconnected through a 'Single Window Concept' to expedite the clearance process.

- Lower logistics competence in LPI is also represented by Sri Lanka's weak performance in the areas of clearance by border control agencies, including Customs. Customs reforms are inevitable, and the full use of the Automated System for Customs Data (ASYCUDA) World system for the online Customs clearance process and the development of a computerised system of risk management are highly important in enhancing the competence and quality of logistics services through the 'Regulatory Compliance' factor.
- Similarly, as per the results of the study, the 'Freight Mode' factor is also identified as a highly contributing factor to the competence and quality of logistics services in Sri Lanka. This factor extracts two variables: service quality of Maritime Transport service providers and service quality of Air Transport service providers. These two modes account for more than 90% of the freight movements in the country. As the 'Freight Mode' factor is highly reliable in influencing competence and quality of logistics services, maritime and air transport service providers must maintain higher service standards to cater to the needs of the importers and exporters. Developing the essential and required competencies of Maritime and air transport service providers is highly required to enhance the overall logistics competence in Sri Lanka.
- The study revealed that the 'Collaboration' factor, 'Port Efficiency' factor, 'Stakeholders' factor, and 'Infrastructure' factor have the least contribution to the competence and quality of logistics services dimension in Sri Lanka. The industry should also focus on these factors to enhance its contribution to the logistics competence dimension. The 'Collaboration' factor is highly influenced by the variables: border management & clearance efficiency, and collaboration among regulatory agencies. Higher efficiency in Customs clearance is also backed by collaboration among regulatory agencies supporting the Customs clearance process.
- 'Stakeholders' factor captured the variables: role of trade and transport-related associations and service quality of consignees and shippers. Different associations in Sri Lanka monitor and provide guidelines to the logistics service providers (LSPs) to maintain international standards. Some of these organisations are Sri Lanka Freight Forwarders Association (SLAFFA), Sri Lanka Airline

Cargo Association (SLACA), Sri Lanka Logistics Providers Association (SLLPA), Ceylon Association of Ship Agents (CASA), and Association of Container Transporters (ACT). The companies involved in providing logistics services should become members of their respective grouping or professional organisations. Also, the companies should have a minimum number of professionally trained and qualified staff from these professional organisations.

- Infrastructure is highly contributed to by the variable transportation infrastructure. Though infrastructure remains a less contributing factor to logistics competence in Sri Lanka, it is important to overcome the impediments in the trade logistics infrastructure to enhance logistics competence. Areas such as the digitalisation of the trading processes, developing road, rail, and maritime infrastructure, upgrading handling equipment at ports, and developing areas within proximity to airports and seaports need to be prioritised when addressing the infrastructure factor.

CONCLUSION

Competence and quality of logistics services in Sri Lanka are among the main areas for developing the logistics sector in the country. In that context, the present study was conducted to identify the factors contributing to the Competence and Quality of Logistics Services in Sri Lanka, with reference to the Logistics Performance Index (LPI). Having employed Exploratory Factor Analysis on twenty-four identified variables based on the World Bank's findings (Arvis et. al., 2018) and also on the findings of the past literature, the study outcomes enabled the identification of seven factors that could be inferred as contributing to the Competence and Quality of Logistics Services in Sri Lanka. These factors are Logistics Inputs Factor, Regulatory Compliance Factor, Collaboration Factor, Freight Mode Factor, Port Efficiency Factor, Stakeholders Factor, and Infrastructure Factor. However, only the three factors, namely, Logistics Inputs, Regulatory Compliance, and Freight Mode, emerged as reliable and consistent measures to interpret the influence on Sri Lanka's Logistics Competence and Quality.

The outcomes of the study also enabled the development of a conceptual model, depicting the influential drivers and the corresponding paths of their influence towards enhancing the country's competence and quality of logistics services. This enabled deriving several important inferences, leading to policy recommendations relevant to competence and quality of logistics service provision in Sri Lanka. Such strategic interventions, which have to be further refined and endorsed through future research, are likely to enable maintaining higher competitiveness, improved integration with the international supply chains, and higher standards, and thus, could potentially facilitate upgrading the LPI ranking of Sri Lanka. The dream of the nation of Sri Lanka becoming a leading 'Logistics

Hub' in the Asian region could thereby be made a reality, facilitating the country's macroeconomic prospects for a higher rate of economic growth and development.

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