RESEARCH ARTICLE

CONFIRMATORY FACTOR ANALYSIS FOR THE INFRASTRUCTURE DIMENSION OF LOGISTICS PERFORMANCE INDEX: CASE OF SRI LANKA

Anju Ilangasekara and Wasantha Premarathne

Department of Management and Finance, General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka.

……………………………………………………………………………………………………....

Manuscript Info

…………………….

Abstract

…………………………………………………………

Sri Lanka has initiated major development programmes over the years to enrich its trade facilitation. Out of all, one of the main objectives is to transform Sri Lanka into a logistics hub to smoothly operate international trade. The perspective of the logistics sector in introducing such programmes is helpfulin planning and finalizing development policies. Potential investors investigate LPI as a multi-dimensional indicator before placing investment decisions.When compared to other competing countries in the region, the LPI scores of Sri Lanka have not been satisfactory.Quality of trade and transport related infrastructure dimension is underperforming since 2007.In that scenario, it is a contemporary requirement to evaluate the logistics performance index and test the construct validity of the index in Sri Lanka.Therefore, the objective of this research was to conduct a confirmatory factor analysis for the infrastructure dimension of logistics performance index based on Sri Lanka. The results were grounded on a questionnairesurveyfrom a sample of 60 industry professionals from 20 freight forwarding companies.The date collection was limited to registered freight forwarding companies atthe Sri Lanka Freight Forwarders Association.The indicators of each dimension of the infrastructure dimension of LPI was verified through a Confirmatory Factory Analysis using IBM SPSS Amos. The study confirms the construct validity of the infrastructure dimension and the results were in consistent with the conceptual framework of LPI.

……………………………………………………………………………………………………....

Introduction:-

Many centuries ago, the concepts of logistics have been applied all over the world from construction of palaces to military warfares and presently towards the development of global supply chain networks that facilitate maritime transportation, freight forwarding, warehousing and other aspects of logistics management. Logistics Management can be defined as a part of Supply Chain Management that involves the effective and efficient forward and reverse flow of goods, services and relevant information from point of origin to point of consumption while meeting customers' requirement (Council of Supply Chain Management Professionals, 2016). From a business perspective, logistics plays a vital role for organizational performance and customer satisfaction. Also, better logistics performance helps the economic development of a country via macroeconomic perspective. Sri Lanka has been recognized as one of the fastest growing logistics hubs in the world that facilitates top class multi-modal logistics services. Thus, it has the highest potential to emerge as the South Asia's logistics hub that connects international

Corresponding Author:- Anju Ilangasekara
Address**:-** Department of Management and Finance, General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka.

1018

maritime and aviation routes. The end of the civil war provoked more opportunities for nationwide development projects and widened international relations. Ever since then, it has been one of the main objectives of the Sri Lankan government to improve the logistics sector of the country.

The Logistics Performance Index (LPI) is a mechanism mainly applied for international research purposes to evaluate the logistics performance of a country via comparing, benchmarking and analysing logistics related data. It has been calculated every two years since 2007. LPI is described as a benchmarking tool that enables the countries to measure the logistics performance and introduce initiatives for further improvements (The World Bank, 2016).When concerning the LPI historical data since 2007, it has shown that infrastructure development is a driving force forrelationships across gateways via enhancing accessibility and connectivity in developing countries (Arvis, et al., 2014).Quality of trade and transport related infrastructure has resulted a low performance since the start of LPI survey.Transport infrastructure, transport superstructure and policies and procedures are the components of a transportation system in a country. Therefore, improvements made to those components will result an overall improvement in the transport system. Since transportation is a supporting service of logistics, it influences the quality of trade in a country. Accordingly, it demonstrates a strong indication why the infrastructure dimensionis the most underperformed dimension of LPI in Sri Lanka.LPI is an indicator that allows countries to identify challenges, know when to invest and take further steps for economic development.However, the expected competitiveness was not obtained due to the low performance of LPI score in Sri Lanka.

Table 1:- Sri Lanka's LPI scoreof each dimension from 2007 to 2018.

	2007	2010	2012	2014	2018
Quality of trade and transport related infrastructure (Infrastructure)	2.1	1.9	2.5	2.2	2.5
Frequency with which shipments reach consignee within scheduled or expected time (Timeliness)	2.7	3	2.9	3.1	2.8
Efficiency of customs clearance process (Customs)	2.3	2	2.6	2.6	2.6
Ease of arranging competitively priced shipments (International Shipments)	2.3	2.5	3	2.6	2.5
Competence and quality of logistics services (Services Quality)	2.5	2.1	2.8	2.9	2.4
Ability to track and trace consignments (Tracking and Tracing)	2.6	2.2	2.7	2.8	2.8
Overall	2.4	2.3	2.8	2.7	2.6

Source: The World Bank (2018)

As per Table 1, quality of trade and transport related infrastructuredimensionis underperformingsince 2007. Infrastructure dimension hasattained a score of 2.1 in 2007 howeverthere is a significant reduction to 1.9 by 2010. It has managed to score 2.5 in 2012.However, it has reduced to 2.2 in 2014. As per the latest LPI survey in 2018, again the score has hit for 2.5 range.As per the World Bank (2017)Sri Lanka has excluded from LPI rankings in 2016 since only few observations were carried out during the 2016 survey.There has been major ups and downs across the years in infrastructure dimension of LPI in Sri Lanka.

Literature Review:-
Concerning ageneraloutline of global freight forwarders and express carriers, the LPI is a benchmarking toolimplemented by the World Bank that evaluatelogistics performances of countries.LPI survey includes over 160 countries in order toidentify challenges and opportunities to improve thelogistics performance(Arvis, et al., 2016).LPI survey takes express carriers, freight forwarders, industry professionals and other stakeholders in the world to obtain the feedback through questionnaires. It is categorized into two levels: International LPI and Domestic LPI. Domestic LPI is a survey designed for more detailed observation related to time limitations, cost constraints, organizational performance and core logistics activities. The weighted average of each country scores measured through six key dimensions are evaluated in International LPI. It compares the performance of each country from lowest score 1 to highest score 5, with the highest score representing the highest performance (The World Bank, 2016). There are two main categories for the six dimensions of International LPI named as inputs and outcomes as shown in Figure 1 (Arvis, et al., 2018). The inputs are the areas for policy regulations and they are infrastructure, customs and quality of logistics services. The outcomes are the service delivery performance and they are international shipments, timeliness and tracking and tracing.During the survey, the responses given by the trading partners of the selected country are used to assessthe LPI score of that respective selected country (The World Bank, 2016).
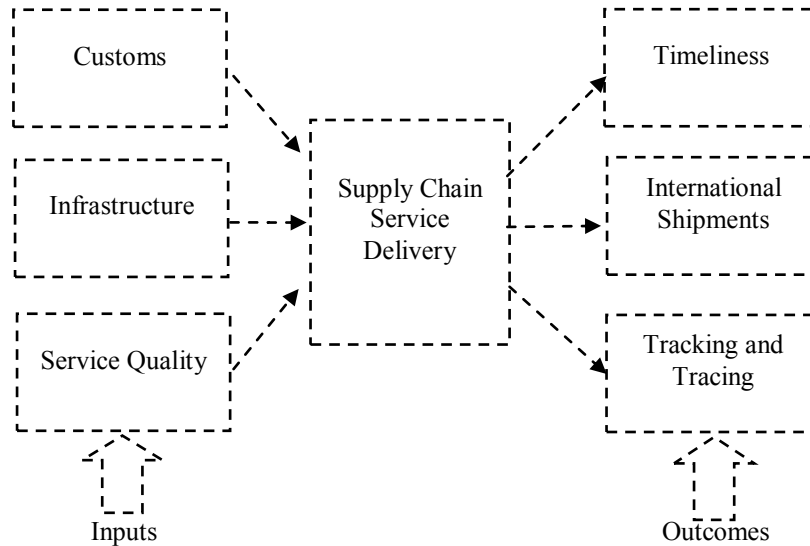
Figure 1:- Inputs and Outcomesof LPI.
Source: Arvis, et al. (2018).

The quality of port infrastructure, airport infrastructure, road infrastructure, rail infrastructure, warehousing andtransloading facilities, telecommunication infrastructure and IT servicesare the determinants of the quality of trade and transport related infrastructure (Arvis, et al., 2016).The quality of freight transport related infrastructure has a positive relationship with the LPI score of a country (Celebi, et al., 2014).

Ojala and Celebi (2015) have also shown port expansion and new terminal establishments as key infrastructure development areas. Dyck and Ismael (2015) identified water depth, berth length and terminal size as attributes of assessing the quality of port infrastructure. Ugboma, Ugboma and Ogwude (2006) have considered factors such as port efficiency, frequency of ship visits and adequate infrastructure as port selection criteria. Ha (2003) stated that availability of port related activities, availability of facilities, port location, port turnaround time, port management, ease of customs clearances and port costs also major criterions for the evaluation of port infrastructure.Nam and Song (2010) highlighted that there should be policy re-adjustments and heavy strategic decision making contribution to derive the real potential of the port industry. Port storage/ warehousing and port facilities, port capacity, accessibility and water depth adequacy are significant infrastructure indicators that help to determine the port logistics performance.The World Bank (2010) has recognized container traffic: inbound and outbound, loaded and empty, traffic growth (Twenty foot Equivalent Units), number of berths and ship to shore gantry cranes, available draft, yard storage area, public or private operator, turnaround times and processing of electronic manifests and loading plans (local) as the indicators to assess the port infrastructure. The World Bank (2010) has recognized the indicators presented in Table 2 to assess the port infrastructure.

Table 2:- Port infrastructure indicators.

Ports	Container traffic: inbound and outbound, loaded and empty
	Traffic growth (Twenty Foot Equivalent Units)
	Number of berths and ship to shore gantry cranes
	Available draft
	Yard storage area
	Public or private operator
	Turnaround times
	Processing of electronic manifests and loading plans (local)

Source: The World Bank (2010)

Adler and Berechman (2001) studied about the airport quality from airlines viewpoint and followed Data Envelopment Analysis (DEA) methodology to rank the quality of airports. The quality of the airport service has been assessed using number of terminals, number of runways and distance to the nearest city-centrealong with

several other variables. Gillen and Lall (1997) have considered number of runways, terminal area and number of gates to assess the airport quality.Fasone and Zapata-Aguirre (2016) focused on airport efficiency and mostly backed by previous studies which followed Data Envelopment Analysis (DEA) methodology. The study has identified how airport efficiency can be evaluated and several key indicators of airport infrastructure were shown in comparison with the literature.The World Bank (2010) has recognized the indicators depicted in Table 3 to assess the airport infrastructure.

Table 3:- Airport infrastructure indicators.

Airport	Runways and length
	Traffic volume (passengers, cargo, and aircraft movements)
	Scheduled freighter services and belly cargo operations
	Private sector involvement
	Cargo storage facilities
	Ground handling companies

Source: The World Bank (2010)

Jayaweera (2011) identified inefficiencies as the major issue in inland freight transport in Sri Lanka since it has contributed to urban traffic congestion and road damages. Moreover, Jayaweera (2011) has explained the inefficiencies in truck fleets by stating 57 percent are small trucks while only 38 percent are medium and large trucks out of the overall freight transport truck fleet. Furthermore, the study shows that some roads do not have heavy load capacities.In fact, there is a possibility of more congested roads due to the diversion of freight traffic flow from existing routes to the new ones with the development of new roads. In a study about Turkey's LPI, Ojala and Celebi (2015) have compared the infrastructure dimension of LPI with the peer groups and have found that it has been improved since 2007. The main reason was the sufficient investment on road infrastructure facilitating inland freight transportation. They have found that Build-Operate-Transfer (BOT) model has contributed to upliftthe logistics connectivity through road infrastructure development.Ojala and Celebi (2015) have discussed the key areas that should be considered for further developments and have identified the key reasons behind the performance gaps of each dimensions of LPI. In the assessment of infrastructure dimension of LPI, the impact of variables in domestic LPI were identified separately. Deichmann and Wheeler (2006) have studied about a road quality index with three dimensions and they are percentage of paved roads, maintenance capacity and control of unofficial payments. Buys, Deichmann and Wheeler(2006) have identified that lack of transport infrastructure leads to a hindrance in expanding trade globally. The World Bank (2010) has recognized the indicators shown in Table 4 to assess the road infrastructure.

Table 4:- Road infrastructure indicators.

Road	Breakdown of road network by type and length of links
	Road freight volume
	National fleet by type (wheels or tonnage, fixed axle and articulated)
	Large third party fleet operators
	Use of standard waybills (consignment notes)
	Allocation of capacity (long term contracts, urban brokers for trucking services, electronic market)

Source: The World Bank (2010).

Jayaweera (2011) has also found that 99 percent of the total inland freight transportation is operated through road networks while only one percent is operated through rail mode. Fathima and Jayasinghe (2014) have conducted a research to identify the issues in railway contribution to freight transportation. In their study, they have based the major proposals of the national physical plan - 2030 which will bring further developments of the spatial network of logistics affairs in Sri Lanka. The World Bank (2010) has recognized the indicators in Table 5 to assess the rail infrastructure.

Table 5:- Rail infrastructure indicators.

Rail	Network description including gauge, number of lands, length of network and border crossings
	Volume of freight traffic (bulk, loose, container or trailer)
	Scheduled unit container trains (local)
	Number and location of loading yards with container gantries (local)

Number and location of rail inland container depots	
Allocation of capacity (long term contracts, urban brokers for trucking services, electronic market)	

Source: The World Bank (2010).

Jayaweera (2011) has shown that major issues of freight transport were caused due to untraced investment on warehouses, processing centres and container depots.Thus, Jayaweera (2011) has clearly highlighted the importance of investment in warehousing and transloading infrastructure.Tongzon (2009) has mentioned that in the case of a shipment of perishable goods adequate infrastructure such as, refrigerated containers should be mandatory. Thus, it will be a priority consideration in port selection.According to Jayaratne, Premaratne and Wijayasiri (2016) the respondents (exporters, merchants, shipping lines, freight forwarders, chambers and related organizations) have emphasized the inadequacy of facilities at warehouses despite the insufficiency of the number of warehouses available in Sri Lanka. The issues mentioned were absence of suitable storage racking systems, poor conditions, poor management and inadequate safety and security measure. The World Bank (2010) has recognized the indicators shown in Table 6 to assess the warehouse infrastructure.

Table 6:- Warehouse infrastructure indicators.

Warehousing	Large third party operators
	Major truck terminals and distribution centers

Source: The World Bank (2010).

Ojala and Celebi (2015) highlighted that ICT infrastructure should also undergo a parallel development since it was revealed that poor communication between ports and their institutes has often resulted supply chain drawbacks.Keceli (2011) also points out the importance of ICT infrastructure since most of the operations are run through paper-based system due to inadequacy of online-data exchange platforms. Tongzon (2009) shows a similar resemblance by stating that limited accessibility to information such as shipment arrivals will decelerate the documentationprocess and port functioning practices. This is caused due to absence of sufficient information system.Unavailabilityofsufficient inter-modal links will not be helpful to move cargo conveniently fromoneport to another, thus causinghighcongestion, shipment delays and increased costs.Table 7 presents the indicators proposed by the World Bank (2010) to assess the ICT infrastructure.

Table 7:- ICT infrastructure indicators.

Commerce	Electronic payments for bank transactions and payments to government
	Legislation for e-signatures
	Business to business (domestic, international)
	Typical terms of payment (invoice, CAD)
	Access to foreign exchange accounts

Source: The World Bank (2010).

Methodology:-
The researchershaveadoptedpositivismas the research philosophy since it investigates via a scientific and quantitative manner.Considering the research approach, the deductive approach has been used and the survey methodhas been used as the research strategy. Amono method has been used by the researchers as per the choice of the research andcross-sectional data were utilized for the study.The most underperformed dimension of LPI in Sri Lankais the infrastructure dimension.Port infrastructure, airport infrastructure, road infrastructure, rail infrastructure, railway infrastructure, warehousing and transloading infrastructure and ICT infrastructurearethe six dimensions of the infrastructure dimension of LPI. The conceptual framework depicted in Figure 2 showsthe infrastructure dimension of LPI through its six dimensionsandthe relationship of other five dimensions towards the LPI.
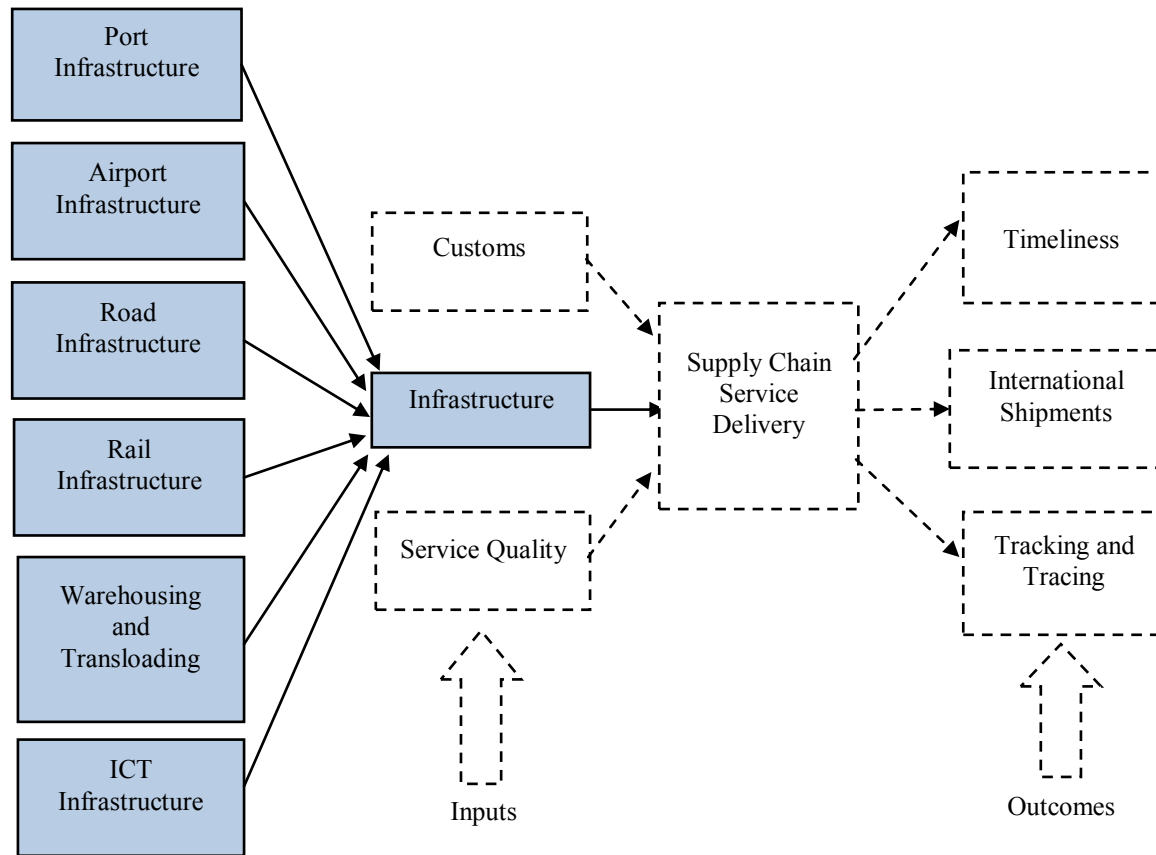
Figure 2:- Conceptual framework of LPI.
Source: Arvis, et al. (2016).

Freight forwarding companies registered in Sri Lanka Logistics and Freight Forwarders Association (SLFFA) were selected for the survey. Using the simple random sampling method, the researchershave selected3 respondents each from 20 freight forwarding companies to obtain a 60 sample size.The researchershave followed survey method for data collection.Content validity of the questionnaire was confirmed during the experts' assessment prior to the pilot study. A reliability test was conducted for the survey questionnaire and it was tested using Cronbach's Alpha. A Confirmatory Factor Analysis (CFA) was performed using IBM SPSS AMOS software.

Results:-
The highest number of respondents weretransport managers and operations executives. The sample included 35 various designations such as directors, general managers, head of departments, IT managers, warehouse managers, assistant managers, executives, supervisors and coordinators.Consideringthe experience as an industry professional,22 respondents have more than 10 years of experience. In second, 19 respondents have experience for 6-9 years and in third14 respondents have experience for 3-5 years. Only 5 respondents have less than 2 years of experience. Awareness regarding LPI and participation for LPI survey were evaluated using two separate questions in the survey questionnaire. Accordingly, 47 respondents knew about LPI and 21 respondents have participated the LPI survey conducted by the World Bank. As per the direction of trade and transport, respondents deal with export trade has the highest number with 40 respondents.In import trade, domestic trade and international transit trade there were 34, 21 and 17 respondents engaged respectively.

Prior to analyzing the data, reliability and validity were checked. The validity was tested during the expert assessment and a pilot study conducted by the researchers prior to primary data collection. Test validity was performed through face validity by five industry experts.The reliability was tested using Cronbach's alpha value. The reliability value higher than 0.70 is acceptable (Bearden et al., 1998).

Table 8:- Reliability statistics of six dimensions of infrastructure.

Dimension	Cronbach's Alpha	Number of Items
Port Infrastructure (PI)	0.977	11
Airport Infrastructure (AI)	0.958	10
Road Infrastructure (RoI)	0.945	6
Rail Infrastructure (RaI)	0.927	6
Warehousing and Transloading (WI)	0.952	6
ICT Infrastructure (ICTI)	0.936	6

Source: Survey data (2018).

A Confirmatory Factor Analysis (CFA) was performed using IBM SPSS AMOS to confirm whether the items are loaded as expected in the conceptual framework. The covariances for six dimensions of infrastructure were observed in the default model. According to Table 9, all the covariances among the dimensions are statistically significant.

Table 9:- Covariances of the default model.

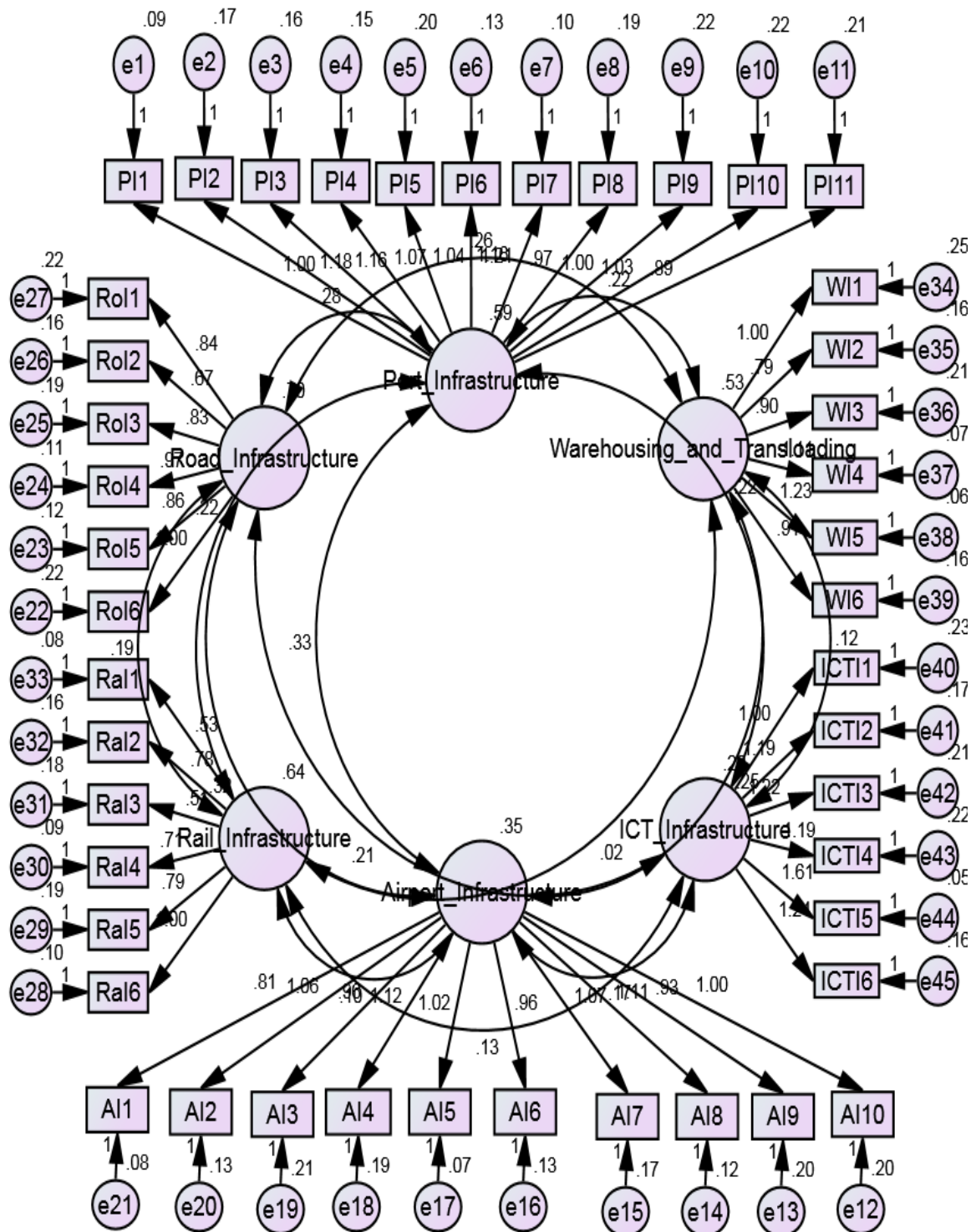|			Estimate	P
PI	<-->	AI	0.326	***
PI	<-->	RoI	0.282	0.004
PI	<-->	RaI	0.219	0.014
PI	<-->	WI	0.218	0.009
PI	<-->	ICTI	0.224	0.001
AI	<-->	RoI	0.315	***
AI	<-->	RaI	0.101	0.019
AI	<-->	WI	0.254	***
AI	<-->	ICTI	0.167	0.002
RoI	<-->	RaI	0.188	0.021
RoI	<-->	WI	0.259	0.006
RoI	<-->	ICTI	0.206	0.005
RaI	<-->	WI	0.021	0.023
RaI	<-->	ICTI	0.127	0.045
WI	<-->	ICTI	0.120	0.040

Source: Survey data (2018).

Figure 3:- Covariances of the default model.
Source: Survey data (2018).

Figure3illustrates the graphical presentation of covariances among the six dimensions of the infrastructure dimension of LPI.
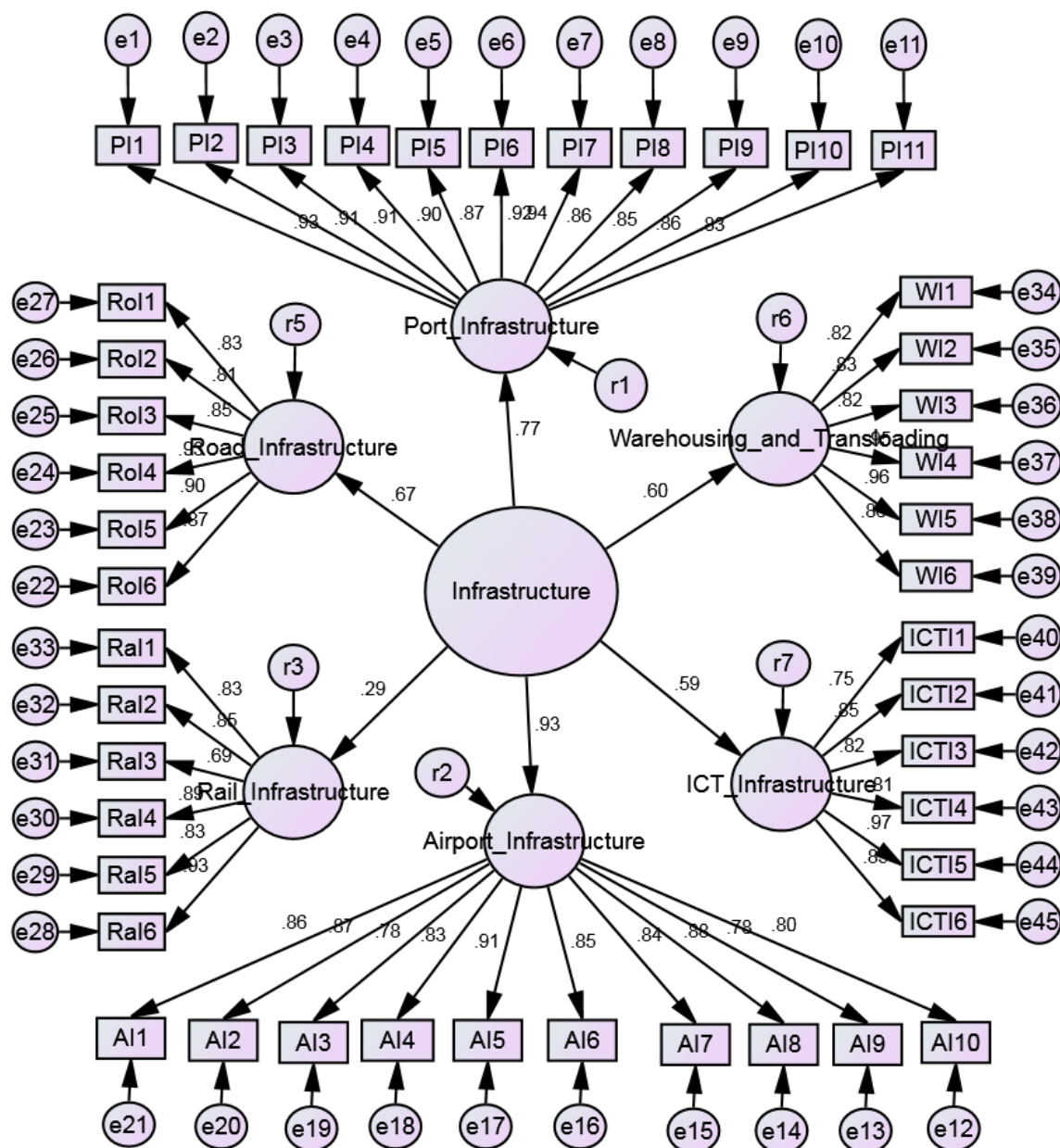
Figure 4:- Output of the structural model.
Source: Survey data (2018).

Figure4 indicates the factor loadings upon the dimensions and the items in the structured model. It is clear that there is a high factor loading on the six dimensions.According to Table 10, the standardized regression weights of the default model are quite high. The standardized regression weights of the items of each dimension show high factor loadings.

Table 10:- Standardized regression weights.

			Estimate
RoI	<---	Infrastructure	.674
RaI	<---	Infrastructure	.482
AI	<---	Infrastructure	.935
ICTI	<---	Infrastructure	.594
WI	<---	Infrastructure	.596

| PI | <--- | Infrastructure | .765 |

Source: Survey data (2018).

The acceptable level of CMIN is more than 0.05 (Hair et. al, 1998, 2006, 2010). Accordingly, CMIN value of 1625.44 is an extreme indication of model fit.CMIN/DF (Relative Chi-square) of default model emphasizes that chi-square is divided by the degree of freedom. CMIN/DF value of less than 3.00 is acceptable (Hair et. al, 1998, 2006, 2010). Kline (2005), Byrne (2001) and Bollen (1989) also agree on this conclusion. Thus, CIM/DF value of 1.731 in the default model indicates a strong goodness of fit of the model. NPAR value of default model (96) indicates the number of parameters of the model.The result has shown a RMR value of 0.054 of the default model. RMR value is the root mean square residual and it indicates how far the default model's variances and covariances vary from the observed variances and covariances. RMR value of less than 0.05 is a better indication of model fit (Diamantopoulos and Siguaw, 2000). Accordingly, RMR value of 0.054 of the default model is almost close to a good model fit. The acceptable level for GFI (Goodness of Fit Index) is less than 0.90 (Hair et. al, 1998, 2006, 2010). AGFI (Adjusted Goodness of Fit Index) also should have an acceptable level of less than 0.90 (Shevlin and Miles, 1998). In the study's results obtained, the GFI value of 0.533 and AGFI value of 0.485 are within the acceptable level.

The acceptable level of NFI (Normed Fit Index) should be less than 0.90 (Hair et. al, 1998, 2006, 2010). According to the study's results, NFI value of 0.630 is within the acceptable level. RFI (Relative Fit Index) value of 0.610 can also be accepted. CFI (Comparative Fit Index) value should be less than 0.90 for it's acceptable level (Hair et. al, 1998, 2006, 2010). Hence, CFI value of 0.798 in the default model indicates fairly good model fit. TLI (Tucker-Lewis Index) value of 0.787 also show a fairly good model fit. IFI (Incremental Fit Index) indicates a good model fit with a value of less than 0.90 (Hair et. al, 1998, 2006, 2010). IFI value of 0.801 in the default model is almost close to 0.90 and thus it indicates a good model fit. According to the study's results, the Root Mean Square Error of Approximation (RMSEA) value is 0.111. RMSEA of 0.05 or less indicates good fit (Ingram, et. al, 2000).

Conclusion:-
It is a contemporary requirement to evaluate the logistics performance of a country since the logistics sector is important for global competitiveness. Since there is a government objective to become South Asia's logistics hub, the logistics performance should be developed in all aspects. Logistics Performance Indexis a recognized and accepted mechanism to evaluate the logistics performance of a country. This study has analyzed the most underperforming dimensions of the LPI. It was noted that since the start of the LPI survey, Sri Lanka was underperforming compared to countries in South Asia who compete to establish the logistics hub status. A Confirmatory Factor Analysis (CFA) was conducted and results interpreted high factor loadings. Thus, the construct validity of the structured model was confirmed. All the items used were appropriately loaded on to their relative dimensions. Therefore, this study confirms the construct validity of the infrastructure dimension and the results were in consistent with the conceptual framework of LPI.

References:-
1. Adler, N. &Berechman, J. (2001) Measuring Airport Quality from the Airlines Viewpoint: An Application of Data Envelopment Analysis. Transport Policy, Vol. 8, pp 171–181.
2. Arvis, J., Saslavsky, D., Ojala, L., Shepherd, B., Busch, C. & Raj, A. (2014) Connecting to Compete 2014. Trade Logistics in the Global Economy. Washington, DC: World Bank.
3. Arvis, J., Saslavsky, D., Ojala, L., Shepherd, B., Busch, C., Raj, A. &Naula, T. (2016) Connecting to Compete 2016. Trade Logistics in the Global Economy. Washington, DC: World Bank.
4. Arvis, J.,Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K.&Kiiski, T. (2018) Connecting to Compete 2018. Trade Logistics in the Global Economy. Washington, DC: World Bank.
5. Bearden, W. O., Netemeyer, G. R. & Mobley, M. (1998) Handbook of Marketing Scales: Multi-Item Measure for Marketing and Customer Behavior. Sage Publication, Newbury Park, USA.
6. Bollen, K. A. (1989) Structural Equations with Latent Variables. John Wiley and Sons, New York, USA., ISBN-13: 9780471011712, pp 514.
7. Buys, P., Deichmann, U. & Wheeler, D. (2006) Road Network Upgrading and Overland Trade Expansion in Sub-Sahara Africa, The World Bank.
8. Byrne, B. M. (2001) Structural Equation Modeling with AMOS: Basic Concepts, Application and Programming. Lawrence Erlbaum Associates, Mahwah, New Jersey, USA., ISBN-13: 9780805841046, pp 352.

9. Celebi, D., Ojala, L., Kauppila, J. & Crist, P.(2014) Understanding Drivers of Trade and Transport Performance. Vietnam. International Symposium on Logistics.

10. Council of Supply Chain Management Professionals. (2016)Available from: https://cscmp.org/supply-chain-management-definitions [Accessed 5th July 2016].

11. Diamantopoulos, A. &Siguaw, J. A. (2000) Introducing LISREL: A Guide for the Uninitiated. Sage Publications, London, ISBN: 9780761951711, pp 171.

12. Fasone, V. & Zapata-Aguirre, S. (2016) Measuring business performance in the airport context. A critical review of Literature. International Journal of Productivity and Performance Management, Vol. 65 Issue 8.pp 1137-1158.

13. Fathima, J. &Jayasinghe, A. B. (2014) Evaluating the Effectiveness of the Logistics Network of Sri Lanka (Exiting vs Proposed) Using Multiple Centrality Assessment. (MCA). SAITM Research Symposium on Engineering Advancement. pp 58-61.

14. Gillen, D., &Lall, A. (1997) Developing Measures of Airport Productivity and Performance: An Application of Data Envelopment Analysis. TransportationResearch Part E, Vol. 33 N 4, pp 261–273.

15. Ha, M. S. (2003) A Comparison of Service Quality at Major Container Ports: Implication for Korean Ports. Journal of Transport Geography, Vol. 11 Issue 2. pp 131-137.

16. Hair, J. F., Black, W. C., Babin, B.J., Anderson, R. E. & Tatham, R. L. (2006) Multivariate Data Analysis. 6th Edition., Prentice Hall, Upper Saddle River, NJ., USA., ISBN-13: 9780130329295. pp 928.

17. Hair, Jr. J. F., Black, W. C., Babin, B. J. & Anderson, R. E. (2010) Multivariate Data Analysis. 7th Edition., Prentice-Hall, Upper Saddle River, NJ., USA., ISBN-13: 978-0138132637. pp 816.

18. Hair, J. F., Tatham, R.L., Anderson, R.E. & Black, W.C. (1998) Multivariate Data Analysis. 5th Edition., Prentice Hall, Upper Saddle River, New Jersey, USA., ISBN-13: 9780138948580. pp 758.

19. Ingram, K. L., Cope, J. G., Harju, B. L., &Wuensch, K. L. (2000) Applying to Graduate School: A Test of the Theory of Planned Behavior. Journal of Social Behavior and Personality, Vol 15 Issue 2. pp 215-226.

20. Jayaratne, S., Premaratne, D. &Wijayasiri, J. (2016) Trade and Transport Audit: Sri Lanka. Working Paper Series No.26. Institute of Policy Studies of Sri Lanka. pp 26-51.

21. Keceli, Y. (2011) A proposed innovation strategy for Turkish port administration policy via information technology, Maritime Policy & Management: The flagship journal of international shipping and port research, 38:2, pp 151-167.

22. Kline, R. (2005) Principles and Practice of Structural Equation Modeling. 3rd Edition., Guilford Press, New York, USA., ISBN-13: 9781593850753. pp 366.

23. Nam, H. S.& Song, D. W. (2010) Maritime Logistics Hub in Concept and Practice. 12th WCTR, July 11-15, 2010 – Lisbon, Portugal. pp 1-21.

24. Ojala, L. &Celebi, D. (2015) The World Bank Logistics Performance (LPI) and Drivers of Logistics Performance. International Transport Forum.

25. Shevlin, M. & Miles, J.N.V. (1998) Effects of sample size, model specification and factor loadings on the GFI in confirmatory factor analysis. Personality Individual Differences, 25. pp 85-90.

26. The World Bank (2018). Available from: http://lpi.worldbank.org/ [Accessed 25th April 2020].

27. The World Bank. (2010) Trade and Transport Facilitation Assessment. A Practical Toolkit for Country Implementation. Washington, DC: WorldBank.

28. Ugboma, C., Ugboma, O. &Ogwude, I. C. (2016) An Analytic Hierarchy Process (AHP) Approach to Port Selection Decisions - Empirical Evidence for Nigerian Ports. Maritime Economic and Logistics, 8. pp 251-266.

29. Van Dyck, G. K. & Ismael, H. M. (2015) Multi-Criteria Evaluation of Port Performance in West Africa Using Analytic Hierarchy Process (AHP). American Journal of Industrial and Business Management. AJIBM Vol. 5 Issue 6. pp 432-446.