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**WORLD MARITIME UNIVERSITY**

Malmö, Sweden

**LOGISTICS PERFORMANCE AND ITS  
IMPACT TO EXPORTS GROWTH OF SRI  
LANKA**

By

**SEBASTIAN SHANIKA ROSHINI**

**Sri Lanka**

A dissertation submitted to the World Maritime University in partial  
Fulfilment of the requirement for the award of the degree of

**MASTER OF SCIENCE**

**In**

**MARITIME AFFAIRS**

**(SHIPPING MANAGEMENT AND LOGISTICS)**

2019

## Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):



(Date): 24 September 2019

Supervised by: **Dr. Tiago FONSECA**

Supervisor's affiliation: World Maritime University

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## Abstract

Logistics has become a crucial dimension in the field of international trade with recent global changes. The strategic geographic positioning in the East West maritime route gives a competitive edge to Sri Lanka to develop as an exports oriented economic hub in the Indian Ocean in line with the Vision 2025 of Sri Lanka. The logistics and exports performances of Sri Lanka are below the global top performers and some regional top performers. This study using data from 119 countries for 2007-2018 econometrically shows the positive relationship between logistics performance and exports. A simulation exercise undertaken shows that if Sri Lanka improves its logistics performance by 43-69% catching up Singapore, its exports are estimated to rise by USD 104 to 137 million yearly. To draw insights on specific actions to be designed in order to achieve this, we have surveyed 63 stakeholders including logistics service providers, importers and exporters. The questionnaire collects data on specific logistics drawbacks, institutional factors that can be improved associated with Sri Lanka. By combining the results from the econometric estimation, those of the survey and the literature review, we provide recommendations as strategies to be considered by state bodies and policymakers to overcome those barriers in order to achieve intended hub status in line with Vision 2025.

**KEYWORDS:** Logistics Performance, Exports Growth, Sri Lanka Vision 2025, Exports Oriented Economic Hub

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## List of Abbreviations

DOC	Department of Commerce
GPN	Global Production Network
EU	European Union
ELG	Exports-Led-Growth
FDI	Foreign Direct Investment
FTZ	Free Trade Zone
GCF	Gross Capital Formation
GDP	Gross Domestic Production
GLE	Growth-Led-Exports
H-O Theory	Heckscher-Ohlin Theory
ICT	Information and Communication Technology
LPI	Logistics Performance Index
MCC	Multi Country Consolidation
MOF	Ministry of Finance
NAFTA	North American Free Trade Agreement
NEG Theory	New Economic Growth Theory
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
TEU	Twenty Foot Equivalent Unit
US	United States

## Chapter 01 - Introduction

This chapter presents an overview of the maritime sector development, the current exports and logistics performance of Sri Lanka linked with the visionary objectives of the country to compete with the top performers in the area. This chapter also provides the motivations behind this study, stating its research questions and intended objectives of the study. Next, the contribution of the findings of the study is presented: i.e. contribution to the literature, policy standpoint and benefits to the state decision makers and private logistics service providers as well. Finally the overall structure of this study is presented.

### 1.1. Background

Trade between nations has become the dominant factor for improving the wealth of the world population (Smith, as cited by Munim & Schramm, 2018). Globalization has increased competition and developed international trade between countries over the past decades (UNCTAD, 2008; Roekel, 2017). These developments have led to increasing the importance of logistics in international trade and raising logistics as a major component that contributes to for the development of countries (Song & Panayides, 2012; Puretas *et al.*, 2013; Marti *et al.*, 2014). As such, assessing the performance of logistics components has become a key requirement in the development of economies (Roekel, 2017). Infrastructure development in the transport sector is a crucial factor in terms of logistics performance (Gonzalez *et al.*, 2008). As airports and seaports have become the key parts of the supply chain network, it is required to pay much attention to the development of those ports. And, also for the other port-related components such as infrastructure facilities for the smooth functioning of the supply chain (Perera, 2019). The geographic location within the international transport route is another significant factor for countries to achieve competitive advantages in the international supply chain (Benassi, 2015). The port of Colombo of Sri Lanka derives benefits in the maritime sector due to its geographical location in the “Silk Route” which is considered as the most significant and strategic geographical area in the east west maritime route (Edirisinghe, 2013; Ministry of Foreign Affairs, 2016; Fernando, 2017; Perera, 2019; Masakorala, 2019). Annually, more than

60,000 ships sail in this east west maritime route, carrying two-thirds of the world’s oil and one half of all container shipments (Fernando, 2017; Perera, 2019) bringing a competitive edge to Sri Lanka. The port of Colombo, which has been ranked as the 24<sup>th</sup> global port among the 100 global ports in the Lloyd’s list 2018 (Nightingale, 2018), is a transshipment port/hub. Transshipment hubs facilitate international shipping as an intermediate destination by transferring cargo from larger vessels to smaller vessels and vice versa, and serve the final ports of destination or another transshipment port (OECD, 2011). Table 1 illustrates the annual share of cargo volume transhipped by eight South Asian ports during 2003-2012 and it reveals that almost three-quarters of the containers handled at Colombo are transshipment boxes (World Bank, 2016). As depicted in Figure 1, the container throughput of Port of Colombo doubled during the year 2017 up to the level of 6,209 million TEUs<sup>1</sup> from 3,079 million TEUs in 2006 showing remarkable progress in the field of shipping.

Table 1: Annual Share of Cargo Volume at Transhipped – Selected South Asian Ports

Port	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	%Change
Colombo	66	66	67	73	73	76	76	75	73	73	10.6
Cochin	0	0	0	0	0	0	0	0	3	2	-
Kandla	0	0	0	1	3	2	0	2	1	0	-
Kolkata	5	6	6	5	5	5	4	2	2	1	-80
JNPT	9	9	6	5	6	6	4	3	2	1	-88
Mumbai	8	9	16	22	27	21	36	34	31	31	287.5
Tuticorin	0	0	0	0	0	0	3	0	3	2	-
Visakhapatnam	16	15	08	9	8	7	8	3	8	6	-62.5

Note: Figures are based on volume. Source: World Bank, 2016

Container throughput

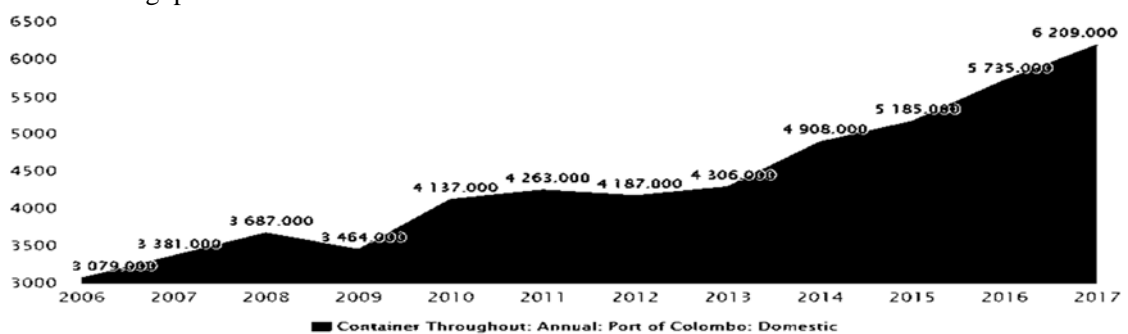


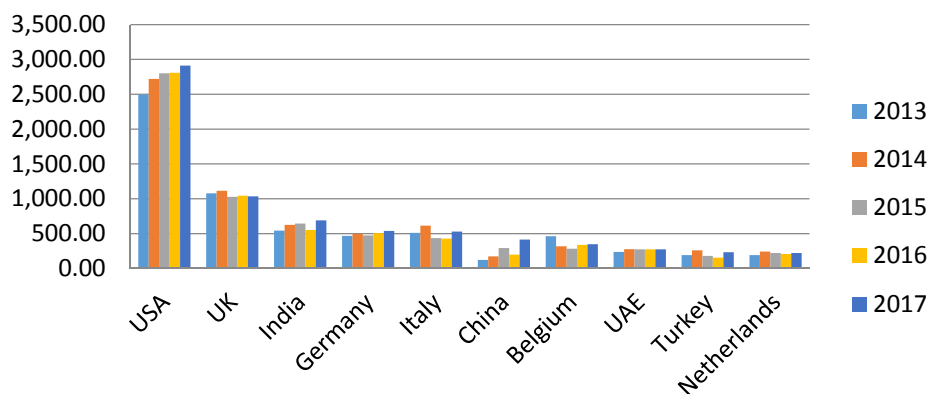
Figure 1: Container Throughput of Port of Colombo

Note: Values of throughput in million TEUs. Source: Central Bank of Sri Lanka [CBSL], 2018

<sup>1</sup> TEU stands for Twenty Foot Equivalent Unit.

## 1.2. Sri Lanka: An Exports Oriented Economy

The change of foreign trade policy of Sri Lanka in 1977 has become a dominant factor for economic transformation which led to achieving not only the above mentioned performance in the maritime sector but also contributed to other sectors of the economy. Sri Lanka started to follow economic liberalization process in 1977 subsequent to depressed effects of the inward looking policy so far applied. Sri Lanka became the leading country of applying economic liberalization policies in the South Asian region (Athukorala, 1998). The period from 1977 onward, the exports of Sri Lanka play an important role in the economy, influencing the increase of the level of economic growth, employment and the balance of payments (Athukorala, 1998). The total value of exports of Sri Lanka in 2017 was recorded as US\$ million 11,411.23 (Department of Commerce [DOC], 2018) showing an 11.69 per cent improvement compared with that of the year 2016. The Figure 2 exhibits the major destinations of exports of Sri Lanka. The United States was the largest buyer of Sri Lankan products, corresponding to approximately 25 per cent of the total export value share. The UK, India, Germany and Italy were the next important buyers, respectively. Further, the total value of exports covered by these five export destinations in 2018 was 49 per cent from the total value of exports amounting to US\$ 12 Billion.



Source: DOC, 2017

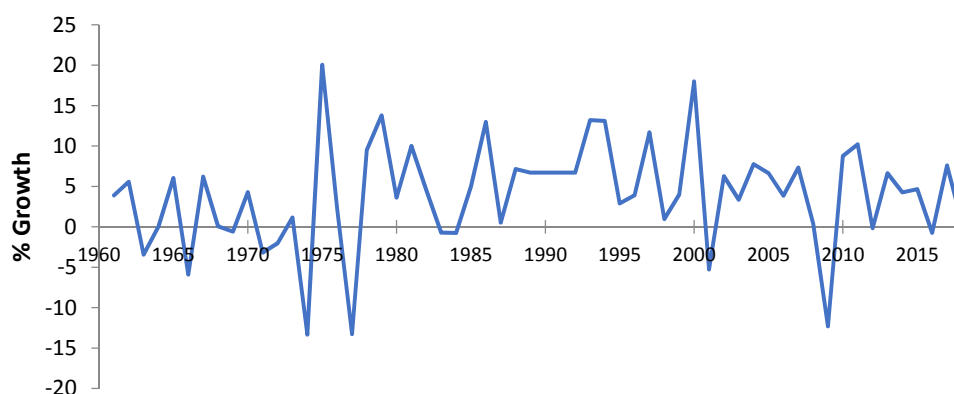
Figure 2: Major Destinations of Exports of Sri Lanka

Apparel was the main exports product of Sri Lanka representing 45 per cent of total exports value in 2018 generating the main source of foreign exchange to the country. Tea, solid tires, cinnamon and cinnamon-tree flowers were the subsequent important exports products. Figure 3 shows the percentage growth in exports of Sri Lanka. Table 2 shows a comparison of the percentage of exports growth rate in the South Asian region. It can be seen that there is a trend of increasing exports growth of South Asia except for Sri Lanka and Nepal. The data reveals exports performance of Sri Lanka is very weak.

Table 2: Exports Growth Rate of South Asia<sup>2</sup>

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sri Lanka	-12.31	8.76	10.20	-0.18	6.64	4.26	4.66	-0.74	7.59	0.49
India	-4.83	19.48	15.49	6.81	7.79	1.78	-5.65	5.07	4.69	13.45
Bangladesh	0.03	0.94	29.34	12.53	2.45	3.20	-2.83	2.20	-2.34	8.09
Pakistan	-3.36	15.71	2.37	-15.00	13.58	-1.48	-6.34	-1.60	-0.78	9.92
Bhutan	-2.39	7.52	3.20	-2.40	3.87	-5.75	-3.50	-9.10	11.60	-
Nepal	3.87	-10.44	-2.11	1.92	10.33	18.76	6.79	-13.66	13.70	4.35

Note: Numbers are in percentage. Source: World Bank, 2019



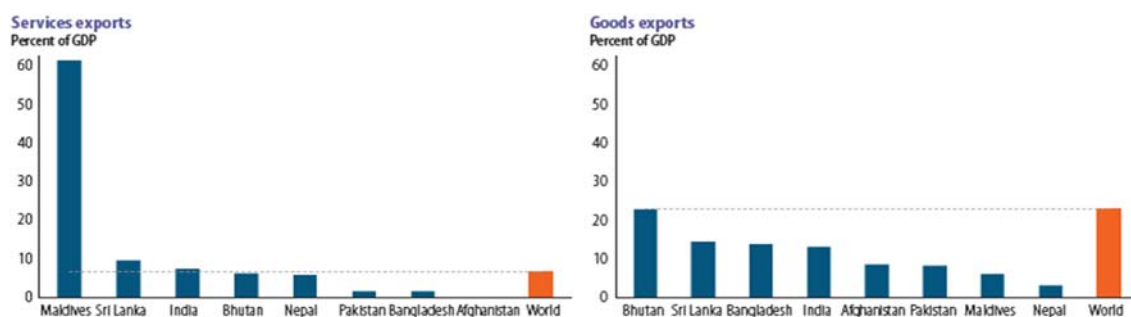
Source: World Bank, 2019

Figure 3: Percentage Growth in Exports of Sri Lanka

<sup>2</sup> The countries that make up South Asia include Sri Lanka, Pakistan, Afghanistan, Nepal, India, Bangladesh, Bhutan and Maldives. Source: World Bank, 2018

Presently, the domestic market of Sri Lanka is limited to 20 million consumers. Hence, as government policy document predicted, an external growth is needed to achieve a high and long term growth. With a view of improving opportunities for local businesses and expediting the development of the country in line with the global changes, the Sri Lankan government launched the Vision 2025, to promote Sri Lanka as an exports oriented economic hub in the centre of Indian Ocean. The main objective of this outward approach was to secure opportunities for local businesses in Global Production Networks (GPNs) and increase the efficiency of the economy (Ministry of Finance [MOF], 2018). The government expected to have higher income and better standard of living through these developments. The government also aimed to double exports to \$20 billion per year and raising the per capita income to \$5,000 per year.

In the meantime, the report of “*Exports Wanted*”<sup>3</sup> released by World Bank (2019) highlighted the underperformance exports in South Asian region and revealed the reasons. The report has identified the exports of services in Maldives, Sri Lanka, and India as being above the world average. However, in respect of goods exports, all countries are far below except Bhutan (Figure 4). The report further stated that the total exports of goods and services in South Asian countries were lower than world average, except Maldives and Bhutan.



Source: World Bank, 2019

Figure 4: Exports Share in South Asia

<sup>3</sup> World Bank (2019), *Exports Wanted*

<http://documents.worldbank.org/curated/en/527281554827140474/Exports-Wanted>

The report emphasized that when the world average is 22 per cent, goods exports of Sri Lanka was only around 13 per cent implying underperforming exports. Moreover, the same report identified “difficult logistics (roads, ports, storage)” as the main bottleneck for higher exports in the South Asian region. 60% of respondents have indicated the importance of “difficult logistics” as the major bottleneck in exports in this region (Figure 5). Hence, our next attempt was to understand the current logistics performance of Sri Lanka through the rankings and scores of Logistics Performance Index (LPI hereafter).



Source: World Bank, 2019

Figure 5: Main Bottlenecks for Higher Exports - South Asia

### 1.3. Logistics Performance of Sri Lanka

The Logistics Performance Index (LPI) can be used as a good proxy for involvement of countries in the Global Value Chains (Memedovic *et al.*, 2008). From the year 2007, the World Bank publishes Logistics Performance Index for every other two years. The six parameters of LPI can be categorized into two groups. The first three relate to regulation and are considered as inputs to supply chain. The second three components are associated with supply chain performance outcomes (Arvis *et al.*, 2016).



Inputs to supply chain:

- Customs: The efficiency and effectiveness of the customs dispatch procedure are measured through speed, simplicity and predictability of customs agencies.
- Infrastructure: The quality of the country's transport and telecommunications infrastructure is measured under this component.
- Logistics quality and competence: It measures how certain parties provide quality logistics services to customers and optimize the relationship between organizations and consumers.

Supply chain performance outcomes:

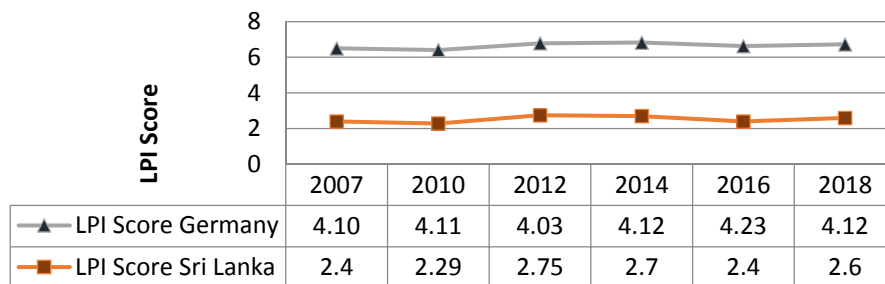
- Tracking and tracing: It measures the tracking and tracing of shipments. Tracking refers to identifying the exact location and the route of each consignment up to its delivery to the end customer.
- Timeliness: The punctuality of shipment delivery times is measured through timeliness. The delays of shipments influence adversely on the existing high level of competition.
- International shipments: It measures how easy it is to arrange shipments at competitive prices.

Table 3: LPI Rankings and Scores of Sri Lanka

Year	Rank	LPI Score	Customs		Infrastructure		International shipments		Logistics competency		Tracking & Tracing		Timeliness	
			R	S	R	S	R	S	R	S	R	S	R	S
2007	92	2.40	91	2.25	105	2.13	112	2.31	84	2.45	75	2.58	113	2.69
2010	137	2.29	143	1.96	138	1.88	117	2.48	142	2.09	142	2.23	125	2.98
2012	81	2.75	71	2.58	89	2.50	50	3.00	68	2.80	86	2.65	110	2.90
2014	89	2.70	84	2.56	126	2.23	115	2.56	66	2.91	85	3.12	85	2.76
2016	86	2.40	79	2.25	123	2.25	103	2.31	67	2.45	82	2.58	87	2.69
2018	94	2.60	79	2.58	85	2.49	112	2.51	109	2.42	78	2.79	122	2.79
2007-2018	-2	+2	+12	+3	+20	+3	-	+2	-25	-03	-3	+2	-9	+1

Note: "R" and "S" stand for Rank and Score respectively. Source: World Bank

The table 3 exhibits the rankings and scores of LPI of Sri Lanka for the years 2007, 2010, 2012, 2014, 2016 and 2018. Sri Lanka ranked in the 92<sup>nd</sup> position in the global ranking of 160 countries in 2007. Even after 10 years, Sri Lanka ranked 94th position in the LPI for the year 2018 with a score of 2.60. The score has risen from 2.4 in 2007 to 2.70 in 2014. However, from 2014 to 2018 it dropped to 2.6. While the performance in customs and infrastructure has increased, the performance in international shipments, logistics competence and timeliness has worsened last two years. Germany topped the rankings with a score of 4.12 and the Figure 6 compares the performance of Sri Lanka and Germany. Average LPI of the South Asian region (Figure 7) was 2.30 in 2018 with India leading by 3.07 score. Further, the Table 4 shows that logistics performance of South East Asian region countries except Cambodia is far better than Sri Lankan situation.



Source: World Bank, 2018

Figure 6: LPI Comparison: Sri Lanka and Germany

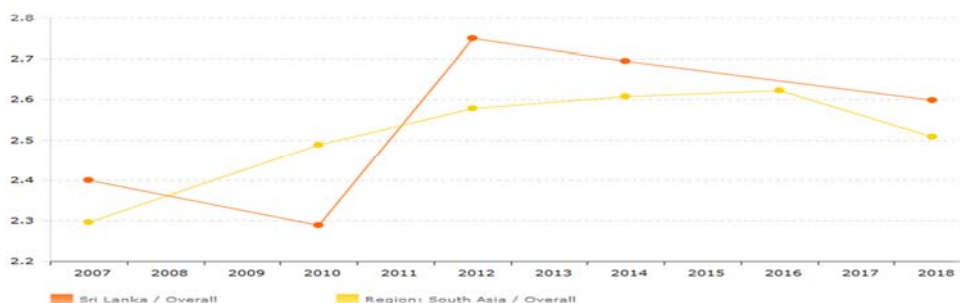


Figure 7: LPI Comparison: Sri Lanka and South Asia

Notes: The countries that make up South Asia include Sri Lanka, Pakistan, Afghanistan, Bangladesh, Nepal, India, Bhutan and Maldives. Source: World Bank, 2018

Table 4: LPI Comparison-South East Asia and South Asia

Country	2007	2010	2012	2014	2016	2018
South East Asia						
Singapore	4.19	4.09	4.13	4.00	4.14	4.00
Indonesia	3.01	2.76	2.94	3.08	2.98	3.15
Malaysia	3.48	3.44	3.49	3.59	3.43	3.22
Thailand	3.31	3.29	3.18	3.43	3.26	3.41
Vietnam	2.89	2.96	3.00	3.15	2.98	3.27
Cambodia	2.5	2.37	2.56	2.74	2.80	2.58
South Asia						
Bangladesh	2.47	2.74	-	2.56	2.66	2.58
India	3.07	3.12	3.08	3.08	3.42	3.18
Nepal	2.14	2.20	2.04	2.59	2.38	2.51
Pakistan	2.62	2.53	2.83	2.83	2.92	2.42
Sri Lanka	2.40	2.29	2.75	2.70	2.40	2.60

Source: World Bank, 2018

#### 1.4. Problem Statement and Research Questions

Having considered the export performance and logistics performance of Sri Lanka and the findings of the report “*Exports Wanted*” of the World Bank (2019), we observed a direct link between exports performance and logistics performance. In this context, although the Sri Lankan government set targets to improve exports by \$20 billion per year with the aim of positioning Sri Lanka as an exports oriented economic hub in the Indian Ocean through the Vision 2025, it is uncertain whether Sri Lanka will be able to achieve its hub status under the current logistics and exports performances. The Vision 2025 Sri Lanka further aimed to enhance the infrastructure and other logistics performance. Having considered above all, the major aim of this study was to investigate the effect of logistics performance on Sri Lankan exports with the intent of enabling policymakers to bring reforms or strategies to achieve visionary objectives.

Hence, the aim of this study can be condensed into the following research questions:

1. What are the influential factors affecting exports in economies?
2. What is the impact of logistics performance on exports in economies?

3. To what extent improvements in logistics performance effect on exports of Sri Lanka?
4. What are the logistics barriers encountered by logistics service providers of Sri Lanka?
5. To what extent the policymakers address the logistics barriers in terms of achieving exports growth and related visionary objectives of Sri Lanka (becoming the exports oriented economic hub in the Indian Ocean)?

#### Objectives of the Study

The above-stated research questions are linked with the following broad objectives of this study:

1. To understand main concepts and theories behind the international trade and identify the flows from chosen factors to exports through a comprehensive literature review.
2. To empirically estimate the impact of chosen factors on exports in economies using econometric modelling.
3. To compute the expected improvements in logistics performance of Sri Lanka catching up top performers and compute expected increase on exports through a simulation exercise.
4. To identify major logistics performance-related barriers that affects and discourage on Sri Lankan exports through a logistics survey.
5. To recommend how those critical factors could be stimulated by way of achieving visionary policy objectives of Sri Lanka.

#### 1.5. Research Contribution

This study contributes in numerous ways. The motivation behind of this study is the growth of Sri Lankan shipping industry has been dramatically high during the last few years and

the policies of government on economic growth are thought to be visionary<sup>4</sup>. Therefore, from a policy standpoint, mainly the findings of this study contribute to a diagnostic assessment of the drawbacks on logistics performance of Sri Lanka, thereby contributing to the understanding of the different potential reforms and strategies under different dimensions.

The other contribution of this study is the construction of an empirical model for measuring the effects of determinants of exports from a set of economic indicators, which were estimated for a cross-section of 119 countries over the period 2007-2018. This is a greater coverage than Poretas *et al* (2013), Marti *et al* (2014) and Gani (2017) and a more recent one.

Focusing on the simulation exercise, this study brings an illustrative assessment for estimating the expected level of improvements in the various logistics dimensions (customs, infrastructure, international shipments, quality of logistics services, tracking and tracing and timeliness) to catch up benchmarking countries and compute the growth in exports of Sri Lanka under each improvements.

The economic targets which set without conducting a proper and systemic study may be unrealistic. The budgetary allocations also are done in terms of these unrealistic targets may be not effective or unreasonable since not having identification of priorities. Sometimes, investments in transport and infrastructure sectors to achieve global needs may be a challenge for an economy. Hence, our mechanism can be used as a tool for economies for doing budgetary allocations and investing effective and reasonable manner.

As mentioned earlier, the performance of LPI components: international shipments, competence, tracking and tracing and timeliness are considered as supply chain outcomes

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<sup>4</sup> Efforts of Sri Lankan Government towards trade facilitation . Weerakon, D., & Perera, N. (2014). *The Role of Sri Lanka in enhancing Connectivity between South Asia & South East Asia*, ADBI Working Paper 487. Tokyo: Asian Development Bank Institute. Retrieved from: <http://www.adbi.org/workingpaper/2014/06/30/6349.sri.lanka.role.connectivity/>

(Arvis *et al.*, 2016) and performances in those fields depend on the intervention and performance of private bodies (logistics service providers and shipping lines/agents). As such, our findings give an indication for those parties to react to market fluctuations and global changes for better performance.

### Research Structure

The study is structured as follows. Chapter 2 presents theoretical underpinnings and a review on literature of the linkage between exports and other variables with reviewing the importance of logistics performance on achieving economic gains. Chapter 3 describes data and econometric model. Chapter 4 presents the results of the estimated econometric model and survey questionnaire. The discussion of the results is provided under the Chapter 5 and finally, Chapter 6 concludes and includes policy remarks.

## Chapter 02 – Literature Review

The literature review in this chapter has been divided into three main parts focusing on a funnel approach – from broader concepts to more detailed and specific facts that enable triangulation of the findings. The first part reviewed the literature on theoretical concepts including six basic constituents of international trade theory and how these theories are applied to investigate the impact with different aspects. Under the second part review, the studies on causal flows from GDP to exports, investments to exports, imports to exports and LPI to exports will be taken. Thirdly, the studies on LPI and its components are reviewed from the view of trade facilitation through a macro to micro perspective. Finally, the research gap is presented.

### 2.1. Review of Theoretical Framework

Among various international trade theories, there are economic theories that deal with international trade aspects. The classical theories such as the theory of comparative advantage, the theory of Heckscher-Ohlin (H-O Model), the theory of gravity model and some modern theories such as new trade theory, new economic geography theory and new growth theory as well will be taken to explain why countries trade. Moreover, the key concepts of theories to be taken under the study will provide a foundation for designing questions in the logistics survey<sup>5</sup> and triangulating the empirical findings.

#### 2.1.1. The Comparative Advantage Theory

The main theory which is to be taken to review under this study is the international trade theory which can be considered as the foundation for the theoretical framework of exports growth related studies (Gani, 2017). According to Adam Smith (1776), countries can take benefits through international trade based on the concept of absolute advantages in production. In contrast, David Ricardo (1870) showed that each country should specialise

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<sup>5</sup> Chapter 3 further explores the linking of questions of logistics survey with the theories concerned under the theoretical framework and the Appendix 1 shows the linkage between the theories and survey questions.

in producing goods based on comparative advantage in production (Suranovic, 2016). Comparative Advantage theory states that countries can engage in mutually beneficial trade with each other with the lowest opportunity cost of production relative to the other trade partner. A country's comparative advantage can be recognized by comparison of production costs across countries. Ricardo suggests comparing opportunity costs of producing goods instead of comparing the monetary costs of production or resource costs such as labour (Suranovic, 2016). The figure below illustrates that using all its resources, country X can produce 30 units of commodity A or 6 units of commodity B, and country Y can produce 35 units of Commodity A or 21 units of commodity B. In this case, country Y has the absolute advantage in producing both products, but it has a comparative advantage in B because it is relatively better at producing them. Country Y is 3.5 times better at B, and only 1.17 times better at A. Therefore, if both countries try to become self-sufficient by producing both of the two products ( $A = 15 + 15 = 30$ ;  $B = 12 + 3 = 15$ ), the world output will be 45 units. However, if country X and Y country try to specialize in producing A and B respectively, the total production will be increased [ $30(A) + 21(B) = 51$  units].

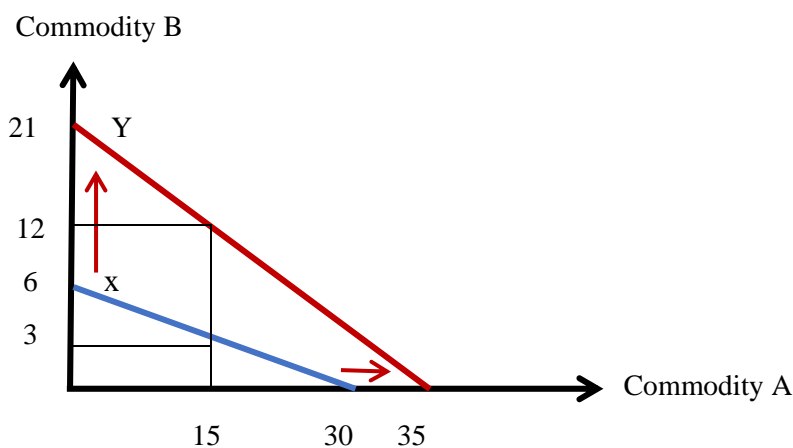


Figure 8: Illustration of Comparative Advantage

### 2.1.2. The Heckscher-Ohlin theory

The Heckscher-Ohlin model for the trade theory is a further development of the Ricardian framework that discusses the comparative advantage with geographical resources that countries have (Borisova, 2013). Heterogeneity and specialisation are basic features that



can be seen in the production patterns around the world (Morrow, 2010). Therefore, the Heckscher-Ohlin theory suggests that capital-abundant country exports capital-intensive goods, whereas labour-abundant countries tend to export more labour-intensive goods (Suranovic, 2016). As an example, the United States produces more aircrafts than China whereas China supply more apparels than United States. Each country produces and exports goods which relatively better than the other country (Suranovic, 2016).

### 2.1.3. The Gravity Theory

The Gravity Theory of Jan Tinbergen (1962) based on Newton's law of universal gravitation led to many theoretical and empirical literatures (Silva & Tenreyro, 2006) and it is another constituent of the trade theory. The gravity model suggests that bilateral trade flows depend on the volume of income in both exporting and importing country positively and negatively on the distance between them (Marti *et al.*, 2014). The basic gravity equation for trade states that the trade flow from country  $i$  to country  $j$  ( $T_{ij}$ ), is proportional to the product of the two countries' GDPs ( $Y_i$  and  $Y_j$ ) and inversely proportional to their distance ( $D_{ij}$ ) (Silva & Tenreyro, 2006), as described by Equation 1. The Equation 2, shown below, is the log-log Model of the Gravity equation.

$$F_{ij} = G \frac{M_i^{\beta_1} M_j^{\beta_2}}{D_{ij}^{\beta_3}} \eta_{ij} \quad (1)$$

$$\ln(F_{ij}) = \beta_0 + \beta_1 \ln(M_i) + \beta_2 \ln(M_j) - \beta_3 \ln(D_{ij}) + \varepsilon_{ij}. \quad (2)$$

The transport cost is being generally measured by distance or proximity and geography is a powerful determinant of bilateral trade; thus proximity of a country to other countries has been included to the international trade function (Frankel & Romer, 1999). Gravity models have been extensively used by scholars. For example, Frankel & Romer (1999) used a gravity model to measure the impact of trade on income for a sample of 151 countries. Otsuki *et al* (2000) employed the gravity model to estimate the impact of changes in differing levels of protection based on the EU standard for 15 European countries and 9 African countries between 1989 and 1998. The study of Anderson and Wincoop (2003) also

was based on the gravity model to estimate the exports potential of environmental goods in India for the period between 1991 and 2011.

#### 2.1.4. The New Trade Theory

The new trade theory was developed in the 1970s and 1980s from the comparative advantage-based model by explaining the empirical elements of trade (Krugman, 1980). It suggested that, the crucial factors in industries for deciding trade patterns are economies of scale and network effects. Network effects refer that product becomes more valuable when it is used by many. The specialization leads to increase economies of scale and monopolistic competition. Therefore, the role of government is to facilitate to the industry by promoting free trade zones and providing other necessary infrastructure as well in order to attract key industries.

#### 2.1.5. The New Economic Geography Theory

The traditional trade theory states that if there is an economic liberalisation between two countries, both countries receive benefits of comparative advantage (Ascani *et al.*, 2012). The international trade theory combined with the concept of economic integration is connected with location/geography issues (Ohlin, 1933; Predöhl, 1950; Balassa, 1967). The New Economic Geography (NEG) theory (Krugman, 1991) refers to the formation of a wide variety of an economic agglomeration in a specific geographical space. Three basic assumptions are important in geographical economics (Hassink & Gong, 2019).

(i). Increasing returns and economies of scale.

It is suggested that firms should be concerned about geographically located large firms in order to increase returns instead of establishing small firms in different locations for the purpose of reducing production costs (Ascani *et al.*, 2012),

(ii). Production factors (labour and capital) are regarded as mobile, and

(iii). Transport cost is important when selecting location.

According to the third assumption, NEG theory generally adopts some forms of ‘iceberg transport costs’ which are paid as cost of shipment in the transport in addition to direct cost of transport. Therefore, firms make decisions on whether they should establish regional plants/branches or export as an alternative in order to reduce additional transport costs (Ascani *et al.*, 2012). The empirical study on NEG theory of Hanson (1996) has attempted to show the impact of reducing trade costs between Mexico and USA as a result of North American Free Trade Agreement (NAFTA) on the location of Mexican manufactures and the increase of market access for Mexican firms due to economic integration. The study of Marques (2008) also has suggested that deeper economic integration in Europe created agglomeration processes resulting in income differences across regions.

#### 2.1.6. The New Growth Theory

The new growth theory supports a different notion in international trade compared to that of the previous theories. It describes two important views of an economy (Cotright, 2001). Firstly, it considers technological progress as a product of economic activity. As such, the new growth theory referred to as “endogenous” growth theory that describes long run economic growth and that it internalizes technology into the economic system. This differs from the “exogenous” growth theory of Robert Solow (1950) which suggests that technology depends on forces outside the economy. Secondly, the new growth theory suggests that knowledge and technology are subject to “increasing returns” not “diminishing returns” unlike land and capital (Romer, 1992; Cotright, 2001). Similarly, new growth theorists argue that government should also finance, or seek finance for, infrastructure projects, such as road, rail, sea, and air transport (Economics online, 2019).

## 2.2. Causal flows from GDP, Investments, Imports and LPI to Exports.

### 2.2.1. Growth – Exports

The study of the relation between exports/exports growth and economic growth has been an important research area in international and development economics (Tekin, 2012). It is revealed that many researchers attempt theoretically and empirically to find out the correlation between trade and growth. The empirical literature on exports and growth can be divided into three broad categories: i.e. studies on production function approach, studies utilizing rank and cross-correlation in a bivariate framework, and studies on causality tests using cointegration and unit root tests (Christopoulos, 2005). Whereas the causality flows from exports to economic growth referred as “Exports-Led Growth” (ELG), the opposite relation, causal flow from economic growth to exports, is referred to as “Growth-Led Exports” (GLE) (Awokuse & Christopoulos, 2009). The present study investigates the causal flow of “growth-led-exports” together with other explanatory variables. Jung and Marshall (1985) and Tekin (2012) are of the view that domestic economic growth dynamics is more relevant for describing exports growth since the output growth leads to increase in productivity growth. In the long run, the productivity growth creates international competitiveness of exports products resulting in enhancement of exports growth. Although a wide empirical literature on causality relations between exports and economic growth is available, the findings of these are varied (Tekin, 2012). Whereas the study of Bahmani-Oskooee and Alse (1993) proved bidirectional causality between exports and economic growth using Granger causality, the study of Jung and Marshall (1985), was unable to support for either exports-led growth or the growth-led exports hypotheses (Tekin, 2012).

### 2.2.2. Capital Investment – Exports

Many studies have been using econometric models to prove the positive relationship of foreign and domestic investment with exports expansion and openness to trade (Culem, 1988; Sharma, Nayagam and Chung, 2012). Only a few studies have been taken for review. Generally, exports expansion leads to economic growth by opening more opportunities for investments in the technological improvements and enhancing international competition

(Balassa, 1978; Bhagwati, 2007). In this context, it is very clear that ‘exports-led investment’ is significant in an economy’s growth process (Botha, 2017). The study of Ibrahim (2000) which analysed the productivity of public and private capital formation in Malaysia based on neo-classical growth regression from 1961 to 1995, revealed that the over the periods under consideration, private investment and exports performance were positively correlated. The results showed that public investment has been unproductive for economic growth. Rajni (2013) investigated the linkages between exports, imports and capital formation of India using co-integration and Granger causality techniques for the period of 1991 to 2010. The results indicated that there is bi-directional causality between gross domestic capital formation and exports growth. The study of Feddersen *et al* (2017), based on co-integration and Granger causality tests, used quarterly time series data from 1975 to 2012 to confirm the concept of “exports encourage investment and capital formation”. In the short run, export growth directly causes to higher economic growth and in the long run as well it triggers faster capital formation leading to economic growth.

Apart from studying the correlation between exports and capital/investments, several studies revealed that logistics performance attracts foreign direct investors to establish imports, production and distribution facilities thus increasing employment opportunities and income levels. Saidi & Hammami (2011) attempted to analyse the importance of transport and logistics through determinants of foreign direct investment among eight developing Mediterranean countries namely Cyprus, Egypt, Israel, Malta, Morocco, Syria, Tunisia and Turkey during the period of 2000–2009. The results suggested that transport systems and logistics are an integral part of the strategy to attract Foreign Direct Investments (FDI).

### 2.2.3. Imports– Exports

The studies on causal flows from imports to exports are very few. The expansion of the International Production Networks means that there will be a high influence of imports (both raw materials and semi-processed products) from partner countries on merchandise exports of a country (UNESCAP, 2011; WTO, 2011).

#### 2.2.4. Logistics Performance – Exports

Logistics values depend on geography, time and value. As such, many recent researches have incorporated logistics variables into the gravity model. Portugal-Perez and Wilson (2010) assessed the impact of different aspects related to trade facilitation on exports performance by estimating the gravity model. Poretas *et al* (2013) analysed logistics performance in European Union with EU exports over the period of 2005 to 2010. Marti *et al* (2014) compared 2005 to 2010 LPI<sup>6</sup> data of countries grouped in five emerging geographical regions namely South America, Africa, Middle East, Far East and Eastern Europe using gravity model. The present study also follows the same line of research by using the LPI index to analyse the causal flows from LPI to exports.

Many studies have been making use of the LPI as a key instrument for analysing various trade related aspects such as trade performances, export competitiveness and “Aid-for-Trade” measures for trade facilitation. The study of Chakraborty & Mukherjee (2016) aimed to find out the relationship of logistics performance and exports in higher income and lower income countries during 2007, 2010, 2012 and 2014 using econometric analysis. Results revealed Aid-for-Trade support needs for lower income countries for trade facilitation. Erken (2014) attempted to study the relationship between the logistics performance and Global Competitiveness Index (infrastructure weighted) of 113 countries. The results revealed that the quality of railroad infrastructure and quality of port infrastructure were the major determinants of logistics performances. The study of Hollweg & Mong (2009) focused on trade restrictions of trade with logistics services in the ASEAN+6 economies. The authors categorized the logistics sector restrictiveness index under six primary headings: i.e. customs, investment, movement of people, and sector-specific restrictions for maritime, aviation, and road transport. The major finding of this study was that the performance of logistics sector would be enhanced under the less restricted trade environment. Ilangasekara & Premarathne (2018) have done another study in terms of Sri Lanka perspective under the theme of “the most underdeveloped areas of the

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<sup>6</sup> World Bank has introduced the Logistic Performance Index (LPI) to identify the challenges and opportunities faced by countries in respect of the performance of logistics.

infrastructure dimension of LPI". Though rail infrastructure was recognized as the prominent underdeveloped infrastructure, the respondents of the study (freight forwarders and other shipping related service providers) have ranked the port infrastructure as the main component that should be given priority order for the development. The development of warehouse and trans-loading, ICT infrastructure, road infrastructure, airport infrastructure and rail infrastructure were ranked respectively next to the port infrastructure. The time delays and lengthy imports and exports procedures of countries cause to reduce the trade volumes and negatively affect firms to enter export markets (Nordås *et al.*, 2006). Poor quality of infrastructure, as well as border inefficiency and lack of transparency, affect considerably on exports performance (Portugal-Perez & Wilson, 2010; Marti *et al.*, 2014). These logistics barriers discourage the entry of new firms to the market, creating a severe loss to economies. Mainly, the non-developed or primitive infrastructure, complex customs procedures and excessive bureaucracy between the state bodies cause an increase in trading costs and delay the efficient movement of goods across borders (Marti *et al.*, 2014). The OECD (2005) estimates that logistics costs range between 2 per cent and 15 per cent of total turnover. Therefore, it is evident that logistics plays an important role in international trade. The facilitation of trade and transport are the key factors that affect the economic development of countries (World Bank, 2018). Hence, the World Bank has introduced the Logistic Performance Index (LPI) to identify the challenges and opportunities faced by countries in respect of the performance of logistics. The LPI is considered as a benchmark tool for countries to develop their own national logistics strategies and policy reforms (Marti *et al.*, 2014). The LPI certainly assists for policymakers in determining priorities for reform, building up public-private dialogue and fostering trade and transport in different countries (Banco Interamericano de Desarrollo, 2010).

### ***Studies on components of LPI***

A number of empirical studies relying on cross country panel data have proved the positive impact of *infrastructure* on output (Gonzales *et al.*, 2008). However, some studies have addressed the reverse causation of infrastructure on growth, which is growth led by higher demand for infrastructure (Demetriades & Mamuneas (2000). Röller & Waverman (2001)

revealed that telecommunications infrastructure has a considerable impact on growth. The findings of Fernald (1999) also supported the hypothesis of transport and growth on the US industry. The study of Calderon and Serven (2003) based on Latin America found a positive and significant contribution from energy. Gonzales *et al* (2008) investigated the main determinants of logistics costs and physical access to services (infrastructure) and how these determinants influenced on growth and poverty of Latin American economies. The empirical results of panel data regression over the 1960-2000 period, showed a positive relationship between infrastructure and growth.

A number of empirical studies have found that infrastructure has a positive effect on logistics performance as well. In the paper “To What Extent Are High-Quality Logistics Services Trade Facilitating” OECD (2011) investigated how infrastructure and border administration impact on trade facilitation. In recent years, Gani (2017) investigated behaviour of exports and imports on logistics performance and found overall logistics performance positively correlated significantly with exports and imports. Further, Gani (2017) pointed out the importance of transport and logistics sector in the field of international trade through facilitating to firms to effectively complete imports and exports procedures and other related transactions.

The *customs* component of the LPI measures the effectiveness and efficiency of customs procedures in terms of speed, simplicity, and predictability (World Bank, 2018). Customs is a significant component in terms of logistics efficiency and transport efficiency. Particularly, in low income countries a small positive change of customs procedure leads to enhance efficiency of total logistics system (Heaver, 1992; Devlin & Yee, 2005). The study of Fernandes *et al* (2015) on customs procedure of Albania found that reductions in physical inspection rates profoundly effect on decreasing delays in customs for Albanian imports. Furthermore, it revealed that reduced delays in customs and reduced inspections under customs control lead to increase in total trade.



Presently, the logistics sector is identified as one of the main sectors in the economic development of a country, since high levels of logistics services lead to measure economic performance (Sharipbekova & Raimbekov, 2018). Arriving shipments at the right time at the time place can be referred to as *timeliness* and trade will increase through better timeliness and correct prediction of the arrival of shipment (Roekel, 2017). Hummels (2001) studied the importance of time as a trade barrier and estimated that each additional day spent in ocean transit leads to decrease the probability of exporting by a country to the United States by 1 to 1.5 per cent. Korinek and Sourdin (2011) stated that *tracking and tracing* is a major area for investments in the near future since all the parties in the supply chain can benefit from improved ability to locate their products. Shamsuzzhoa & Helo (2001) confirmed the importance of tracking and tracing of shipments in terms of customer service and managing logistics networks efficiently.

### 2.3. Research Gap

Gani (2017) has suggested a future research extending analysis on a country-specific basis to ascertain more precise implications at country-specific level. In that sense, this study supported to fill the said gap. In respect of Sri Lankan logistics status, the study of Ilangasekara & Premarathne (2018) has assisted to identify infrastructure related barriers (as a one component of LPI) and to bring suggestions to improve performance in this sector. However, our study has covered not only infrastructure component but also all the components of LPI including data from 2007-2018 and further it has computed the performance gap between Sri Lanka and other reference countries such as Singapore through a systematic econometric analysis. Next, our study fills the gap of recent report of “*Exports Wanted*” of World Bank (2019) by computing the logistics performance gap between underperforming country (Sri Lanka) and top performer (Singapore) and computing expected gain on exports under the improvements in LPI components.

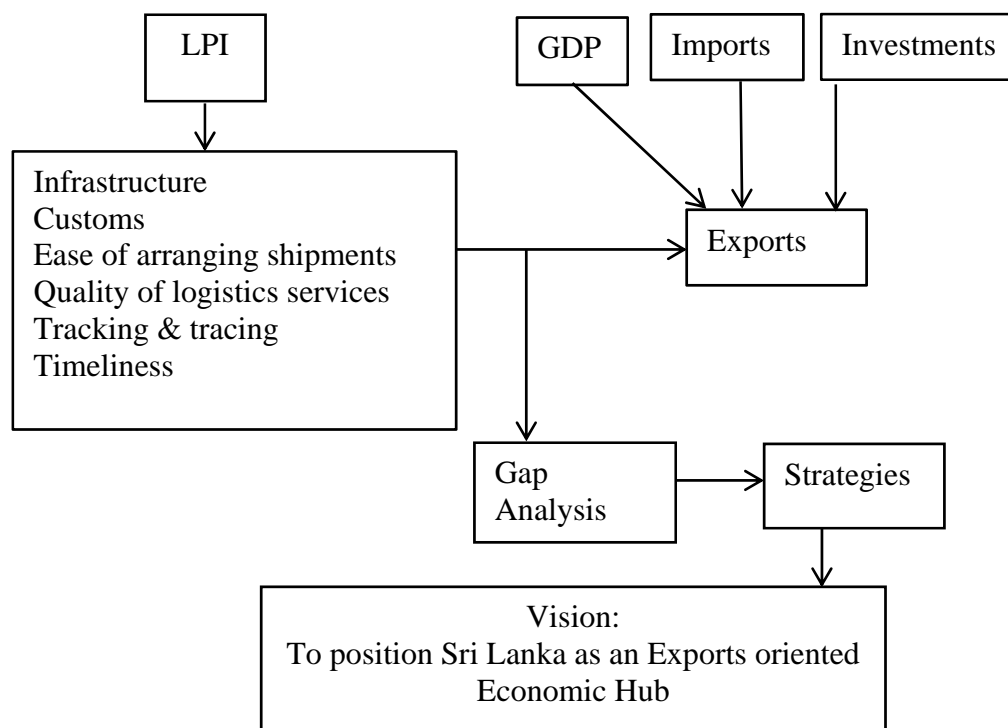
## Chapter 03 – Method and Data

This chapter addresses as to how this study is conducted in order to answer the research questions. Firstly, the conceptual model of the entire study is presented with the motivation of the structure of the whole thesis. The sources of the data collection are explained next and then focused on the econometric model and logistics survey. After that, an explanation of how the data is analysed is provided.

### 3.1. Conceptual Model

Figure 9 summarizes the theoretical notions presented so far in a conceptual model. This model was going to be tested by using a data set consisting of various secondary data sources referring to a cross section analysis for analysing the developments within a time frame from 2007 to 2018.

Figure 9: Conceptual Model



### 3.2. Data

There were two sources of data in the study. The data for econometric analysis: GDP, exports, imports, Gross Capital Formation, LPI and Services Value Added have been obtained from the World Bank database<sup>7</sup>. The World Bank has published LPI data for the years of 2007, 2010, 2012, 2014, 2016 and 2018. Accordingly, the cross-section analysis was done using data belonging to 119 countries for the above years. The next source of data was survey questionnaire. The questionnaire was performed online using specialised survey software (see Appendix 2: Questionnaire). After identifying what factors matter for the logistics performance, the questionnaire was used for understanding on how to improve those. The Appendix 1 shows the linking of questions of the survey with the theories described under the theoretical framework (Chapter 2). The question no 8 and 13 of the questionnaire were prepared based on some selected questions of the World Bank questionnaire designed to measure the LPI. The final sample consisted of 174 firms representing shipping agencies, freight forwarding/NVOCC Operators, importers and exporters. The aim of delivering questionnaires was for further verifying the results of econometric models and identifying areas to be given priority for policy reforms.

### 3.3. Variables

#### Dependent Variable

International trade can be considered as the exchange of capital, goods and services across international borders or territories. As described before, exports are a major component of international trade. The dependent variable of this study is the exports, which has been verified empirically to contribute positive to the growth of economy (Lim & Ho, 2013).

#### Independent Variables

The main covariates of this study are the ones associated with the Logistics Performance.

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<sup>7</sup> <https://lpi.worldbank.org/>

Thus, LPI and its indicators were included to the model as the independent variables namely: customs, infrastructure, international shipments, quality logistics, tracking and tracing, and timeliness. The next independent variable of the study was imports. The increase of imports of raw materials and intermediate products causes to increase exports by way of increasing domestic production. The capital accumulation causes to increase total productivity by increasing the number of firms (Adhikari, 2011). Hence, the Gross Capital Formation (GCF) included to the model as an independent variable and as the proxy for investment. The econometric evidence has shown that both foreign and domestic investment has a positive impact on export promotion and trade openness (Culem, 1988; Sharma, Nayagam and Chung, 2012).

#### Control Variables

Since, exports data does not distinguish between goods and services values, we added the size of the service sector (measured in value added as a percentage of GDP) to control for this confounding factor. A series of time dummy controls for the years 2007, 2010, 2012, 2014, 2016 and 2018 were included to account for macroeconomic and differences in the data collection across the years depending on the model. Gross Domestic Production (GDP) or a set of dummies for income groups as per World Bank (2019) were included to the Model. GDP measures the monetary value of final goods and services that are bought by the final user produced in a country in a given period of time (IMF, 2018). The GDP under this study was considered as the measurement of the economic level of countries.

#### 3.4. Method

The main research strategy of this study was estimating the effect of the exports on the chosen independent variables using econometric model. The results of econometric model were taken for the simulation exercise for computing gaps of logistics performance between Sri Lanka and benchmarking countries and computing potential gains on exports under the improvements of logistics performances. The qualitative method was used for analysing data collected through the online survey questionnaire. The econometric model is described in more detail in the following section.

## Econometric Model

In line with the theoretical and empirical literature, the following cross-section regression models for 2007, 2010, 2012, 2014, 2016 and 2018 were estimated for analysing the influence of LPI on exports. These linear models were estimated for investigating the statistical co-relationship between the dependent variable (exports) and independent variables. The first linear Model is as follows (Model 1). It included LPI and all the components of LPI but did not include GDP as a variable, thus including the income group dummies, due to the reason we described in the 3.2 section.

### Model 1

$$X = \beta_0 + \beta_1 (I) + \beta_2 (C) + \beta_3 (LPI) + \beta_4 (Customs) + \beta_5 (Infrastructure) + \beta_6 (Intern.Shipments) + \beta_7 (Quality Logistics Services) + \beta_8 (Tracking \& Tracing) + \beta_9 (Timeliness) + \beta_{10} (S) + \beta_k (T_k) + \beta_w (Inc_w) + \mu$$

Where,

X: Exports (% of GDP)

I: Imports (% of GDP)

C: Gross Capital Formation (% of GDP)

LPI: Logistics Performance Index

S: Services, Value added (% of GDP)

T: Vector of control variables (Dummies for years 2007, 2010, 2012, 2014, 2016 and 2018)

Inc: Dummies for income groups (low income, lower middle income, upper middle income & high income)

$\mu$ : standard error

Since the LPI components: customs, infrastructure, international shipments, competence, tracking and tracing and timeliness are highly correlated (>0.8), its joint estimation would lead to biased results due to multicollinearity. Therefore, in this study regressions including each index component separately as shown in below were tested. The Model 1 consisted of 7 specifications. The LPI included as a variable to the first specification of the Model 1, and

then the other components: customs, infrastructure, international shipments, quality logistics, tracking and tracing and timeliness were included as variables to the other specifications (from 2<sup>nd</sup> to 7<sup>th</sup> specifications).

### Regressions under Model 1

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (LPI) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (1)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Customs) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (2)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Infrastructure) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (3)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Int.shipments) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (4)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Competence) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (5)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Tracking) + \beta_4 (S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (6)$$

$$X = \beta_0 + \beta_1 (I) + \beta_2(C) + \beta_3 (Timeliness) + \beta_4(S) + \beta_k (T_k) + \beta_k (Inck) + \mu \quad (7)$$

The Model 2 consisted of GDP as a variable, thus not including the income group dummies. Since the issue of biased results due to multicollinearity, as we described earlier, the separate equations including each LPI index component were generated in this Model also as we did in the Model 1. Accordingly, the Model 2 also consisted of 7 specifications as shown below.

### Model 2

$$\begin{aligned} \ln(X) = & \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln(C) + \beta_4 (LPI) + \beta_5 (Customs) + \beta_6 (Infrastructure) \\ & + \beta_7 (Intern.Shipments) + \beta_8 (Quality Logistics Services) + \beta_9 (Tracking \& \\ & Tracing) + \beta_{10} (Timeliness) + \beta_{11} (S) + \beta_k (T_k) + \mu \end{aligned}$$

Where,

$\ln(X)$ : Exports (log)

$\ln(Y)$ : GDP (log)

$\ln(I)$ : Imports (log)

ln(C): Gross Capital Formation (log)

LPI: Logistics Performance Index

S: Services, Value added (% of GDP)

T: Vector of control variables (Dummies for years 2007, 2010, 2012, 2014, 2016 and 2018)

$\mu$ : standard error

### Regressions under Model 2

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (LPI) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (1)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Customs) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (2)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Infrastructure) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (3)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Int.shipments) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (4)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Competence) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (5)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Tracking) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (6)$$

$$\ln X = \beta_0 + \beta_1 \ln(Y) + \beta_2 \ln(I) + \beta_3 \ln C + \beta_4 (Timeliness) + \beta_5 (S) + \beta_k (T_k) + \mu \quad (7)$$

## Chapter 04 – Empirical Results and Findings

As described in the previous chapter, the main research strategy of this study involved the estimation of exports regression with determinants (GDP, imports, Gross Capital Formation, LPI and six indicators of LPI). Empirical analysis of this study adopted a cross-section estimation of the data involving 119 countries and six-time periods (2007, 2010, 2012, 2014, 2016 and 2018) with a total number of observations exceeding 600. The first part of this chapter presents the descriptive statistics, the results of seven (7) specifications of econometric models and the results of simulation exercise. The second part consists of the analysis of results of online logistics survey.

### 4.1. Descriptive Statistics

The cross-section regression analysis has been undertaken with the help of the STATA software (version 13.1). Table 5 and 6 present the descriptive statistics in the form of correlation matrix, means and standard deviations of the variables included in the empirical analysis, if the model runs with all variables including LPI and its six indicators in the two Models. The correlation matrices of two Models indicates the multicollinearity among LPI indicators; infrastructure, customs, international shipments, tracking and tracing, logistics services and timeliness as all correlation values fall over 0.8. In addition to the above results, in the Model 2, we acknowledge the multicollinearity between GDP and imports, GDP and GCF and imports and GCF since correlation values fall over 0.8<sup>8</sup>. However, our aim of this study was to investigate the effect of LPI and its components on exports. On the other hand, the correlation matrices of two Models did not indicate the multicollinearity of LPI or LPI indicators with other independent variables.

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<sup>8</sup> We tested the regressions of Model 2 without the Gross Capital Formation (GCF) variable (see Appendix 3) and did not reveal a substantial statistical change in the coefficients of LPI and its indicators compared to the regression results of exports indicated in the Table 8.



Table 5: Descriptive Statistics and Correlation Table (Model 1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Exports (% of GDP)	1											
(2) Imports (% of GDP)	0.86	1										
(3) Gross Capital Formation (% of GDP)	0.01	0.08	1									
(4) LPI	0.37	0.16	-0.11	1								
(5) Customs	0.39	0.20	-0.11	0.96	1							
(6) Infrastructure	0.36	0.15	-0.10	0.97	0.95	1						
(7) International shipments	0.38	0.18	-0.07	0.93	0.87	0.88	1					
(8) Quality Logistics	0.34	0.13	-0.12	0.98	0.94	0.96	0.90	1				
(9) Tracking & Tracing	0.33	0.12	-0.10	0.97	0.90	0.93	0.88	0.94	1			
(10) Timeliness	0.35	0.13	-0.12	0.94	0.86	0.88	0.85	0.90	0.91	1		
(11) Services Value Added (% of GDP)	0.31	0.25	-0.26	0.58	0.57	0.57	0.52	0.56	0.56	0.55	1	
(12) Income Group	0.41	0.14	-0.09	0.71	0.69	0.71	0.66	0.69	0.69	0.68	0.62	1
Observations	675	675	667	720	720	720	720	720	720	720	661	720
Mean	43.99	47.97	24.43	2.92	2.74	2.81	2.91	2.9	2.98	3.36	54.3	2.85
Standard Deviation	33.3	30.08	7.41	0.6	0.62	0.72	0.53	0.64	0.65	0.6	11.2	1.06
Minimum	0.11	0.07	6.7	1.21	1.11	1.1	1.22	1.25	1	1.38	17.99	1
Maximum	224.76	236.39	67.91	4.23	4.21	4.44	4.24	4.32	4.38	4.8	91.92	4

Table 6: Descriptive Statistics and Correlation Table (Model 2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Exports (log)	1											
(2) GDP (log)	0.94	1										
(3) Imports (log)	0.98	0.95	1									
(4) Gross Capital Formation (log)	0.93	0.99	0.95	1								
(5) Services Value Added	0.41	0.35	0.43	0.31	1							
(6) LPI	0.68	0.59	0.66	0.57	0.59	1						
(7) Customs	0.60	0.50	0.59	0.48	0.58	0.96	1					
(8) Infrastructure	0.67	0.59	0.66	0.57	0.58	0.97	0.95	1				
(9) International Shipments	0.66	0.56	0.64	0.55	0.54	0.93	0.87	0.88	1			
(10) Quality Logistics	0.67	0.59	0.66	0.57	0.58	0.98	0.94	0.96	0.90	1		
(11) Tracking and Tracing	0.66	0.59	0.65	0.57	0.58	0.97	0.90	0.93	0.88	0.95	1	
(12) Timeliness	0.64	0.56	0.63	0.54	0.56	0.94	0.86	0.89	0.85	0.90	0.906	1
Observations	663	694	663	655	720	661	720	720	720	720	720	720
Mean	29.42	25.82	29.56	29.04	2.95	54.29	2.74	2.81	2.91	2.89	2.97	3.36
Standard Deviation	1.99	1.89	1.77	1.86	0.59	11.2	0.62	0.71	0.53	0.63	0.65	0.59
Minimum	23.26	2.56	23.07	23.48	1.21	17.99	1.11	1.1	1.22	1.25	1	1.37
Maximum	33.83	30.86	33.79	34.48	4.22	91.92	4.2	4.43	4.23	4.31	4.37	4.79

The below Figure 10 exhibits the linear relationship between LPI and exports under each year we concerned. We cannot observe a major difference in the distribution of data across the years.

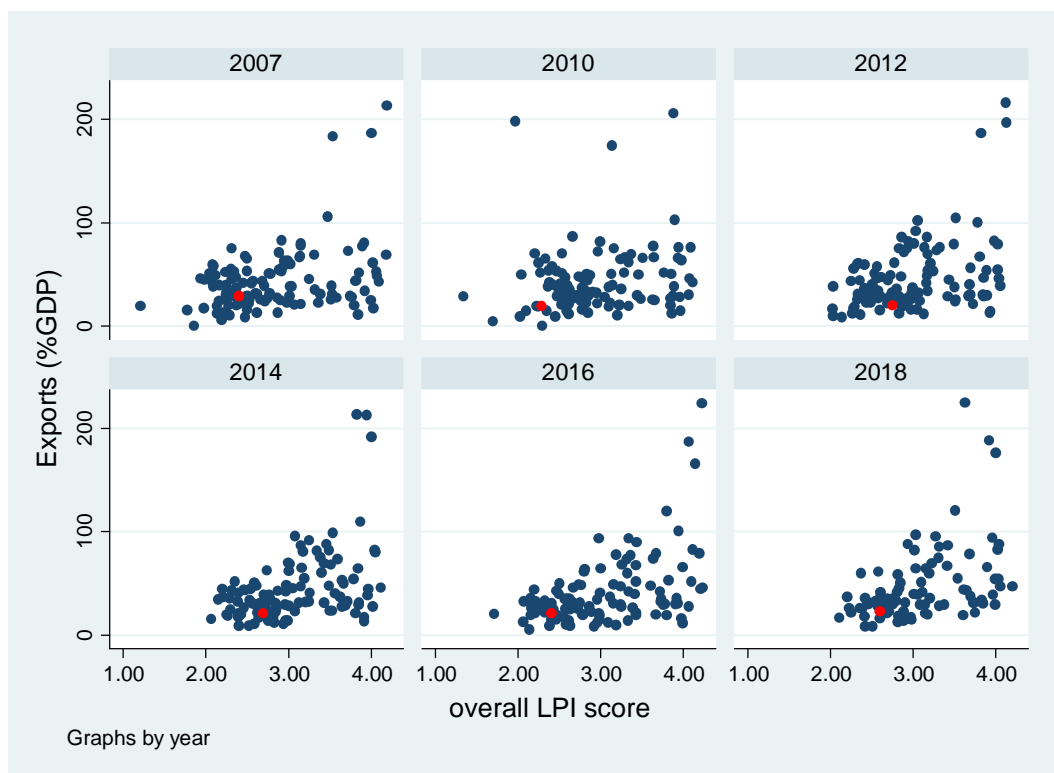


Figure 10: Relationship Between Exports and LPI

Note: In these Graphs, red colour scatters in the distribution represent the position of Sri Lanka among 119 countries.

The Figure 11 compares the LPI distribution in the different income level groups for 2007 and 2018. Apparently, we observe a large positive skew in plot box which is represented 2018 high income group as more data have been distributed in the lower quartile. Comparatively, 2007 upper middle income and high income group data show roughly equally balanced distribution.

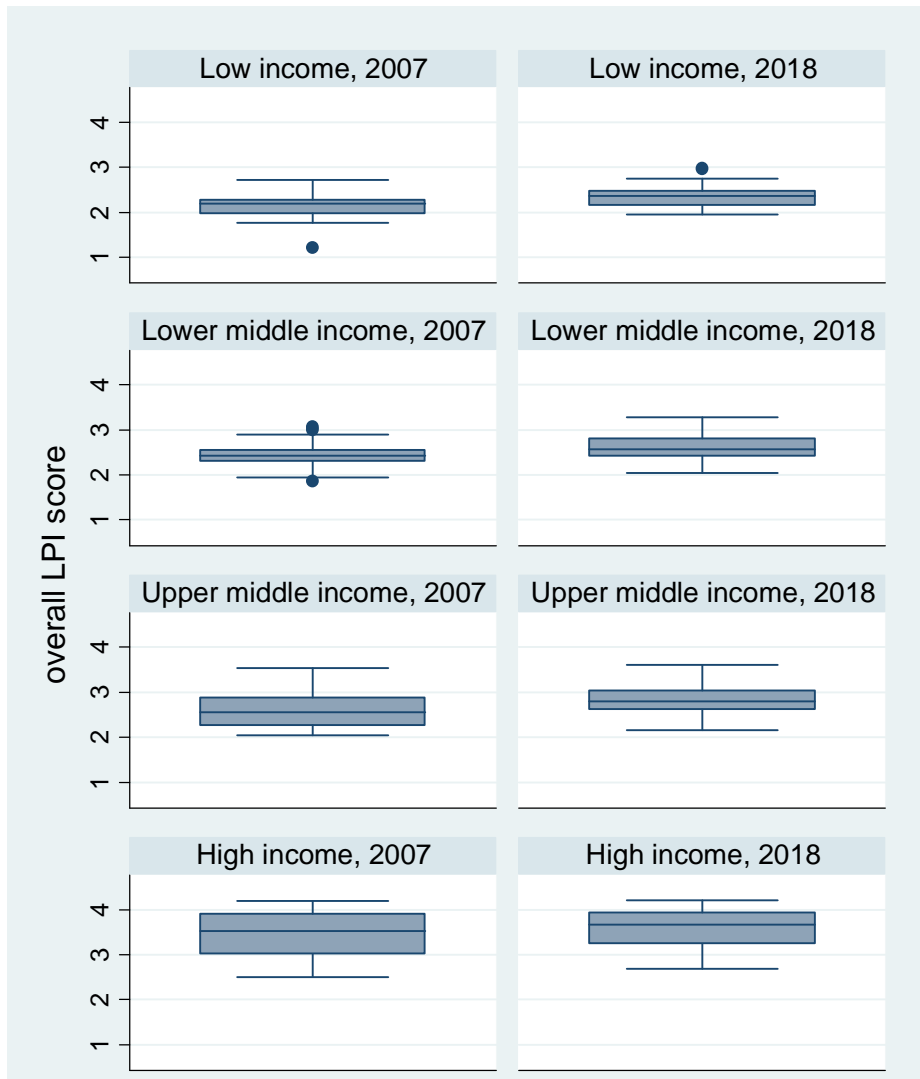


Figure 11: Behaviour of LPI Under Income Groups

The Figure 12, plot box shows the behaviour of LPI components under the different Income level groups for 2007 and 2018.

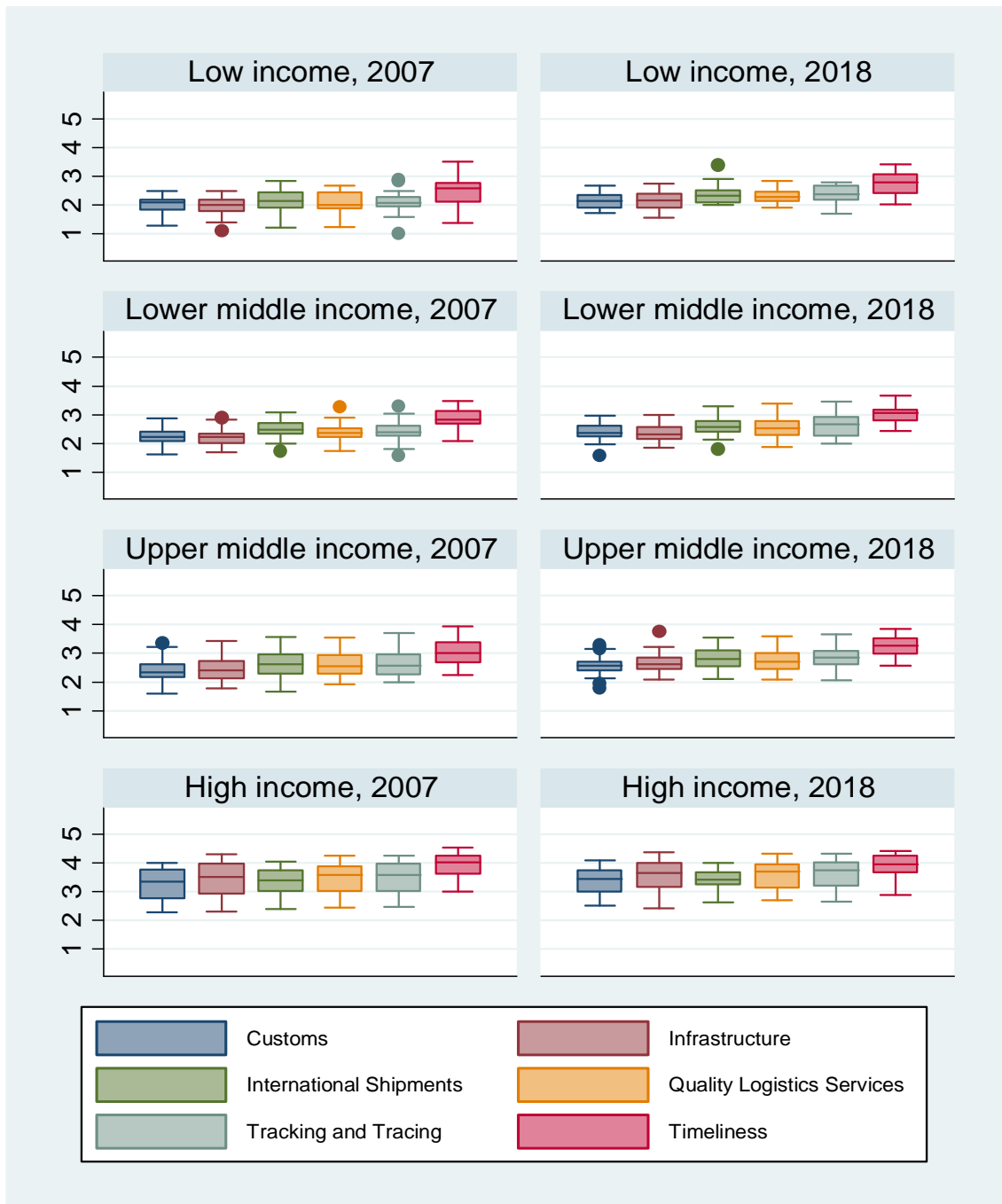


Figure 12: Logistics Performance by Income Groups

## 4.2. Regression Analysis

We tested equations under two Models as described previous. In the Model 1, the dependent variable was exports (X). The dependent variable (exports) and independent variables (imports and GCF) stand in “% of GDP” form. The LPI and its indicators stand in original form (units). We also included dummies for years. Because the dependent variable and several covariates in Model 1 are measured as a percentage of GDP, including GDP as an independent variable would lead to instability problems. To circumvent this problem, we opt by including a set of dummies for the different income level according to World Bank (2019) grouping. The regression results for different specifications under Model 1 are shown in Table 7.

### 4.2.1. Regressions under Model 1

The results from Model 1 show a significant and positive correlation between exports and the variables of interest, namely LPI and all LPI indices at the 1% significant level under the all specifications. The coefficient of imports (significant at 1% level) can be interpreted as a semi-elasticity: 1 percentage point growth in imports causes to increase exports in economies by 0.95 percentage points implying the growth of imports in the economies brings almost similar impact on exports. The proxy for investment (GCF) reveals a significant but negative influence on exports at the 1% significant level in all specifications. In the Chapter 5, we discuss the possible reasons in this regard. Exports reduce by 0.3 percentage points through a 1 percentage point increase in GCF implying the growth in investments leads to a slight fall in exports of economies.<sup>9</sup>

When analysing the behaviour of LPI and its indices under Model 1, we observed a one unit rise in LPI and its indicators (except timeliness factor) approximately brings a 5 percentage points increase in exports. The results also revealed that the timeliness covariate

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<sup>9</sup> The coefficients for the four income group dummies (not shown) as estimated as predicted: when other variables equal, the initial level of exports become increasing with the level of development of economies.

as being the most influential LPI factor. A one unit increase in timeliness caused to improve exports by 6 percentage points.

Table 7: Regression Results for Exports (Model 1)

	Model 1.0	Model 1.1	Model 1.2	Model 1.3	Model 1.4	Model 1.5	Model 1.6	Model 1.7
Imports (% GDP)	0.9524*** (0.018292)	0.9556*** (0.017984)	0.9513*** (0.018073)	0.9575*** (0.018034)	0.9494*** (0.018085)	0.9580*** (0.018095)	0.9592*** (0.018083)	0.9562*** (0.017966)
Gross Capital Formation (% GDP)	-0.3120*** (0.073179)	-0.3215*** (0.071924)	-0.3173*** (0.072307)	-0.3232*** (0.072056)	-0.3258*** (0.072371)	-0.3149*** (0.072206)	-0.3246*** (0.072148)	-0.3132*** (0.071815)
Services Value Added (% GDP)	-0.5382*** (0.062445)	-0.6085*** (0.063011)	-0.5952*** (0.063249)	-0.6044*** (0.063068)	-0.5779*** (0.062447)	-0.5991*** (0.063229)	-0.6049*** (0.063267)	-0.6004*** (0.062508)
overall LPI score		6.6198*** (1.352067)						
Customs			5.3208*** (1.301133)					
Infrastructure				5.2308*** (1.120162)				
International Shipments					5.6830*** (1.388223)			
Quality Logistics Services						5.1500*** (1.201096)		
Tracking and Tracing							5.3034*** (1.174585)	
Timeliness								6.2732*** (1.242103)
Constant	6.1471 (3.908842)	-6.0354 (4.576019)	-2.8435 (4.443604)	-1.7871 (4.205257)	-4.9643 (4.720010)	-3.0558 (4.413735)	-3.0234 (4.353662)	-8.4794* (4.806449)
R <sup>2</sup> <sub>adj</sub>	0.8473	0.8526	0.8510	0.8522	0.8510	0.8514	0.8518	0.8530
N	651	651	651	651	651	651	651	651
F	328.9968	314.4197	310.3945	313.2169	310.4143	311.3174	312.4287	315.2722

Notes: Standard Errors are in parenthesis. All regressions include year dummies (2007, 2010, 2012, 2014, 2016 and for 2018). The asterisks, \*, \*\*, and \*\*\*; designate that the coefficient is statistically significant at the 10, 5 and 1 per cent levels, respectively. All specifications include four dummies for the income groups as per the classification of World Bank: <https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2019-2020>.



#### 4.2.2. Regressions under Model 2

Secondly, we tested the Model including GDP as a variable, thus not including the income group dummies. In the Model 2, exports, GDP, imports and GCF were measured by the natural log and LPI and its indicators stand in original form (units). The Table 8 exhibits the results of Model 2.

The results from Model 2 showed a significant and positive correlation between exports-GDP, exports-LPI and exports-imports at the 1% significant level under all specifications. In contrast, investment and exports exhibited a positive but negative relationship at 1% significant level except Model 2.5 and 2.7. In contrast to Model 1, we observed the higher impact of “international shipments” on exports (a 0.24% increase) compared to other components. Timeliness was the second most important factor. One unit increase of timeliness led to a 0.22% increase in exports. Further, one unit increase of customs and “tracking and tracing” caused roughly a 0.20% rise in exports. Comparatively, quality of logistics services indicated a slight lower impact, with a 0.18% growth on exports where a one unit improvement.<sup>10</sup>

In comparison with Model 1, the fit of Model 2 to the data was higher. The adjusted R-square of Model 2 was above 90% while in Model 1 was below 86%. For this reason and because for trackability reasons, we used the results of Model 2 (log-log) for the simulation exercise in the next section and for the evaluation of results in the next chapter.

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<sup>10</sup> For the sake of simplicity, we do not consider the distribution of the estimated coefficients but use the point-estimate interpretation. However, we acknowledge that the coefficients on the LPI can be statistically not different from each other.

Table 8: Regression Results for Exports (Model 2)

	<b>Model 2.0</b>	<b>Model 2.1</b>	<b>Model 2.2</b>	<b>Model 2.3</b>	<b>Model 2.4</b>	<b>Model 2.5</b>	<b>Model 2.6</b>	<b>Model 2.7</b>
GDP (log)	0.1945*** (0.053090)	0.1998*** (0.050963)	0.2088*** (0.051301)	0.1934*** (0.051033)	0.2170*** (0.051453)	0.1891*** (0.051670)	0.1947*** (0.051333)	0.1909*** (0.051167)
Imports (log)	1.0742*** (0.027390)	1.0132*** (0.027551)	1.0190*** (0.027646)	1.0208*** (0.027334)	1.0170*** (0.027835)	1.0308*** (0.027609)	1.0285*** (0.027347)	1.0197*** (0.027513)
Gross Capital Formation (log)	-0.1445*** (0.052616)	-0.1321*** (0.050530)	-0.1350*** (0.050818)	-0.1315*** (0.050608)	-0.1468*** (0.050884)	-0.1306** (0.051253)	-0.1362*** (0.050889)	-0.1244** (0.050788)
Services Value Added (% GDP)	-0.0044*** (0.001453)	-0.0089*** (0.001521)	-0.0084*** (0.001522)	-0.0087*** (0.001517)	-0.0077*** (0.001489)	-0.0079*** (0.001531)	-0.0083*** (0.001523)	-0.0080*** (0.001494)
overall LPI score		0.2446*** (0.033033)						
Customs			0.2015*** (0.029430)					
Infrastructure				0.1948*** (0.026804)				
International Shipments					0.2395*** (0.035853)			
Quality Logistics Services						0.1842*** (0.030566)		
Tracking and Tracing							0.1984*** (0.029617)	
Timeliness								0.2203*** (0.031367)
Constant	-2.8988*** (0.280118)	-2.0665*** (0.291407)	-2.2491*** (0.286616)	-1.9866*** (0.297071)	-2.2381*** (0.288379)	-2.2262*** (0.294551)	-2.1629*** (0.292266)	-2.3207*** (0.282228)
R <sup>2</sup> <sub>adj</sub>	0.9691	0.9716	0.9712	0.9715	0.9711	0.9708	0.9711	0.9713
N	640	640	640	640	640	640	640	640
F	2229.8867	2183.8905	2157.6654	2177.2820	2150.3596	2122.9910	2151.1893	2165.7400

Notes: Standard Errors are in parenthesis. All regressions include year dummies (2007, 2010, 2012, 2014, 2016 and for 2018). All values of export, GDP, import, GCF are in PPP current International dollar. The asterisks, \*, \*\*, and \*\*\*; designate that the coefficient is statistically significant at the 10, 5, and 1 per cent levels, respectively.

Overall, we cannot see a significant statistical change to exports in economies by changing LPI factors but, all components of LPI have a significant effect on exports across countries during 2007, 2010, 2012, 2014, 2016 and 2018.

Moving to the other determinants, comparatively, we observed a higher effect of GDP on exports in Model 2.4. A 1% increase in GDP led to a 0.22% rise in exports. We argue the reason might be the higher impact of “international shipments” factor as we identified before. The second most higher effect displayed under the Model 2.2 (with customs component) implying a 0.21% rise in exports under a 1% growth in GDP. In the Models 2.1, 2.3, 2.6 and 2.7, we observed a similar flow of impact. A 1% rise in GDP affected for roughly a 0.19% increase in exports. The least impact of GDP on exports reported in Model 2.5 (with quality logistics services component).

In respect of the relationship between imports and exports in this Model, we found a relatively a higher effect of imports on exports across countries. A 1% growth in imports generated approximately a 1 to 3% increase in exports in all specifications. Comparatively, the correlation between GCF and exports showed a slight different flow across specifications. The reasons for this negative relationship were beyond the scope of this study. The Model 2.7 indicated a 1% growth in investment led to a 0.12% reduction in exports. In the Models 2.1, 2.2, 2.3, 2.5 and 2.6, the effects of investments on exports were almost equal (a 0.13% fall in exports). Relatively, a higher impact on exports (a 0.14% fall) exhibited in the Model 2.4 with 1 unit increase in the international shipments component.

#### 4.3. Simulation Results

We used the results of Model 2 for the simulation exercise. Hence, this section is presented the results of a simulation exercise that brings the level of LPI of Sri Lanka to the level of benchmarking countries (Singapore and Malaysia) and shown the expected gain on exports of Sri Lanka under the improvements of logistics performance. As described in the Chapter 1, Singapore and Malaysia were Asian countries associated to the higher logistics performance in the region. According to 2018 LPI ranking order, ranking of Singapore was

7<sup>th</sup> and Malaysia ranked as 41<sup>st</sup> among 160 countries. The Table 9 and 10 summarized the results of simulation.

The fourth columns of both Tables 9 and 10 represent the percentage change of LPI scores of Singapore and Malaysia compared to that of Sri Lanka and the fifth columns demonstrate the expected gain on exports of Sri Lanka under the improvements in the LPIs parallel to benchmarking countries. According to the Table 9, a \$107 million gain on exports was received by Sri Lanka through the improvement in customs by 51%. The improvements in the “international shipments” and “tracking and tracing” by 43% and 46% respectively contributed to each \$104 million gains. While the improvement in infrastructure by 63% generated 1.04 % (\$124 million) collection on exports, 1.05% (\$126 million) gain generated by 69 % development in “quality logistics services”. The largest gain (\$137 million) was attained from the 55% enhancements in the timeliness component.

In comparison, the gain from simulation exercise of Malaysia was less than the gain from Singapore since we observed relatively low performance of logistics in Malaysia. The Table 10 shows that if Sri Lanka improves customs by 12% and “tracking and tracing” by 13%, a \$26 million and a \$29 million gain on exports respectively can be collected. Whereas the improvements in infrastructure by 27% brought a 0.44% (\$52 million) gain, the developments in timeliness factor by 24% generated a \$60 million collection on Exports. Further, Sri Lanka receives \$66 million gain from 13% improvement in “quality logistics services”. The biggest contribution (\$81 million) generated from 33% developments in the “international shipments” component.

Table 9: Simulation Results - Sri Lanka and Singapore

LPI Indicator	Sri Lanka	Singapore* <sup>1</sup>	Difference of Performance (%)	Expected Gain on Exports (%) <sup>*2</sup>	Expected Gain on Exports (Value \$ million) <sup>*3</sup>
Customs	2.58	3.89	51%	0.89%	107
Infrastructure International Shipments	2.49	4.06	63%	1.04%	124
Logistics	2.51	3.58	43%	0.87%	104
Quality	2.42	4.1	69%	1.05%	126
Tracking & Tracing	2.79	4.08	46%	0.87%	104
Timeliness	2.79	4.32	55%	1.14%	137

Note: LPI data represents the 2018 year data

\*<sup>1</sup> Singapore is considered as the benchmark country that has higher LPI scores in South East Asian Region.: <https://lpi.worldbank.org/international/global/2018>

\*<sup>2</sup>2018 year Exports log points of Sri Lanka (29.52) were taken for calculations.

\*<sup>3</sup>2018 year Exports value (\$12 billion) of Sri Lanka was taken for calculations.

Table 10: Simulation Results -Sri Lanka and Malaysia

LPI Indicator	Sri Lanka	Malaysia* <sup>1</sup>	Difference of Performance (%)	Expected Gain on Exports (%) <sup>*2</sup>	Expected Gain on Exports (Value \$ million) <sup>*3</sup>
Customs	2.58	2.9	12%	0.22%	26
Infrastructure International Shipments	2.49	3.15	27%	0.44%	52
Logistics	2.51	3.35	33%	0.68%	81
Quality	2.42	3.3	36%	0.55%	66
Tracking & Tracing	2.79	3.15	13%	0.24%	29
Timeliness	2.79	3.46	24%	0.50%	60

Note: LPI data represents the 2018 year data

\*<sup>1</sup> Malaysia is considered as the benchmark country that has higher LPI scores in South East Asian Region.: <https://lpi.worldbank.org/international/global/2018>

\*<sup>2</sup>2018 year Exports log points of Sri Lanka (29.52) were taken for calculations.

\*<sup>3</sup>2018 year Exports value (\$12 billion) of Sri Lanka was taken for calculations.

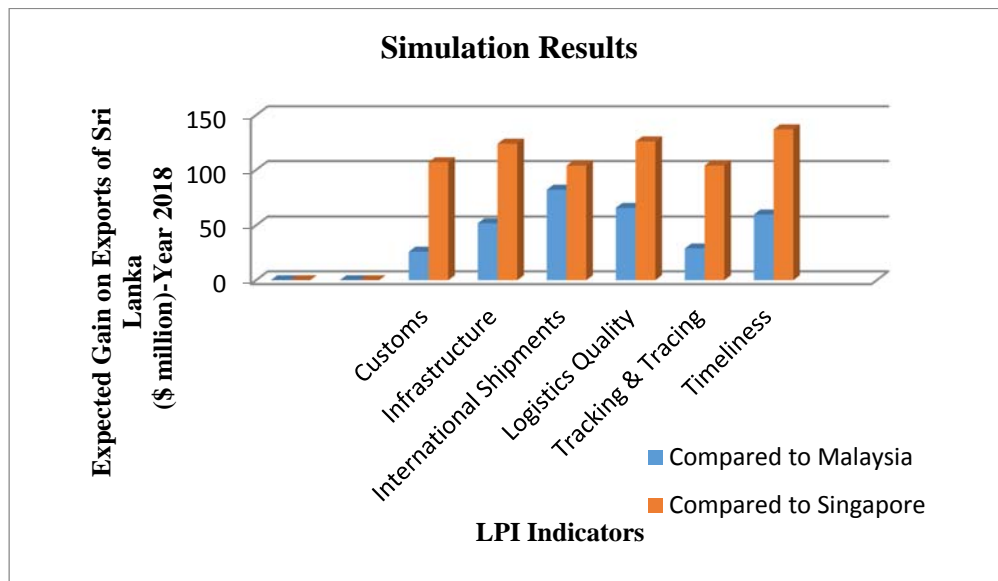


Figure 13: Simulation Results

#### 4.4. Logistics survey

In the previous section, the regression results revealed that logistics performance has a positive substantial influence on exports growth and the simulation exercise results confirmed the positive gains for exports of Sri Lanka with the improvements of logistics performance. This section presents a qualitative analysis through the results of logistics survey which was conducted to investigate the current status of logistics performance of Sri Lanka with a view of understanding the policy reforms to be taken to improve logistics performance.

A total of 174 participants were targeted as the sample to answer questionnaire through e-mail. It was revealed that most of e-mails were not delivered to recipients due to technical problems or changing e-mail addresses. Importantly, it was felt that participants were reluctant to respond revealing their identity because many questions have been addressed issues of government policies and procedures of government organizations. Therefore,

only 63 participants responded and among them are 24 Senior Executives, 13 Country Managers, 11 Department Managers, 9 Junior Executives and 6 Supervisors (Figure 14).

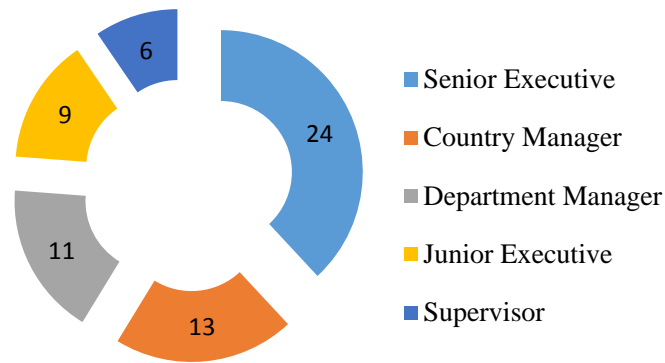


Figure 14: Positions of Respondents

Over half of those responded, 37 represented Freight Forwarding/NVOCC operating business firms, whereas 13 respondents were shipping agents (Figure 15). The similar rates of responses from port related officials and manufacturer/importer/exporter were reported (5). Moreover, it was revealed that just a small number of officials (3) representing ministry/department has participated in the survey.

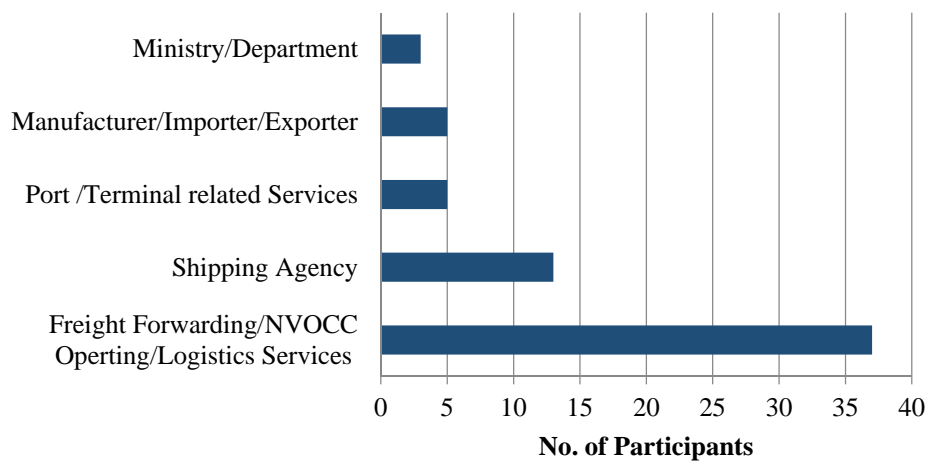


Figure 15: Types of Organisation/Business

In response to the question number five and six of the questionnaire; the time to imports and time to exports (time related for compliance for all documents of all government agencies), 17 respondents commented that more than 24 hours are taken for imports. Nearly, one fourth (16) participants suggested that it takes 7-12 hours while another similar number of respondents believed it takes 13-18 hours. Another 9 participants suggested that this task can be completed within 19-24 hours. Only a small minority (6) reported that more than 6 hours is taken to imports (Figure 16).

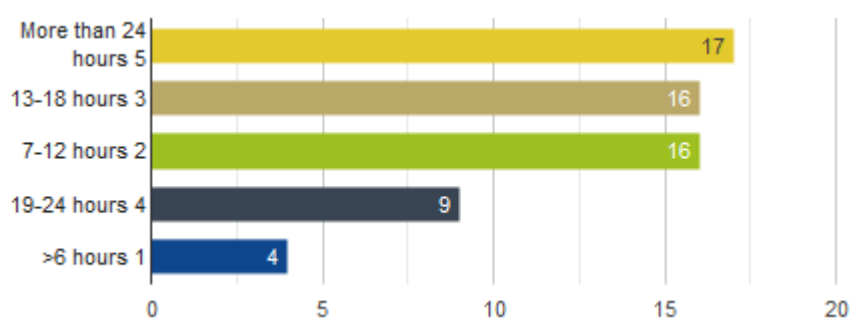


Figure 16: Time to Imports

Compared with responses of time to imports, half of respondents suggested that the exports procedure can be completed within 2 days. Nearly, one third believed that this task can be fulfilled under one day. Whereas 10 respondents were of the view that it takes 3-5 days, only a small number of participants (2) commented that 5 or more days are taken for same.

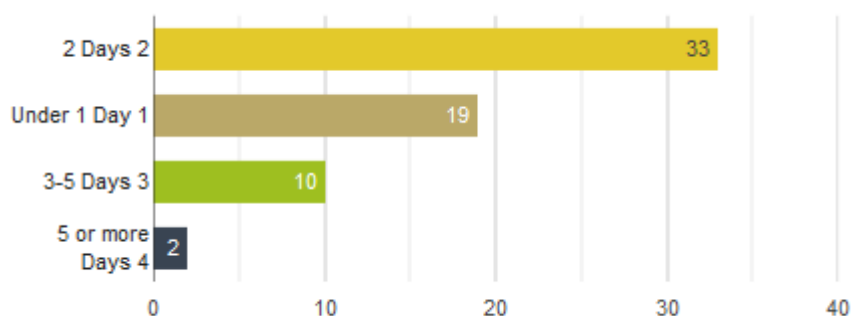


Figure 17: Time to Exports



When the respondents were asked on major sources of delay in imports and exports shipments, the majority (42) replied customs delays and 33 replied that documentation was the major source of delay (Figure 18). 24 and 20 participants commented on port congestion and logistics incompetence respectively. In addition to the said sources, the following have been identified by some participants as reasons for delay in imports and exports.

1. Breakdown of LCL cargo (imports)
2. Lack of “One stop shop”
3. Lack of coordination among boarder agencies
4. Lack of knowledge of customers about imports/exports/trade procedures.

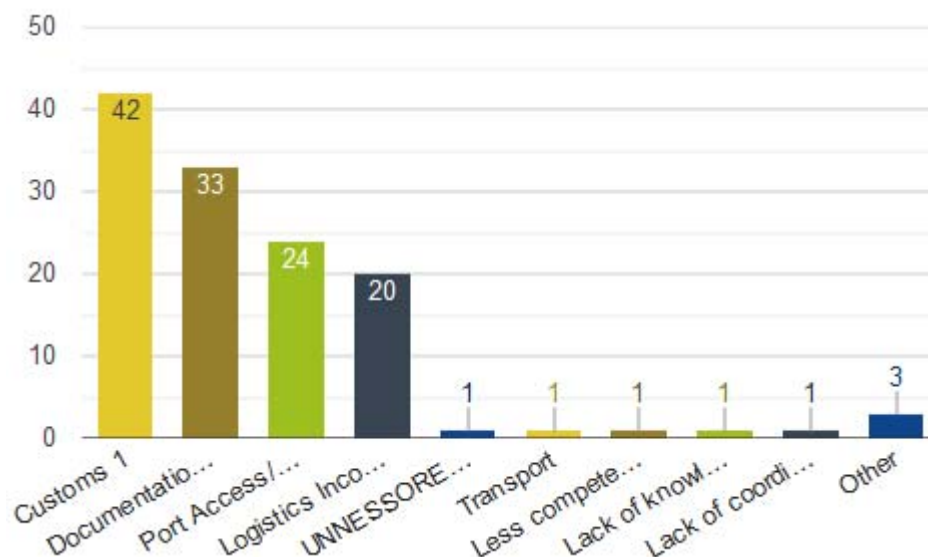


Figure 18: Major Sources of Delays in Exports and Imports

Note: Major Sources of delays in shipments: Customs, Documentation, Port Access/congestion, Logistics incompetence, unnecessary documents, Transport, Less Competition, Lack of knowledge of customers about imports/ exports/ trade procedures, Lack of Coordination among boarder agencies, and other

The previous results were further strengthened by Figure 19 findings of efficiency of customs clearance process. Over the half of participants confirmed that the efficiency of customs clearance process was under the average level and 18 persons were of the view

that customs clearance process was inefficient. Only one sixth replied that it was a highly efficient process.

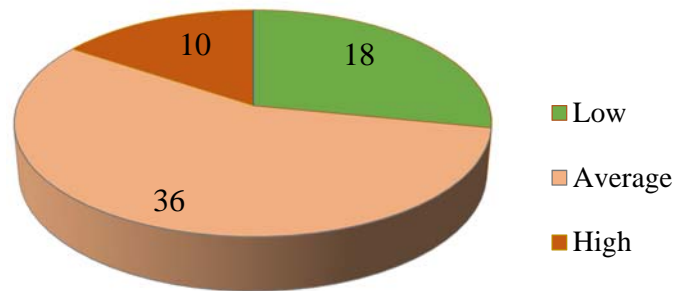


Figure 19: Efficiency of Customs Clearance Process

The seventh and eighth questions of the survey questionnaire had been designed with a view to measuring the cost of trade and the quality of infrastructure, respectively. According to the Table 11, rail transport charges were the lowest and the majority of the participants were of the opinion that other charges (port, airport, road and warehouse service) were in an average level. In contrast, only 21 participants suggested that airport charges were high. In terms of preferences of respondents regarding the quality of infrastructure, the majority was of the opinion that the level of quality of ports, airports, roads and warehouse services were considered under average level similar to the level of charges. Further, 26 participants suggested that the quality of rail infrastructure was low and another 23 respondents expressed that rail road infrastructure was of low quality.

The Table 11 summarises the replies of respondents given under question numbers 5, 6, 7, 8, 11 and 12 which we discussed so far. We have measured the logistics performance under four categories namely, cost, time, quality and efficiency. The highlighted boxes indicate the highest responses under each question.

Table 11: Summary of Replies of Respondents of Survey (1)

Performance Criteria	Que. No	Component	1 day	2 days	3-5 days	<5 days	
(1) Time	(5)	Time to Exports	19	33	10	2	
	(6)	Time to Imports	>6 Hours 4	7-12 Hours 16	13-18 Hours 16	19-24 Hours 9	<24 Hours 17
	(11)	Sources of delays of Imports & Exports Shipments	Customs 42	Documentation 33	Port Access 24	Logistics 20	Other 8
(2) Efficiency	(12)	Efficiency of Customs clearance process	Very Low 0	Low 18	Average 36	High 10	Very High 0
	(7)	Ports Airports Roads Rail Warehouse	Very Low 0 1 1 5 0	Low 3 4 8 27 5	Average 42 33 34 20 43	High 15 21 16 6 12	Very High 2 3 2 0 2
(4) Quality	(8)	Ports	5	12	31	12	1
		Airports	0	8	42	11	0
		Roads	5	26	26	4	0
		Rail	18	23	17	2	0
		Warehouse	1	11	35	14	0
				Very Low	Low	Average	High

The Table 12 represents a summary of replies of drawbacks related to Sri Lankan logistics performances. We categorised those drawbacks based on the sources of drawbacks as human based, institution based, policy based and activity based. The right side column of the same Table linked the replies of participants with possible solutions. In the Table 12, SD, D, M, A and SA stand for the preferences: Strongly Disagree, Disagree, Moderate, Agree and Strongly Agree respectively. The highlighted boxes indicate the highest responses under each question.

In terms of preferences of participants under the major eight logistics barriers, nearly, over 50 participants accepted the lack of national policies/plans and policy cohesions as the major drawback and 24 persons strongly agreed to the above reason. Another similar number of participants (45) believed in existing adverse government regulations and implementation barriers as the other significant reasons. Out of 45, nearly half of the total respondents (30) have expressed their consent of agreeing to the reason of existing adverse government regulations. Also another 43 persons recognized lack of visionary leadership and policy cohesion were as the main reasons. While 20 persons moderately agreed to the reasons of lack of e-commerce and insufficient infrastructure, a total of 25 participants agreed on the factor of insufficient infrastructure. Interestingly, 22 respondents strongly identified the lack of integrating the ports with logistics parks, Free Trade Zones (FTZs) facilitating cargo consolidation and Multi Country Consolidations (MCCs) was as another primary issue in Sri Lankan logistics sector.

Consequently, the aim of the remaining final question of the survey was to finding the status of preferences of participants on the possible solutions against logistics barriers related with positioning Sri Lanka as a logistics hub. Apparently, an half of persons strongly accepted the removal of bureaucratic bottleneck and red tapes. Another half of that amount agreed with it. A total number of 35 participants suggested (agreed) to the solution of “capacity building to face industry revolution”. As highlighted in the previous paragraph, 30 respondents agreed to the solution of integrating the ports with logistics parks, FTZs facilitating cargo consolidation and MCCs. Almost a similar number of persons (48)

recognized the importance of facilitating e-commerce and other advanced digitalized trading platforms and automation of logistics industry with re-engineering & restructuring systems. Moreover, 25 persons strongly agreed to the introduction of friendly trade regulations while another 25 respondents agreed to increase infrastructure development. Almost 51 persons suggested that, the introduction of trade friendly regulations was the solution.

Table 12: Summary of Replies of Respondents of Survey (2)

		Logistics Related Barriers ( Question No 15)					Suggested Solutions (Question No 16)						
		SD	D	M	A	SA	SD	D	M	A	SA		
(1)	<b>Human based Issues</b>	Lack of visionary leadership(s)	0	2	19	24	19						
		Lack of knowledge of policy implementers	1	6	16	20	21						
(2)	<b>Institution based Issues</b>	Implementation barriers related with institutional framework	0	1	16	28	17	Simplification of government procedures with strengthening institutional framework	1	3	11	25	23
								Discourage of Bureaucratic bottlenecks/red-tapes	1	2	16	15	30
(3)	<b>Policy based Issues</b>	Existing adverse government regulations	0	3	15	30	15	Trade friendly regulations & policy cohesion	1	0	12	26	25
		Lack of long term national policies/plans & Policy cohesion	0	1	11	28	24						
(4)	<b>Activity based Issues</b>	Lack of Customs & other e-services compared to international level	1	6	20	21	16	Facilitating e-commerce & other advanced digitalized trading platforms	1	3	11	19	29
		Insufficient infrastructure	0	5	20	25	14	Infrastructure development (Ports, Airports, Roads, Railroads & Warehouses)	1	0	15	25	23
								Capacity building to face industry revolution	1	0	15	35	13
		Lack of integrating the ports with logistics parks & FTZs facilitating MCCs	0	2	21	19	22	Automation of Logistics industry with re-engineering & restructuring systems	2	1	14	28	19
						Integrating the port with well-connected logistics parks & FTZs facilitating MCCs	1	0	13	30	20		

## Chapter 05 – Discussion

This chapter, firstly, presents the discussion of concepts and theories that were taken up within the theoretical framework with findings with a view to supporting the arguments or suggestions pertaining to the future study areas to overcome research limitations. Secondly, the evaluation of results with the previous literature responding to the research questions about the impact of logistics performance on exports in economies, the extent to which improvements in logistics performance effect on exports of Sri Lanka and the extent to which the policymakers address the logistics barriers is presented.

### 5.1. Evaluation of Concepts and Theories with Research Findings

Our major aim of study was to find the impact of logistics performance on Sri Lankan exports. Overall empirical findings revealed that GDP, imports and logistics performance had positive relationship on exports in economies in the period concerned. In accordance with the empirical results, the simulation results assisted to measure the expected gain on exports of Sri Lanka subject to the improvement of logistics performance under infrastructure, customs and other LPI components. The logistics survey results revealed the underperforming areas in the Sri Lankan logistics sector and possible solutions.

In this context, what is desired in this section is to focus on integrating our findings with core theories that we discussed previously. Economies engage in trade, based on relative and comparative advantages achieved by them, as suggested by David Ricardo (Evans, 1989). The Ricardian theory predicted labour as a determining factor of comparative advantage. The theory of H-O Model suggested capital, land and entrepreneurship in addition to labour. Unlike in the trading environment that prevailed in these classical theories introduced, substantial differences are observed in the present international trading environment with the effects of globalization, digitalization and liberalization associated with trade facilitation efforts. Our findings confirmed that Sri Lanka can potentially attain annually a roughly \$26-81million gain on exports, if the state takes action to improve logistics performance by 12-30% to catch up with the Malaysian level. If Sri Lanka desires

to achieve status similar to Singapore, the state has to make more efforts (roughly a 50% improvement) to gain more on exports (annually a \$100 million potential gain on exports). This implied that an economy can achieve comparative advantage as well by improving its logistics performance. Obviously, as suggested in classical theories, land, labour, capital and entrepreneurship are production factors and factor endowment can be used as a determinant of comparative advantage. Our results revealed that the growth of production tends to increase in exports (trade) in economies complying with the theorem of Gravity model and to be consistent according to Bahmani-Oskooee and Alse (1993). However, the 'iceberg transport costs' suggested by Krugman (1991) and other trade barriers which involve in many stages of the trading process lead to changing prior determined trading patterns predicted under the H-O theorem. With high logistics costs and poor quality logistics performances, the tradable goods may turn to be non- tradable or non- exportable goods. Or else, the result may be a production to be of non-exportable goods. As suggested by the New Growth Theorists, we observe that the technological capabilities incorporated to the production and logistics sector in a great deal result in the increase of the production of technology intensive commodities with a higher value. In this context, we propose that the systems of customs, transport, infrastructure and other related logistics fields should be adjusted in line with the intended changes. Moreover, the capabilities of state bodies and logistics service providers also should be incorporated with the adjusted systems in order to make competitive advantages.

## 5.2. Evaluation of Literature with the Findings

Our results on the relationship between investment alone and exports indicated that the actions for growth in the investment in economies in the period concerned may be associated with a slight fall in exports. This finding is not a pattern of consistent growth in the economy according to Ibrahim (2000), Rajni (2013) and Feddersen *et al* (2017) but partially consistent with Chakraborty & Mukherjee (2016). Generally, investment inwards associate with best management practices and the technical assistance enhance the productivity resulting in the growth of production in the long run. Alternatively, our results indicated that the production growth driven by investment may divert to domestic



consumption other than exports. On the other hand, the reason may be the shifting of investment priorities from production to service or industry sector with the development of economies. The other reason may be that the returns on investments being long term.

Focusing more on the results of the LPI and literature, we observed that our overall findings are partially consistent with Poretas *et al* (2013), Marti *et al* (2014), Chakraborty & Mukherjee (2016) and Gani (2017). Specifically, our empirical results of Model 2 indicated “ease of arranging international shipments” was the most important element and this was consistent with Marti *et al* (2014). The reason for indicating the higher impact of “ease of arranging international shipments” on exports may be the increase of competitiveness in the international trade by entering more logistics service providers. As we pointed out in the section 1.3 of the Chapter 1, the performance of Sri Lanka in the “ease of arranging shipments” has worsened during last two years. Accordingly, these results indicate the non-friendly trade regulatory environment in Sri Lanka along with the entry barriers to local and foreign logistics players. Our simulation results in respect of this factor as well revealed, that Sri Lanka was below Singapore by 43%. Hence, this was an indication to the logistics service providers, shipping lines/agents to make strategies to enhance the easiness of arranging shipments to gain more on exports to the country as predicted by us and obtain more individual benefits by expanding trade connections/networks. The Empirical results revealed timeliness is the most influential factor implying the relatively high orientation of economies towards punctuality of shipment delivery times in the high level competitive environment. Our results confirmed that a \$137 million gain on exports can be attained if Sri Lanka improves timeliness by 55%. In respect of Sri Lankan logistics drawbacks, we found time consuming imports process compared to exports making serious bottlenecks in productions, deliveries and re-exporting procedures as well. The main reasons for the delay in shipments were issues linked with customs and documentation. Results revealed that the efficiency of customs clearance process of Sri Lanka was under average level. As remedial measures adopted in customs issues can increase the efficiency of the total logistics system (Heaver, 1992; Devlin & Yee, 2005), the relevant state bodies should focus on improvement of the present customs level conforming to global standards. According to our

results, Sri Lanka should improve customs by 50%, if the country needs to catch up with the Singapore level and it can assist in increasing exports annually by \$107 million. We suggest that the government expedite the implementation of the single window project in order to bring more potential benefits to all parties involved in the trade process. This will help in eliminating the excessive and unnecessary document action resulting in the increase of transparency and eliminating red tape and the other inefficiencies in the system. In respect of the cost of infrastructure of Sri Lanka, rail transport was the cheapest mode of transport but the quality of railroad transport was under average to lower level compared to other transport modes. This finding was consistent with Ilangasekara & Premarathne (2018). This was an indication to the government to pay more attention to improve quality of railroad infrastructure in keeping with global standards. If Sri Lanka improves the infrastructure by 63% to catch up with Singapore, the annual exports can increase by \$123 million. The improvements in the infrastructure sector directly leads to cut down transport cost which affect the determining of competitiveness.

Moving on to the major logistics barriers against 2025 Vision of Sri Lanka, the results implied that Sri Lanka lacks long term national policies and policy cohesions. This indicated that the shipping and logistics sector expect long term national policies irrespective of the changes in government as practiced by many states in the world. Policy cohesion is also very important because in the absence of policy cohesion, ambiguities can be brought about among the state bodies and in the trade as well. The proper coordination and consultation among the state bodies can help the trade experts to bring about policies or regulations prior to making solutions that will enable to overcome this situation. Moreover, the results pointed out to the necessity of simplification of government procedure by strengthening the state bodies. This implied the prevailing complex procedures and adverse impacts on bureaucratic bottleneck and red tape associated with state bodies. Therefore, this study recommends strengthening of the state bodies and the systems rather than focussing on officials. We find that the automation and digitalization process brings substantial benefits to the logistics industry. As such, we emphasize that Sri Lankan logistics industry adopt e-commerce and other advanced digitalized trading platforms. The automation of

logistics industry with re-engineering & restructuring systems also assists Sri Lanka in pursuance of the intended hub status. In conclusion the results suggested that the current status of the logistics services of Sri Lanka should be in line with the best practices recognized globally. The government should more specially focus on integrating ports with logistics parks and FTZs enabling consolidation activities because the government wishes to attract logistics firms more recognized globally, with a view to achieving hub status.

## Chapter 06 – Conclusion

The purpose of this study is to find and explain the impact of logistics performance on export growth of Sri Lanka with a view to achieving visionary objectives of the country (positioning Sri Lanka as an export oriented economic hub in the Indian Ocean). The answers have been provided through an econometric estimation with a logistics survey and through evaluation of the findings of the material presented previously from the literature review.

The strategic geographic positioning in the East West maritime route gives a competitive edge to Sri Lanka to develop as a maritime hub and as an exports oriented economic hub. As a transshipment hub, the Port of Colombo is harnessing those competitive advantages of competing with regional ports. Sri Lanka followed economic liberalization policies from 1977, and afterwards the key sectors of the country including the maritime sector gradually developed deriving benefits to the economy. The Vision 2025 is the policy document presented by the government to position Sri Lanka as an exports oriented economic hub in the Indian Ocean. Sri Lanka has failed to improve the level of logistics performance over a 10 year period when compared to other developed countries and some regional top performers like Singapore. In similar manner, the exports performance is also relatively below regional counterparts and stagnating. In this context, the World Bank has pointed out that logistics barriers act as a major obstacle on exports of South Asian economies.

As such, the primary aim of this study was to investigate as to how logistics performance affects the exports of Sri Lanka to achieve the intended hub status as outlined in the policy document. Our cross section analysis revealed the positive and significant influence of the LPI and other LPI indicators on exports in economies. The results revealed that the GDP and the imports also indicated a positive impact on exports. However, investments alone as a driving force improving exports were not supported in our study. We recognized the time consuming import process, the delays in customs issues and documentation, breakdowns of LCL cargo (imports), lack of “One stop shop”, the low quality of rail infrastructure and the less efficient customs clearance process as major drawbacks. As such, the required policy

reforms/strategies have been recommended to be applied by the government to achieve the intended hub status such as introduction of long term national policies, maintenance of policy cohesion, introduction of trade friendly regulations, facilitation for e-commerce & other advanced digitalized trading platforms, automation of logistics industry with re-engineering & restructuring systems, infrastructure development in keeping with global standards, simplification of government procedures by strengthening institutional framework, integrating ports with logistics parks and FTZs.

We were able to show that Sri Lanka would attain a substantial gain on exports, if the government takes action to improve the logistics performance. It can be concluded that the overall improvements in standards in logistics performance would lead to increase the exports of Sri Lanka substantially. The increase in exports income would lead to upgrade the development level of Sri Lanka up to a high income level from the upper middle income level.

We recognise that there were a number of limitations to our study. Causality flows from exports to economic growth are referred to as exports-led growth which means that the growth of a country depends on its ability to exports. On the other hand, the reverse causal flow from economic growth to exports is referred to as growth-led exports (Lim & Ho, 2013). Hence, our results of the econometrics model have been affected by the reverse causation. Although the analysis focused on factors affecting exports, we deliberately excluded the distance factor identified by the previous literature due to the practical difficulty and complexity of collecting data for 119 countries. Hence, we suggest that a systemic study should be undertaken expanding our conceptual framework in future, including the distance factor. This study covered only measurable factors and therefore we believe that sometimes the factors such as trade restrictions, geo political reasons may have a very strong effect on exports. As such, a panel data analysis is suggested in future adding more macro indicators. Even in terms of qualitative data, the response rate of the survey was around 37%, which limits the representative aspect of the targeted sample. As the reason for it we would like to state that some participants are reluctant to reveal their

identity because most of the questions addressed are in respect of government issues. In conclusion, let us be permitted to state that, it was not possible to cover all the factors concerned in great detail due to time constraints.

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## Appendix 1: Linking Questions with Theories

	Theory	Logic Behind Theory	Question No
01	Comparative Advantage Theory of David Ricardo (1817)	David Ricardo (1817) showed that each country should specialize in producing goods based on comparative advantage in production (Suranovic,2016). As per comparative advantage theory, countries can engage in mutually beneficial trade with each other with lowest opportunity cost of production relative to the other trade partner. By comparison of production costs across countries, a country's comparative advantage can be recognized. Ricardo suggests to compare <i>opportunity</i> costs of producing goods instead of comparison of monetary costs of production or resource costs such as labor (Suranovic,2016)	7,8
02	Gravity Theory of Jan Tinbergen (1962)	The Gravity Theory of Jan Tinbergen (1962) based on the Newton's law of universal gravitation led to many theoretical and empirical literatures (Silva & Tenreyno, 2006) and it is another constituent of trade theory. In its simplest form, a gravity model considers that bilateral trade flows depend positively on the volume of income in both economies (exporters/importers) and negatively on the distance between them (Marti et al, 2014). As shown in below, the basic gravity equation for trade states that the trade flow from country i to country j ( $T_{ij}$ ), is proportional to the product of the two countries' GDPs ( $Y_i$ and $Y_j$ ) and inversely proportional to their distance ( $D_{ij}$ ) (Silva & Tenreyno, 2006).	7,8,13, 14,15,16
03	New Trade Theory of Paul Krugman (1980)	The new trade theory was developed in the 1970s and 1980s from the comparative advantage-based model by explaining the empirical elements of trade (Krugman, 1980). As per this New Trade	5,6, 7,8,13,14, 15,16

		<p>Theory, the crucial factors in industries for deciding trade patterns are economies of scale and network effects. Network effects refer that product becomes more valuable when it is used by many. The specialization leads to increase economies of scale and monopolistic competition. Therefore, the role of government is to facilitate to industry by promoting free trade zones and providing other necessary infrastructure as well in order to attract key industries</p>	
04	New Economic Geography Trade Theory of Paul Krugman (1991)	<p>The new economic geography trade theory refers to the formation of a wide variety of an economic agglomeration in a specific geographical space. Three basic assumptions are important in geographical economics (Hassink &amp; Gong, 2019).</p> <ul style="list-style-type: none"> <li>i. Increasing returns and economies of scale,</li> <li>ii. Production factors (labour and capital) are regarded as mobile and</li> <li>iii. Transport costs are integrated in the models.</li> </ul> <p>As per the third assumption, New Economic Geography theory generally adopts some forms of ‘iceberg transport costs’ which are paid as cost of shipment in the transport in addition to direct cost of transport. Therefore, firms take decisions on whether they should establish regional plants/branches or exports as an alternative in order to reduce additional transport costs. (Ascani et al, 2012)</p>	7,8,13,14, 15,16
05	New Growth Theory of Paul Romer (1992)	<p>New Growth Theory suggests that unlike land and capital, knowledge is not subject to diminishing returns (Romer,1992). Similarly, New Growth theorists argue that government should also finance, or seek finance for, infrastructure projects, such as road, rail, sea, and air transport. (Economics online, 2019)</p>	7,8,9,10, 13,14,15,16

## Appendix 2: Survey Questionnaire

### *Survey on Assessing the Impact of Logistics Performance on Export Growth*

The information gathered through this questionnaire will be used as a part of empirical research for assessing of the relationship between Sri Lanka's Logistics Performance and Export Growth, within the scope of dissertation for obtaining the Master of Science in Maritime Affairs (Specialization -Shipping and Logistics Management). The questionnaire consists of 10 questions and tables. It will be appreciated to complete the questions, which will take no longer than 5 minutes to complete.

**Target Respondents:** to be completed by Sri Lankan Shipping Agents, Freight Forwarders/NVOCC Operators, Importers & Exporters.

**Confidentiality:** Please note that the responses you provide are completely anonymous and confidential. The research outcome and report will not include references to any individuals and the questionnaire will be destroyed after completion of the research.

Please tick the answer you perceive is right and one of the choices from the table provided to show your consent to be part of the research.

#### **Part One : Introductory Part**

1. Your Position in your Company?
  - Senior Executive
  - Country Manager
  - Department Manager
  - Supervisor
  
2. Type of business of company/organization?
  - Shipping Agency
  - Logistics/ Freight Forwarding /NVOCC Operator
  - Manufacturer /Importer/Exporter
  - Port related/Terminal Operator
  
3. Organizational level?



- Headquarter
- Country Branch Office
- Local Branch Office
- Independent Firm

4. The cargo of your company is mainly transported by? (multi-choice)

- Sea
- Air

**Part Two- Survey Questions**

**Time for Trade**

5. Time to import (time related for compliance with all related documents of all government agencies)?

- >6 hours
- 7-12 hours
- 13-18 hours
- 19-24 hours
- <24 hours

6. Time to export (time related for compliance with all related documents of all government agencies)?

- Under 1 day
- 2 Days
- 3-5 days
- <5 Days

**Cost for Trade**

7. Based on your experience, select best option that describe logistics performance environment of Sri Lanka.

	<b>Costs</b>	<b>Very Low</b>	<b>Low</b>	<b>Average</b>	<b>High</b>	<b>Very High</b>
i.	Port Charges					
ii.	Airport charges					
iii.	Road transport rates					
iv.	Railroad transport charges					
v.	Warehousing services rates					

**Quality of Infrastructure**

8. Select best option that describe Quality of infrastructure of Sri Lanka

	<b>Quality of Infrastructure</b>	<b>Very Low</b>	<b>Low</b>	<b>Average</b>	<b>High</b>	<b>Very High</b>
i.	Port infrastructure					
ii.	Airport infrastructure					
iii.	Road transport infrastructure					
iv.	Railroad infrastructure					
v.	Warehousing services infrastructure					

**Efficiency of Customs clearance process**

9. How many days it takes to clear import cargo with Customs and agencies?

- 1-2 Days
- 3-4 Days
- 5 Days
- 6-7 Days
- <7 Days

10. How many days it takes to clear export cargo with Customs and agencies?

- 1-2 Days
- 3-4 Days
- 5 Days
- 6-7 Days
- <7 Days

11. What are the major sources of delay in import & export shipments?

- Customs
- Documentation
- Traffic/Access/Port Congestion
- Logistics incompetence
- Other (Please specify).....

12. As an overall, the Efficiency of clearance process (Customs)?

- Very low
- Low
- Moderate
- High
- Very High

13. Efficiency of following procedures

	<b>Procedures</b>	<b>Hardly ever</b>	<b>Rarely</b>	<b>Sometimes</b>	<b>Often</b>
i.	Are import shipments cleared & delivered as scheduled				
ii.	Are export shipments cleared & delivered as scheduled				
iii.	Is the customs clearance process transparent				
iv.	Do you receive adequate information when changing regulations				

14. How much do you agree to the following as issues/challenges of Sri Lanka Logistics Performance?

**SD=Strongly Disagree, D=Disagree, M=Moderate, A=Agree, SA=Strongly Agree**

	<b>Issue/Challenge</b>	<b>SD</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>SA</b>
i.	Poor Quality infrastructure					
ii.	Government regulations/restrictions					
iii.	Issues of Inland Transportation causes to delays & high costs					
iv.	Technology barriers/Lack of usage					
v.	High cost of doing business					
vi.	Bureaucratic bottlenecks/red-tapes					
vii.	Complex & burdensome import & export procedures					
viii.	Criminal activities(stealing/corruptions)					
ix.	Informal payments					

15. Government Vision 2025 aims to position Sri Lanka as a Logistics Hub and export oriented economic Hub in the East West maritime route. What are the **major logistics related barriers** to achieve these Hub statuses?

**SD=Strongly Disagree, D=Disagree, M=Moderate, A=Agree, SA=Strongly Agree**

	<b>Barriers</b>	<b>SD</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>SA</b>
i.	Lack of visionary leadership(s)					
ii.	Lack of long term national policies/plans & Policy cohesion					
iii.	Implementation barriers related with institutional framework					
iv.	Lack of knowledge of policy implementers					
v.	Existing adverse government regulations					
vi.	Backward Customs & other e-services compared to international level					
vii.	Insufficient infrastructure					
viii.	Lack of integrating the port with logistics parks, free trade zones that enable cargo consolidation, multi country consolidation and other ancillary services in line with some of the best practices globally					

16. How much do you agree with the following as possible solutions to Sri Lanka's Logistics Performance challenges?

**SD=Strongly Disagree, D=Disagree, M=Moderate, A=Agree, SA=Strongly Agree**

	<b>Possible Solutions</b>	<b>SD</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>SA</b>
i.	Infrastructure development (Port, Air, Road, Rail & Warehouse)					
ii.	Trade friendly regulations & policy cohesion					
iii.	Development of Inland Transportation					
iv.	Simplification of government procedures with strengthening institutional framework					
v.	Discourage of Bureaucratic bottlenecks/red-tapes					
vi.	Facilitating e-commerce & other advanced digitalized trading platforms					

vii.	Capacity building to face industry revolution					
viii	Automation of Logistics industry with re-engineering & restructuring systems					
ix	integrating the port with well-connected logistics parks, free trade zones that enable cargo consolidation, multi country consolidation and other ancillary services					
x	Other(Please specify)..... ..... .....					

Thank You

### Appendix 3: Regression Results of Exports

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP (log)	0.0615** (0.023847)	0.0783*** (0.022987)	0.0847*** (0.023266)	0.0724*** (0.022960)	0.0822*** (0.023277)	0.0690*** (0.023219)	0.0693*** (0.023083)	0.0767*** (0.023045)
Imports (log)	1.0548*** (0.026446)	0.9947*** (0.026614)	1.0005*** (0.026725)	1.0026*** (0.026388)	0.9970*** (0.027014)	1.0126*** (0.026623)	1.0098*** (0.026424)	1.0019*** (0.026496)
Services Value Added (% GDP)	-0.0029** (0.001358)	-0.0076*** (0.001445)	-0.0071*** (0.001444)	-0.0074*** (0.001440)	-0.0062*** (0.001402)	-0.0066*** (0.001455)	-0.0070*** (0.001445)	-0.0068*** (0.001418)
overall LPI score		0.2481*** (0.033179)						
Customs			0.2035*** (0.029585)					
Infrastructure				0.1974*** (0.026917)				
International Shipments					0.2403*** (0.036048)			
Quality Logistics Services						0.1881*** (0.030686)		
Tracking and Tracing							0.2006*** (0.029778)	
Timeliness								0.2258*** (0.031416)
Constant	-3.1704*** (0.260827)	-2.3010*** (0.275896)	-2.4950*** (0.270269)	-2.2179*** (0.282239)	-2.5115*** (0.271002)	-2.4553*** (0.279151)	-2.4105*** (0.276219)	-2.5379*** (0.265980)
R <sup>2</sup> <sub>adj</sub>	0.9689	0.9714	0.9710	0.9713	0.9709	0.9706	0.9709	0.9712
N	643.0000	643.0000	643.0000	643.0000	643.0000	643.0000	643.0000	643.0000
F	2498.4641	2419.4949	2388.2922	2411.8137	2377.9012	2353.1744	2381.4174	2403.9770

Notes: Standard Errors are in parenthesis. All regressions include year dummies (2007, 2010, 2012, 2014, 2016 and for 2018). All values of export, GDP, import, are in PPP current International dollar. The asterisks, \*, \*\*, and \*\*\*; designate that the coefficient is statistically significant at the 10, 5, and 1 percent levels, respectively.