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THE IMPORTANCE AND DETERMINANTS OF LOGISTICS PERFORMANCE OF SELECTED COUNTRIES

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The Importance and Determinants of Logistics Performance of Selected Countries

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Abstract

Logistics can be described as having the right type of product or service at the right place, at the right time and in the right condition. The global logistics industry has grown significantly while logistics has become an important part of the business economic system and major global economic activity in recent years. Logistic activities accelerate economic growth and productivity growth. Efficient logistics is an important determinant of a country's competitiveness and source of employment. This study is carried out by 2014 data from 113 countries and it is determined that the effect of sub-components (infrastructure-weighted) of the Global Competitiveness Index to the Logistics Performance Index is by using regression analysis. Results obtained from the regression analysis demonstrate the level of quality of railroad infrastructure and port infrastructure, which are major determinants of logistics performances of the countries. In this context, if a country wants to increase her logistics performance, she should improve the quality of railroad and port infrastructure primarily.

Key words: Logistics, Logistics Performance Index (LPI), Global Competitiveness Index (GCI), Infrastructure

Jel Classification: L91, L92, N70

1. Introduction

Foreign trade, especially export is quite important to increase a country's economic growth rate. Moreover, export plays a key role for the countries to receive a greater share of the global market. Satisfactory and sustainability levels of countries' export depend on exporting high value-added products and increasing the diversity of products and markets. Meanwhile, foreign trade transactions exhibit a complex view and has enhanced the importance of logistics. Logistics is a critical component of relevant across agriculture, manufacturing and service sectors and has to be optimally managed for smooth functioning of production and distribution operations. Additionally, logistics cost accounts for a major component of the input cost in all sectors. By doing so, countries have been forced to develop and integrate with logistics strategies to policies and strategies in question. It is understood and exhibited more clearly by those countries that are capable to take the lead over competitors with adjustments to be made on logistics activities and comprehensive logistics strategies.

In this humble work, firstly, logistics performance will be discussed from a conceptual and historical framework. Secondly, components and process of logistics, the economic impacts of logistics activities, the importance of logistics in the economic development of the countries and logistic performance index are described in the data set and the methods form the part of the study. Lastly, it is aimed to reveal the relationship between the Logistics Performance Index (LPI) and some of the components (infrastructure-weighted) of the Global Competitiveness Index (GCI) related to the countries, and the linear regression analysis will be applied by using IBM SPSS Statistics 20.

2. Literature Review

In the study performed by Mohan in 2013, it was showed that the logistics management has effect on global competitiveness. Furthermore, the paper also examined the salient features of Indian logistics systems. Indian companies need to opt for 4PL services, should bring in savings through usage of high technology tools, systems and collaborations. Finally, the logistics service provider should bring down the logistics cost to clients, while concurrently improving the service standart (Mohan 2013).

E.Sandberg and M.Abrahamsson explore how to generate sustaniable competitive advantage in the best two Swedish practice-companies that successfully exploit logistics as a source of competitive advantage. By using a theoretical framework based on the resource results from review of a firm, the research elaborates the link between operational and dynamic logistics capabilities and sustainable competitive advantage. The study identified the five dynamic capabilities, namely managerial knowledge and presence, cross-functional

teamwork, control, learning and supply chain relationships. Those all are vital for the continuous development of the bundling of logistics process and Information Technology (IT) systems. (Sandberg & Abrahamson 2011).

J. Tongzon examines the determinants of competitiveness in logistics and identified the key factors that are required for a successful a logistics hub. For the logistics hub, the analysis on the determinants of competitiveness is made using Singapore as a case study before drawing some implications for the countries in the Southeast Asian region. The customers of logistics services do pay more attention to operation efficiency when selecting the services. Logistics operators in the service industry, should well understand the requirement of their customers and make efforts to meet and possibly exceed their expectations (Tongzon 2004).

R. Founou developed a framework for analyzing the contribution of IT in the logistics sector. The paper concluded that IT would contribute to competitive advantage in limited cases and that most often the strategic necessity hypothesis would apply. The paper suggests a dual approach to information technology strategic management: first, the firm should develop the capacity to efficiently implement some standart solutions on an opportunity-based approach; second, it should embed its IT system in the organization with a strong top management commitment and a clear strategic alignment. To creat a competitive edge, logistics IT applications were predominantly outsourced (Founou2002).

J. Roy compared Canada's logistics and supply chain management performance, both in terms of international trade and from the perspective of inovative practices adopted by Canadian companies in the domestic market. The study also compared the performance of Canadian and American companies on the basis of logistics costs. Despite recent efforts by the Industries in Canada to understand and support Canada's logistics sector, much remains to be done in terms of assessing and understanding the performance level of Canadian companies regarding supply chain management (Roy n.d.).

To conclude, it has been seen in the research literature that logistics-related studies are related to logistics management and information technology in general. Literature review also shows that there is not a single research on the relationship between Global Competitiveness Index and the Logistics Performance Index. Thus, this study is expected to be a crucial contributor to the literature.

3. The Conceptual Framework

Logistics is, by definition, a functional system which consists in combining and coordinating the operations of different modes of transport as a fundamental pre-requisite for ensuring efficient service (Leal 2012). In other words, logistics is defined as a business planning framework for the management of material, service, information and capital flows. It includes the increasing complex information, communication and control systems required in

today's business environment. It is also defined as the procurement, maintenance, distribution, and replacement of personnel and material. A typical logistics framework consists of physical supply, internal operations and physical distribution of goods and services (NSDC 2010). At the same time, logistics can be defined as having the right type of product or service at the right place, at the right time and in the right condition (bestlogisticsguide n.d.).

However, our expectations for a firm or company are directly related to logistics. The customer expectations define the purpose of a logistics system -it ensures that the right goods, in the right quantities, in the right condition, are delivered to the right place, at the right time, for the right cost. In logistics, these are called as the six rights (USAID 2011).

4. Historical Development of Logistics

The etymology of the word "logistics" is often thought to be related to armed forces, which uses the term to describe all tasks related to troop support. However, the origins of logistics run back much deeper into the past (DHL 2008). Logistics has been playing a fundamental role in global development for almost 5,000 years now. Since the construction of the pyramids in ancient Egypt, logistics has made remarkable strides. Time and again, brilliant logistics solutions have formed the basis for the transition to a new historical and economic area. Examples of this fundamental progress include the invention of the sea-cargo container and the creation of novel service systems during the 20th century. Both are integral parts of globalization today (DHL 2008).

During the Second World War (1939-1945), logistics had evolved greatly. The army logistics of United States and counterparts proved they can do more than what the German army could handle. The supply locations for German armed forces were inflicted with serious damages and Germany was not able to wreak the same havoc on its enemy. The United States military ensured that the services and supplies were provided at the right time and at the right place. It also tried to provide these services whenever and wherever required, in the most optimal and economical manner. The best available options were developed to do the task. This also gave birth to several military logistics techniques which are still in use in a more advanced form (bestlogisticsguide n.d.).

Table 1: Historical Developments of Logistics

PERIOD	EVENT
Around 2700 B.C.	Material handling technology in pyramid construction. Blocks of Stone weighing several tons were transported and assembled at the construction site.
Around 300 B.C.	Revolutionary Greek rowing vessels-the new foundation of intercontinental trade.
Around A.D. 700	Procurement logistics in the construction of the Mezquita Mosque-pillars came to Spain from all parts of the Islamic empire.
Around 1200	The international network known as the Hanseatic League-cooperation for transport bundling and international sea transport.
Around 1500	Progressive postal service in Europe-the first time-definite mail shipping service.
Around 1800	Discovery of new road conveyances and the railroad-expansion of logistics tasks through new Technologies and means of transport.
Around 1940	Military logistics during the world wars-transfer of military logistics concepts to the business world.
1956	Invention of the sea container-structural evolution of world trade and the boom of international flows of goods.
Around 1970-1980	Kanban and just-in-time (JIT)-logistics concepts with a special emphasis on procurement.
Around 1990	Quick response (QR) and efficient consumer response (ECR) technologies-logistics concepts with a special emphasis on distribution.
Today	Supply chain management-a look at the entire logistics chain from the vendor's supplier to the end customer.
Today	Advancing globalization-efficient logistics as a competitive edge in the era of globalization.

Source: (DHL 2008)

Today, logistics is an important part of the business economic system and major global economic activity. The logistics cost are estimated to be between 9-20 % of the GDP. The logistics costs as a percentage of GDP for some countries are given below (Mohan 2013):

Table 2: Logistics Cost-GDP Ratio

COUNTRY	LOGISTICS COST/GDP (%)
US	7.8
Europe	10.0
China	18.0
Japan	11.4
India	13.0

Source: (Mohan 2013)

The global logistics industry has registered significant growth in the last decade wherein the big driver has been the emergence on Third Party Logistics (3PL) and Fourth Party Logistics (4PL) players in the industry who are expected to play much more important role in the years to come.

The global logistics industry is characterised by high costs of operations, low margins, shortage of talent, infrastructural bottlenecks alongside increasing demand from clients for providing one-stop solutions to all their needs and for investing in progressive technology. All these factors further decreases the margins involved in this industry and fastens the process of consolidation in the industry through acquisitions, mergers and alliances (NSDC 2010).

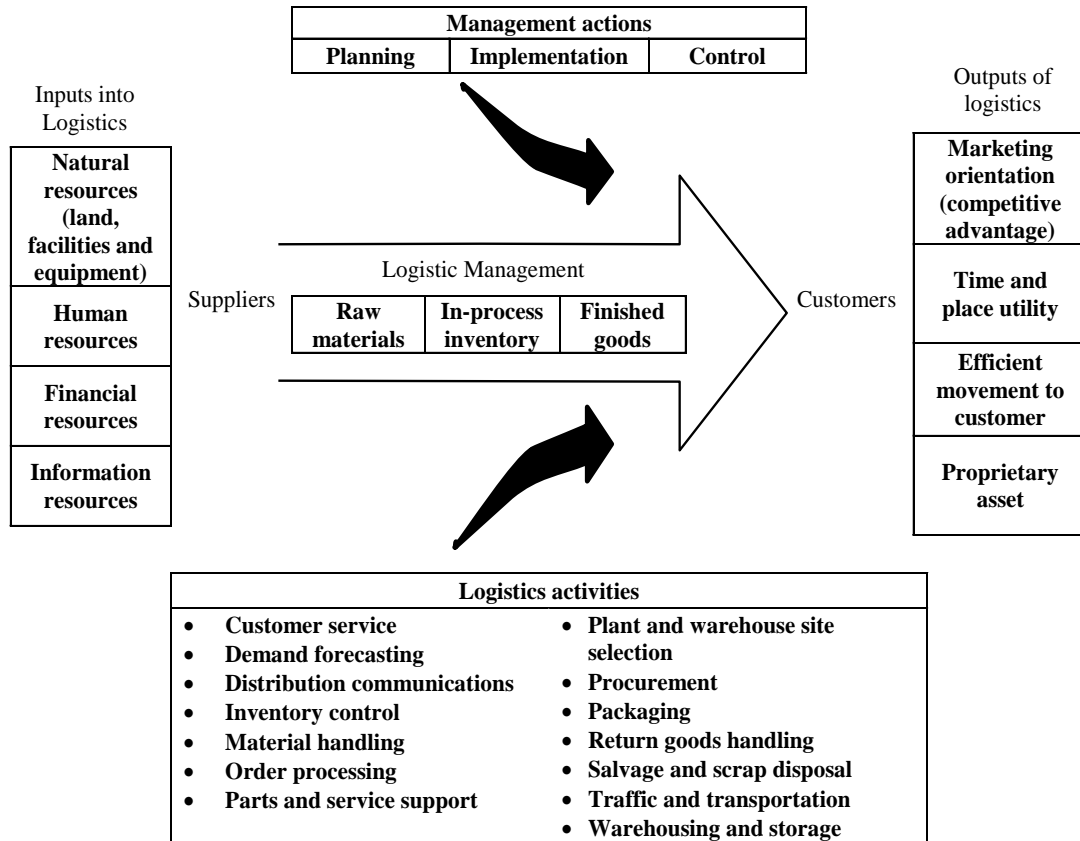
5. Components and Processes of Logistics

Logistics is not confined to manufacturing operations alone. It is relevant to enterprises, including government, institutions such as hospitals and schools, and service organizations such as retailers, banks, and financial service organizations. Examples from these sectors will be used throughout some main books of the field to illustrate the relevance of logistics principles to a variety of operations.

Some of the many activities encompassed under the logistics umbrella are given in Figure 1, which illustrates that logistics is dependent upon natural, human, financial, and information resources of inputs. Suppliers provide raw materials which logistics manage in the form of raw materials, in process inventory and finished goods. The outputs of the logistics system are competitive advantage, time and place utility, efficient movement to the customer, and providing a logistics service mix such that logistics becomes a proprietary asset of the organization (Lambert, Stock& Ellram 1998).

The fundamental goal of international logistics are processing, warehousing and transport (Vallee& Dirksen 2011). However, the value chain for logistics as follows (NSDC 2010):

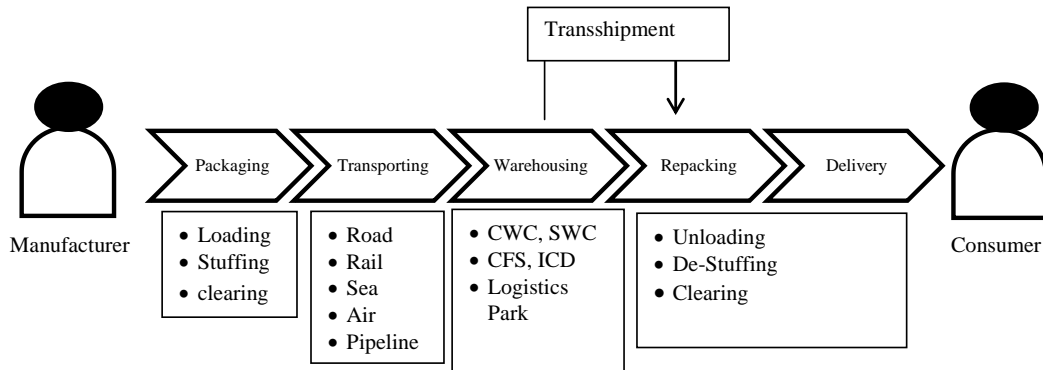
Fig 1: Components of Logistics Management



Source: (Lambert, Stock & Ellram 1998).

Goods that are received from the manufacturers are loaded and stuffed into containers of right size. The goods are then transported by the appropriate mode of transportation (land transport, transport via pipelines, water transport, and air transport) (The Economist 2012). The transported goods are brought to a warehouse and stored safely. Warehousing requires planning of resources, assets, processes, and accurate demand forecasting supported by scalable infrastructure to be profitable (KPMG 2009). The goods are then re-packed in the format suitable to be sent to the customer, and then finally delivered to the customer (Figure 2).

Fig 2: Value Chain: Logistics



Source: (NSDC 2010).

Logistics is a critical component that is essential and relevant across agriculture, manufacturing and service sectors and which has to be optimally managed for smooth functioning of production and distribution operations. Additionally, logistics cost accounts for a major component of the input cost in all sectors, more so in the case of sectors such as cement, steel, automobiles, retail, fast-moving consumer goods (FMGC), pharmaceuticals etc. With rising competition in the sectors that use logistics services, it has become even more important to enhance the efficiency of the system and use the cost-benefit in increasing the company's competitiveness. Besides, with the globalisation enclosure all over the world, a larger number of multi-national companies (MNCs) are sourcing, manufacturing and distributing goods on global scale, and thus need more complex supply chains to be managed. Given such developments, the Transportation, Logistics, Warehousing and Packaging Sector is expected to become a more specialised and niche expertise area where high premium will be charged for increased quality and quantity of services delivered by logistic service provider.

By tracing the flow of a product from the procurement of raw materials through manufacture of the end product to the customer, one can gain a broad view of logistics processes. In this context, a distinction can be drawn among the phases of

- Procurement Logistics
- Production Logistics
- Distribution Logistics
- Spare-parts Logistics
- Reverse Logistics

All types of value chain can be performed in every step of the logistics process. As a result, there are warehouses both in procurement as well as in production and distribution (DHL 2008).

6. Layers to Logistics Services

There are five main inter-related layers of logistics services that involve increasing levels of service and supply chain integration:

6.1 First Party Logistics (1PL)

It concerns beneficial cargo owners who are the shippers (such as a manufacturing firm delivering to customers) or the consignee (such as a retailer picking up cargo from a supplier).

They dictate the origin (supply) and the destination (demand) of the cargo with distribution being an entirely internal process assumed by the firm. With globalization and the related outsourcing and offshoring of manufacturing, distribution services that used to be assumed internally tend to be contracted to external service providers.

6.2 Second Party Logistics (2PL)

It concerns the carriers that provide transport service over a specific segment of a transport chain. It could involve a maritime shipping company, a rail operator or a trucking company that are hired to haul cargo from an origin (e.g. a distribution center) to a destination (e.g. a port terminal).

6.3 Third Party Logistics (3PL)

It concerns freight forwarders that could have stakes in a specific transport segment and its physical assets, but who offer comprehensive freight distribution services along transport chains. These services can involve warehousing, transloading, terminal operations and even forms of light manufacturing such as packaging and labeling (Rodrigue n.d.). A 3PL thus tries to organize the tasks related to physical distribution, so that parts and finished goods can be carried from their origin to their destination. It provides multiple logistics services for its clients and customers (Langley, Allen & Dale 2004).

6.4 Fourth Party Logistics (4PL)

Creates value by redesigning everything from the business perspective to processes as it manages logistics for carriers, forwarders or warehouses (Deloitte 2013). This often involves agreements (subcontracting) with 3PLs and 2PLs (Rodrigue n.d.). 4PL (also sometimes called a lead logistics provider) is a non-asset based company (i.e. they don't own their own trucks or warehouse facilities) that provide logistics consulting services to fully manage, design, and build supply chains. While the logistics and supply chain industry continues to be confused about the exact role and definition of 4PLs, emerging few categories of logistics consulting and management firms are emerging that are invaluable in managing large scale, complex

supply chain functions from the top and overseeing innovative technology solutions (Logistics List 2011).

6.5 Fifth Party Logistics (5PL)

A fifth party logistics provider (5PL) will aggregate the demands of the 3PL and others into bulk volume for negotiating more favourable rates with airlines and shipping companies. Non asset based, it will work seamlessly across all disciplines (logisticsmgt 2011). These are firms who are mainly logistics service providers that plan, organize and implement logistics solutions on behalf of a contracting party by using the appropriate technologies as needed (Deloitte2013). Fifth party logistic is often linked to E-business (logisticsglossary n.d.).

7. The Economic Impacts of Logistics Activities

As it is mentioned before, logistics plays a key role in the economy today, and the market volume of logistics has already reached a substantial level in many economies as a result (DHL 2008). Economic impacts of logistics can be analyzed as follows:

- Logistic activities accelerates economic growth and productivity growth and decreases poverty. There is now overwhelming evidence that trade liberalization is associated with faster productivity growth among the firms of developing countries. It is assumed that increased trade due to broad-based liberalization can, under the right circumstances, promote economic and social development through increased productivity and decreased poverty. In such a case, logistics sector has a crucial role to play in the process (WTO & OECD 2013).
- Logistics is one of the major expenditures for business, thereby affecting and being affected by other economic activities.
- Logistics supports the movement and flow of many economic transactions; it is an important activity in facilitating the sale of virtually all goods and services. To understand this role from a systems perspective, consider that if goods do not arrive on time, customers can not buy them. If goods do not arrive in the proper place, or in the proper condition, no sale can be made. Thus, all economic activity throughout the supply chain will suffer (Lambert *et al.* 1998).
- Logistics may be the best source of competitive advantage for a firm because it is less easily duplicated than other elements of the marketing mix: product, price and promotion. Consider, for example, forming close, ongoing relationship with carriers or logistics service providers can help give the firm a distinct competitive advantage in speed to the customer, reliability, availability, or other customer service factors (Lambert *et al.* 1998).
- Efficient logistics is an important determinant of a country's competitiveness as it is for the firm. The international transport system may suffer from insufficient cross-country

coordination of the network, such as non-integrated time schedules, customs delays, incompatible standards, insufficient flow of information about delays. Logistics services help to solve these problems. For example, they assist clients to save costs by concentrating cargo flows, reducing the ratio of empty voyages and favouring the sharing of information across transport operators (WTO 2004).

- Increasing logistics performance deliver the products to markets at competitive quality and prices (Forrestn.d.).
- Efficient logistics don't just reduce costs of transport and transit time, but also decrease the cost of production. If logistics services are inefficient, firms are likely to maintain higher inventories at each stage of the production chain, requiring additional working capital (bigger warehouses to store larger inventories) (WTO 2004).
- Greater efficiency logistics means that socially important goods, such as basic foodstuffs, can be moved within countries more quickly and lower cost.
- Thanks to efficiency logistics, farmers can access entirely new markets, either in different regions, or, potentially, internationally.
- Logistics is a source of employment. Many of the operations related to logistics are manpower intensive (KPMG 2009). Logistics operations tend to be relatively more labor intensive in developing countries than in developed ones, due to differences in production technology (WTO & OECD 2013).

8. Logistics Performance Index and Its Components

The importance of efficient logistics is now widely accepted by policymakers worldwide. Trade and commerce are moved within and across borders by private operators. The efficiency of those supply chain -logistics performance- is what the Logistics Performance Index (LPI) and its components measure. This performance depends heavily on the policy environment: measured by individual countries or regional economic groups in infrastructure provision, regulation and development of services, or facilitation of trade through more friendly procedures at the border contribute substantially to logistics performance (WTO 2014).

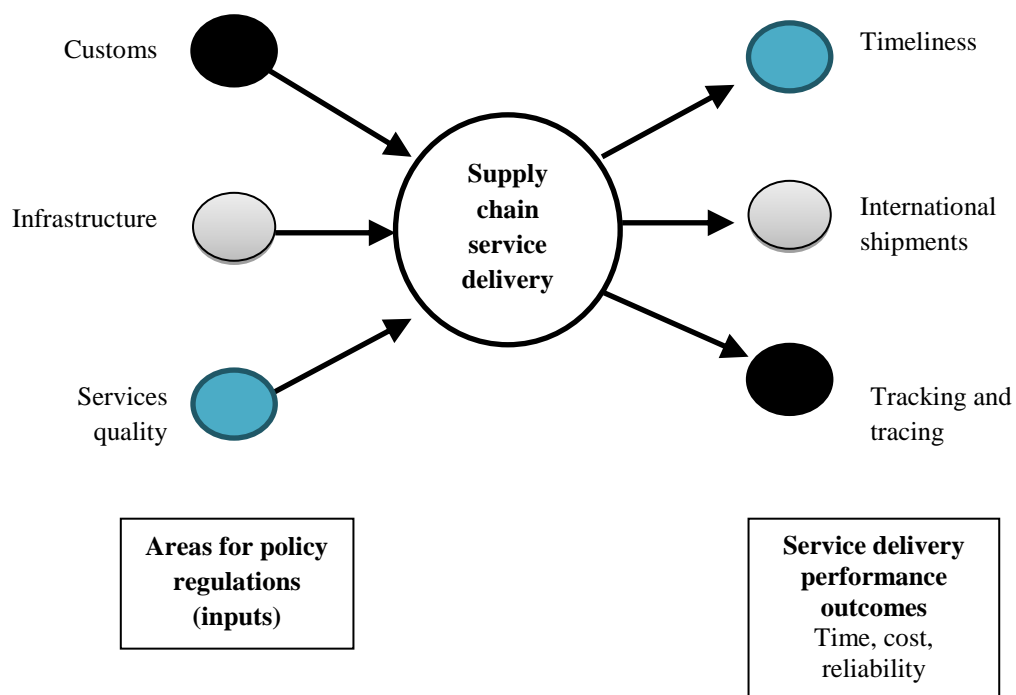
The LPI survey was carried out through The World Bank's partnership with the International Association of Freight Forwarders (FIATA), the Global Express Association (GEA), AND THE Global Facilitation Partnership for Transportation and Trade (GFP) (The World Bank 2002). The Logistics Performance Index (LPI) analyzes countries in six components:

- The efficiency of customs and border management clearance.
- The quality of trade and transport infrastructure.

- The ease of arranging competitively priced shipments.
- The competence and quality of logistics services.
- The ability to track and trace consignments.
- The frequency with which shipments reach consignees within schedule or expected delivery times.

International LPI based on the assessment of foreign operators located in the country's major partners, and weighs the average of the six components above (World Bank 2002).

Fig 3: Input and Outcome LPI Indicators

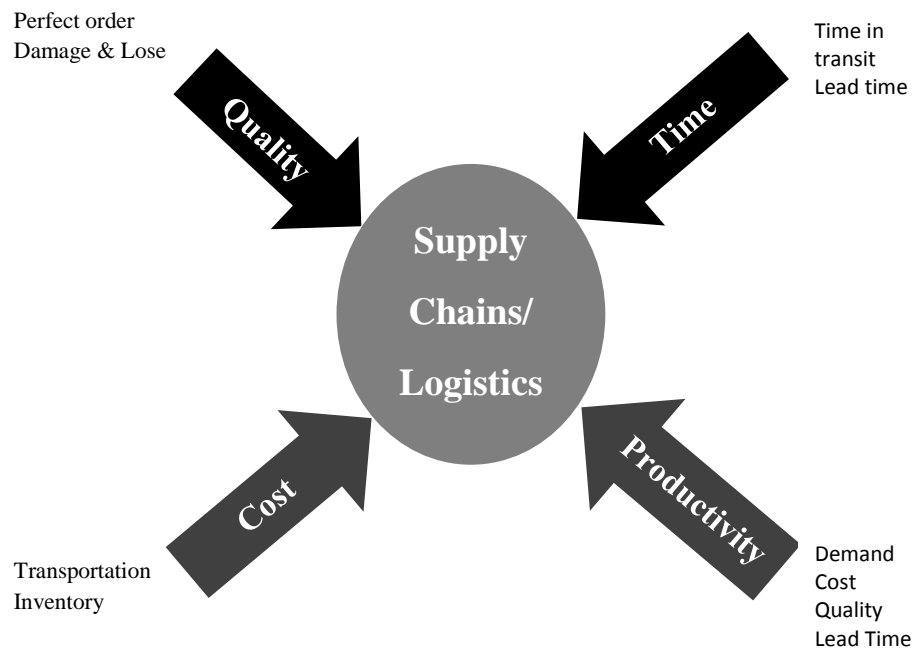


Source: (WTO 2012).

The components were chosen based on recent theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding (WTO 2012).

LPI survey has been made 4 times so far, in 2007, 2010, 2012 and 2014. Based on a worldwide survey of global freight forwarders and express carriers, the LPI is a benchmarking tool developed by the World Bank that measures performance along the logistics supply chain within a country. Allowing for comparisons across 160 countries, the index can help countries identify challenges and opportunities and improve their logistics performance (WTO 2014). The index ranges from 1 to 5, with a higher score representing better performance (The World Bank 2014).

Fig 4: Logistics Performance Drivers



Source: (Forrestn.d.).

The results of LPI 2014 point to Germany as the best performing country with an LPI score of 4.12, and Somalia as the worst with 1.77 (on a scale of 1 to 5) (WTO 2014).

Table 3: The Top 10 Performers on the 2014 LPI-Largely Unchanged Since 2007

	2014 LPI		2012 LPI		2010 LPI		2007 LPI	
Country	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Germany	1	4.12	4	4.03	1	4.11	3	4.10
Netherlands	2	4.05	5	4.02	4	4.07	2	4.18
Belgium	3	4.04	7	3.98	9	3.94	12	3.89
United Kingdom	4	4.01	10	3.90	8	3.95	9	3.99
Singapore	5	4.00	1	4.13	2	4.09	1	4.19
Sweden	6	3.96	13	3.85	3	4.08	4	4.08
Norway	7	3.96	22	3.68	10	3.93	16	3.81
Luxemburg	8	3.95	15	3.82	5	3.98	23	3.54
United States	9	3.92	9	3.93	15	3.86	14	3.84
Japan	10	3.91	8	3.93	7	3.97	6	4.02

Source: (WTO 2014), (WTO 2007)

As expected, high-income countries dominate the top 10 rankings (Table 3) (WTO 2014). In fact, the composition of the 10 has remained relatively unchanged since 2007. Not surprisingly, many of these countries are major and well-established logistics players with a dominant role in global or regional supply chains.

9. Data Set and Methods

In the study, it is aimed to find out the relationship between the Logistics Performance Index (LPI) and some of the components (infrastructure-weighted) of the Global Competitiveness Index (GCI) related to countries. First of all, data for 113 countries in 2014 was compiled and analyzed.

Table 4: Variables Used in Analysis

Logistics Performance Index (Dependent Variable)	Some of the Components of the Global Competitiveness Index (GCI) (Independent Variable)
LPI	Quality of Roads Quality of Railroad Infrastructure Quality of Port Infrastructure Quality of Air Transport Infrastructure Value Chain Breadth Company Spending on R&D

Source: (World Bank 2014), (World Economic Forum, 2014)

For this purpose, by using the linear regression analysis, the Logistics Performance Index was taken as the dependent variable, and the effect of some of the components (infrastructure-weighted) of the Global Competitiveness Index (GCI) (Table 4) was measured. Analysis was performed by using IBM SPSS Statistics 20.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,865 ^a	,748	,734	,27622

a. Predictors: (Constant), Company Spending on R&D, Quality of Port Infrastructure, Quality of Railroad Infrastructure, Quality of Air Transport Infrastructure, Quality of Roads, Value Chain Breadth

When examining the results for the model (Table 5), it is expressed that there is high rate relationship between Logistics Performance Index (LPI) and some of the components (infrastructure-weighted) of the Global Competitiveness Index (GCI). However, it is said that the model is descriptive ($R^2=0,748$).

Table 6: Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24,003	6	4,000	52,432	,000 ^b
	Residual	8,088	106	,076		
	Total	32,090	112			

a. Dependent Variable: LPI

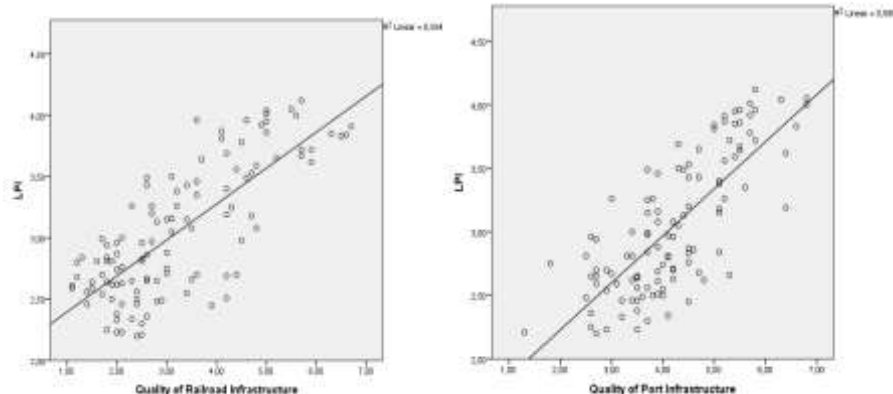
b. Predictors: (Constant), Company Spending on R&D, Quality of Port Infrastructure, Quality of Railroad Infrastructure, Quality of Air Transport Infrastructure, Quality of Roads, Value Chain Breadth

When examining the results for Anova (Table 6), it is seen that the model is significant as a whole. Indeed, $p < 0,05$, $F = 52,432$.

Table 7: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,166	,147		7,945	,000
	Quality of Roads	,005	,045	,012	,114	,909
	Quality of Railroad Infrastructure	,103	,032	,271	3,257	,002
	Quality of Port Infrastructure	,105	,050	,216	2,098	,038
	Quality of Air Transport Infrastructure	,076	,052	,153	1,465	,146
	Value Chain Breadth	,117	,078	,175	1,494	,138
	Company Spending on R&D	,087	,067	,144	1,297	,197

a. Dependent Variable: LPI



It is seen that quality of railroad infrastructure and quality of port infrastructure are major determinants of logistics performances of countries when examining the effect of some of the components (infrastructure-weighted) of the Global Competitiveness Index (GCI) to the Logistics Performance Index (LPI) related to 113 countries since $p < 0,05$ (Table 06) and the coefficient values are positive for both variables. In this context, if the country wants to increase logistics performance, she should improve the quality of railroad and port infrastructure primarily.

10. Conclusions and Recommendations

Today, in the arena of global trade where price competition alone does not make any sense and production costs converges together, the importance of logistics services and strategies has gained equal importance. Countries that move from transportation to logistics are getting a greater share of the international market. It is understood more clearly by the countries that take the lead over competitors with regulations made on logistics activities and comprehensive logistics strategies.

When countries increase their investment on logistics research and give more importance to their logistics, economic development will also be anticipated. Indeed, in the face of the increase in logistics performance of a country, economic growth, employment level and productivity will increase, poverty will decrease. Moreover, as logistics supports the movement and flow of many economic transactions, all economic activities throughout the supply chain will be influenced by these effects. After all, due to the logistics activities, country's comparative advantage will increase since efficient logistics will reduce costs of transport, and decrease the cost of production.

The efficiency of logistics activities are what the Logistics Performance Index (LPI) and its components measure. This efficiency primarily depends on the quality and competence of customs and border management, trade and transport infrastructure and logistics services. In this paper, it is worked on the effect of various technical and physical infrastructure indicators in the Global Competitiveness Report (GCI) to the LPI and it is concluded that the logistics performance would primarily depend on the quality of railroad and port infrastructure. In this regard, countries that develops railway infrastructure and enhances the quality of ports ensures competitiveness and eventually reach the top positions in the Logistics Performance Index.

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