

# Analyzing the Dependency Between National Logistics Performance and Competitiveness: Which Logistics Competence is Core for National Strategy?

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## Abstract

With the advancements in the strategic management field, logistics management has changed considerably and logistics competency has emerged as a new and important area of research. In this regard, the purpose of this study is to find the core logistics abilities, which enable nations to achieve a competitive advantage in the logistics market. Two different data sets, one from World Economic Forum and the other from the World Bank were used. Cluster and discriminant analysis were used to answer the research questions. The results indicated that while the logistics infrastructure and the customs were absolute in determining a high-competitive country, the logistics competence and the tracking & tracing were the core logistics abilities needed to sustain the competitive advantage in long term. The implications of these results are also discussed.

*Key words: Logistics, Strategy, Competitiveness, Logistics Capability, Core Competence.*

## 1. INTRODUCTION

Since international competition has increased aggressively along with advancement in strategic management field, logistics management should turn its attention to those increments as a competitive ability of both firms and the nations. It is no longer enough to think about logistics management at the firm level only, but rather more attention must be shifted to the industry and global national level, as a consequence of the advancements in strategic management.

Since the beginning its scientific history in 1960s, the strategic management field has made significant progress in the areas of strategic planning, competitive advantage, and core competences. That advancement in strategic management took strategy making from strategic planning (Ansoff, 1965) and positioning (Porter, 1980, 1985) to a resource-based view (Barney, 1986, 1991, 1995; Peteraf, 1993; Prahalad and Hamel, 1990). This revolution in strategic management has resulted in the most recent orientation in logistics management: Firstly, finding the core logistic ability for firm level and then expanding it to the national level to sustain the competitive advantage in the long term. Because most of the literature has emerged that national competitiveness has a distinguished nature from competitiveness at the industry or firm level (Boltho, 1996; Strange, 1998).

Kao et al. (2008), describe national competitiveness as a measure of the relative ability of a nation to create and to maintain an environment in which enterprises may compete so that the level of prosperity may be improved. From this definition it can be inferred that nations must make an environment, which is suitable for firms to compete. And also it is known that

logistics competency has an important role for firms' competitiveness (Olavarrieta and Ellinger, 1997; Day, 1994). This sequential logic makes nations to have and maintain a national logistics strategy also.

Thus, the aim of this study is to find the core logistics competences for national competitiveness. We consider that the competitive power of countries will increase with the possession of effective national logistics management and efficient logistics performance. In this manner, we will perform an international comparative study to find the relationship between global competitiveness and national logistics performance. After determining this relationship, we consider that national logistics strategy can be developed more appropriately. This study, therefore, has an importance not only for firms but also for countries to become more competitive in the global economy.

The remainder of the paper is structured as follows. First, in Section 2 competitiveness, strategy and national strategic perspectives are presented as theoretical framework. In Section 3, logistics management and logistic performance measures are mentioned, and the analysis model is explained. Analysis and data preparations are outlined in Section 4. Finally, in Section 5 findings are discussed and implications were introduced.

## 2. COMPETITIVENESS, STRATEGY AND NATIONAL STRATEGIC PERSPECTIVES

The field of strategic management has considerably advanced in both theoretical domain and empirical research over the last decades. While the roots of the strategic management can be traced in military doctrines, especially those drawn up by Sun Tzu, the progress and the evolution in the last few decades has been striking. In this manner, in recent study we will divide the strategic management's advancement into three phases: strategic planning, competitive strategy, and the resource-based strategy. In fact, the progress of the logistics strategy is very parallel with the field of the strategic management. Thus, we will examine the two fields, strategic management and logistics strategy, together as shown in the Figure 1.

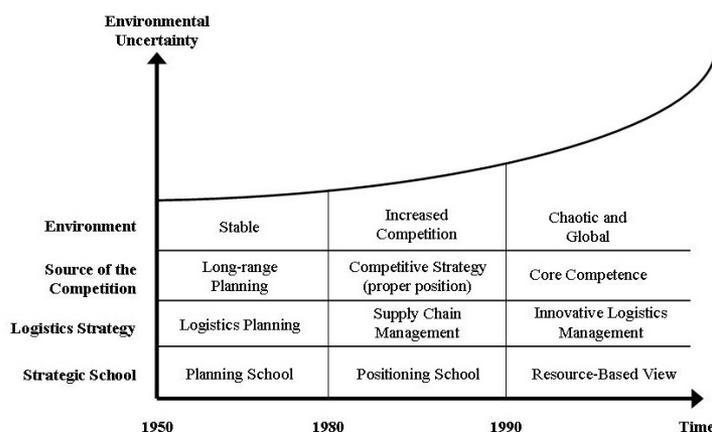


Fig. 1 – Co-Evolution of Strategic Management and Logistics Strategy. Source: adapted from Barca (2003); Bowersox and Daugherty (1995); Hurtado (1999); Mintzberg et al. (1998)

The emergence of modern strategic thinking can be dated back to 1950s, when the managers were faced with the problems of controlling and coordinating the large, complex corporations. The development of financial budgeting provided the basic rules for coordination, but this coordination required a longer planning horizon than the annual planning method. This need triggered the long-range planning or the strategic planning era.

Planning school of strategy can be dated to Ansoff's pioneering book "Corporate Strategy" in 1965. To Ansoff (1965), strategy is a long-range planning process. Therefore, strategy-making is a rational and mechanical model that must depend on significant future objectives. The main contribution of the planning school to strategic management is the declaration of strategy-making as a rational effort and rationalization of that effort with analytical tools (Oliver, 2002) such as BCG matrixes and SWOT analysis. In strategic planning, every phase is described in detail and with the combination of the phases, corporate strategy emerges.

During the era of strategic planning, logistics strategy was basically a matter of system planning that corresponds to the stable environment. This view of logistics strategy fitted well with strategic planning since the main focus was just to forecast the stable future and to make long-range plans in conforming to pre-designed objectives (Hurtado, 1999).

The strategy-making became more complicated during 1970s, not only because of the unstable environment, but also increasing global competition. In this period, the increasing competitiveness of Japan and South-East Asian countries' economy began to be felt in the US. In this environment, positioning school of strategic management began to emerge with M. Porter's book "Competitive Strategy: Techniques for Analyzing Industries and Competitors" in 1980. The school's opinion on strategy that adopts strategies as generic and identifiable positions in the market has focused on an important gap of planning school (Mintzberg et al., 1998). The revolution of the positioning school was the concept of "positioning in the market", which made strategy a visible and concrete construct.

In his books, Porter (1980, 1985) described strategy beginning with the "selection of proper industry". Finding the right industry and the market is the very root of positioning school. To find the most appropriate industry, the firm must analyze the five power factors (rivalry, the threat of substitutes, buyer power, supplier power, and barriers to entry) and to sustain the competitive advantage it must take one of the three generic strategies (differentiation, cost leadership or focusing on a niche market) and manage the value chain. So, for the positioning school, the factors that promote competitive advantage in long term is the selection of the most appropriate industry, and then taking the correct position against the five powers of the market.

The positioning school affected logistics management in two ways. The first effect was the recognition of the importance of balancing cost to service trade-offs (Bowersox and Daugherty, 1995). Using the concepts of Porter, logistics planners began to consider balancing effort toward cost or differentiation and the potential for a niche focus of the market. In this manner, Rao et al. (1988) suggested a logistical framework similar to Porter's generic strategies: cost minimizing, value-added maximization and control/flexibility enhancement.

The second impact of Porter on logistics management was the introduction of Supply Chain Management (Hurtado, 1999). As with the value chain, logistics planners must manage the

supply chain members. To manage the supply chain, firms must establish relations and alliances and create new paths to others that have not been previously connected. In this manner, planners can not rely on pre-designed strategies, but they must creatively engage in the joint commitments, establish long-term relations and contracts, and share information with the units on the supply chain. Thus, during this era, logistics management emerged as a more complex business than a simple planning procedure.

After 1990s, the strategic focus changed from industry-driven factors to internal abilities of the firm. During this period, the environment evolved rapidly into a more chaotic and global market. This dramatic transformation in the environment affected strategy-making which emerged as the “core competence”, and the strategic management field has developed an improved way of understanding, named Resource-Based View (RBV) of the strategy. This new strategy thinking turned the focus from external market factors to internal abilities of the firms which cannot easily be initiated by competitors (Barney, 1994; Collis and Montgomery, 1995; Wernerfelt, 1995).

RBV of the strategy depends on the firm’s ability to use and develop the unique resources of itself for sustainable competitive advantage. The unique resources of a firm are its core abilities. To RBV, the main focus must be to describe, develop and allocate those core abilities for greater performance and competitive advantage (Collis, 1994). From inception, every firm has a variety of physical (capital, production facilities, logistics facilities, and etc.) and non-physical (organizational culture, business models, HRM applications, patents, trademark rights, and etc.) resources. These resources provide firms many various capacities, some of which are more important than others. If a firm can recognize those unique abilities, then it can define its core competences (Hitt et al., 1999). Thus, RBV champions the view that a firm must manage and develop its core competences in a value chain to gather long-term competitive advantage.

In logistics management, RBV draws attention to the internal abilities of the firms in the supply chain. Sustaining competitive advantage does not solely rely on environmental market-driven factors, but also internal core competences. This logic can easily be adapted from firm and industry level to nation and global competition. Like firms, nations have to describe their core competences, e.g. logistics competences, to gain competitive advantage in global markets. In this frame of reference, therefore, in this study we aim to describe the core logistics competences of nations needed in order to be able to sustain competitive advantage in the global competition.

### **3. LOGISTICS MANAGEMENT AND PERFORMANCE MEASURES**

Logistics management, an integral part of supply chain management, aims to reduce costs while increasing customer service level through enhancing productivity by coordinating the flow of materials and information among the supply chain members (Çelebi et al. 2010). An effective logistic management provides the right product in the right place and time with low costs (Handfield and Nichols, 1999). A well-managed logistics system can provide the organization with a sustainable competitive advantage (Gourdin, 2006) because an effective logistics management uses an appropriate strategy to promote customer satisfaction.



The market properties and organizations changed drastically in years. Organizations have moved from centralized, vertically integrated, single-site manufacturing facilities to geographically dispersed networks of resources. These global networks are designed to provide the speed and flexibility necessary to respond to windows of market opportunity (Stock et al. 1998). Logistics strategy gained importance during recent years. Because of its growing importance, there are vast numbers of articles in the literature on logistics strategy (McGinnis and Kohn, 1990; McGinnis and Kohn, 1993; McGinnis and Kohn, 2002; McGinnis et al, 2010; Iosep, 2009; Autry et al., 2008). With strategic logistics management, firms aggressively seek to exploit logistics competencies as a way and means to gain and maintain competitive advantage (Bowersox and Daugherty, 1995).

Because of globalization, it is known that firm-level logistics has been affected by national and global environment, and also logistics affects these environments. From the national perspective it is clear that the distribution from point-of-origin to point-of-consumption has become an enormously important component of the gross domestic product (GDP) of industrialized nations. As a significant component of GDP, logistics affects the rate of inflation, interest rates, productivity, energy costs and availability, and other aspects of the economy. Investment in transportation and distribution facilities, not including public sources, is estimated to be in the hundreds of billion dollars. Considering its consumption of land, labor, and capital, and its impact on the standard of living, logistics is clearly a huge business (Stock and Lambert, 2001:5-6).

Improvements in a nation's productivity have positive effects on the prices paid for goods and services, the balance of national payments, currency valuation, the ability to compete effectively in global markets, industry profits (higher productivity implies lower costs of operation to produce and distribute an equivalent amount of product), the availability of investment capital, and economic growth, leading to higher level of employment.

The development and expansion of global competition began in the 1970s and accelerated in 1990s. Firms have increasingly become more international, as evidenced by the growth in foreign sourcing of raw materials, component parts, sub-assemblies, and labor. Companies have penetrated new markets throughout the world. With rising interest rates and increasing energy costs during the 1970s, logistics received attention as a major cost driver. In addition, logistics costs become a more critical issue for many organizations due to globalization of industry. During the 1990s, market changes accelerated, resulting in the further recognition that logistics could help to create sustainable competitive advantages for organizations (Stock and Lambert, 2001:13).

In an environment characterized by strong and sophisticated competitors, each trying to develop sustainable competitive advantage, many organizations have recognized that logistics competency holds the key to developing or maintaining continued business success. As international competitive pressures continued, and with advances in the field of strategic management, attention shifted to logistics management as a competitive weapon and as an important dimension of competitive strategy. In the last few years, an additional shift in orientation has taken place.

Before determining strategy, performance measurement is necessary for decision-makers. In logistics, performance measurement has been considered as one of the four key competencies,

the other three being positioning, integration, and agility to achieve world class performance (Gunesakaran and Kobu, 2007). Achieving a high level of performance in logistics is important for the profitability and for the efficiency of national economies and the global economy. As international trade increases as a percentage of national domestic activity, so the interactive effects of the productivity of national and international logistics increases. It is understandable then, that corporations and nations should be interested in measures of performance at the macro level (Brewer et al., 2001: 12).

Companies or governments may be interested in measures of logistics performance at the industry level in order to assess the effects of government policies on logistics service suppliers or on the logistics performance of manufacturing and related companies. Studies of logistics performance in manufacturing or in logistics services may be carried out at various levels for policy appraisal and performance comparison. A community aspiring to serve as a national or regional gateway may wish to compare its performance with others, or to assess changes in its performance over time. International comparisons, when available among countries or, increasingly among trade areas may be of value (Brewer et al., 2001: 15).

International comparison of logistics performance is difficult for many reasons. More importantly, logistics costs are affected by a wide range of geographic, economic and cultural conditions that are intimately associated with the way of life in national cultures. There is increasing concern about the relationships of private logistics strategies and public interests and policies. In this study, in the frame of studies on the relationship between competitiveness and logistics, we aim to discover the relationship between national logistics performance and the national and global competitiveness. Because we know that environment is a determining factor for firms' competitiveness, we developed a model after reviewing vast amount of study in literature. The model is demonstrated in Figure 2.

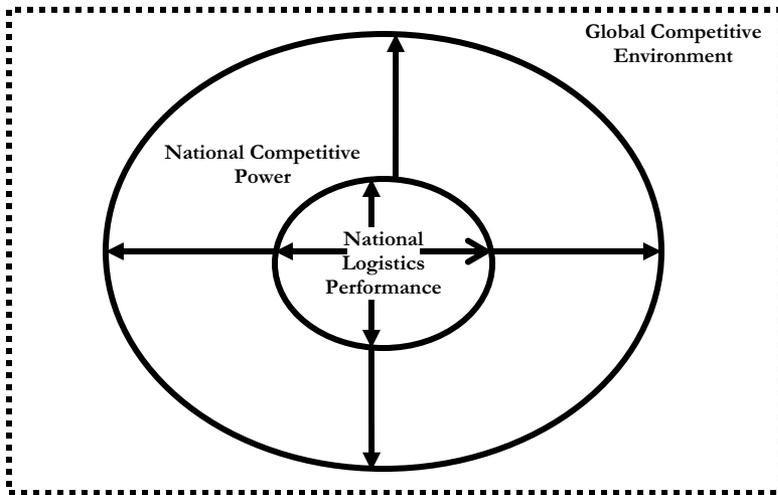


Fig. 2 – Relational Model of National Logistics And Competitiveness. Source: own research

In Figure 2, national logistics performance is demonstrated as core force and determining aspect of national competitive power. We consider that if logistics performance is developed, then national competitive power will be strengthened. However, being aware of the many different aspects of logistics, we aim to identify the core logistics factors which are important for determining national logistics strategy. By doing so, we can improve national competitive power and gain competitive advantage in global environment. We test the model incrementally in the analysis section. Hence, the research questions are determined as follows:

- Which of the logistics competence(s) must be developed to become a highly competitive country? (National Logistics Power)
- Which of the logistics competence(s) must be developed to sustain competitive power? (Core Logistics Ability)

#### 4. ANALYSIS

As we mentioned before, the aim of this study is to find the national logistics performance and national and global competitiveness relations. We will try to reach this objective in three steps, shown in Figure 3.

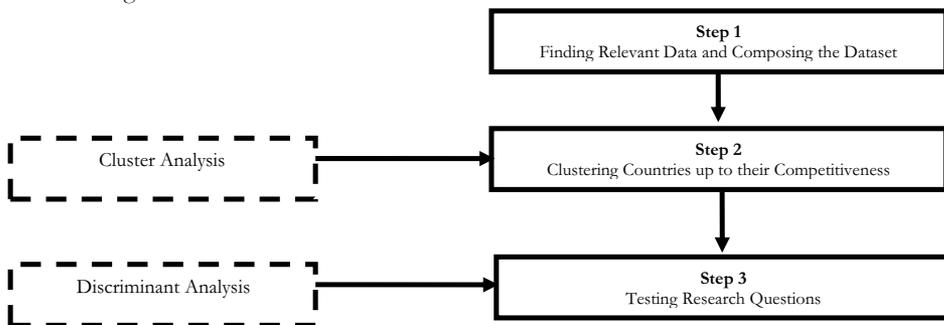


Fig. 3 – Steps of Analysis. Source: own research

##### 4.1 Finding Relevant Data and Composing the Dataset

There are two different datasets used in the analysis. One is global competitiveness data and the other, logistics performance index data. Global competitiveness data is gathered from World Economic Forum and logistics performance data is gathered from the World Bank's published reports.

World Economic Forum (WEF) has been compiling the competitiveness index study since 1989. WEF's research field is the competitiveness of nations. According to WEF, competitiveness of nations is;

*“a field of Economic theory, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people.”*

WEF has been measuring competitiveness of nations through twelve pillars. These pillars are demonstrated in Table 1. On the WEF internet website, researchers can find detailed information on competitiveness measurement (World Economic Forum Website).

Tab. 1 – World Competitiveness Measurement Pillars. Source: World Economic Forum Website

Pillars	Sub index Groups
First pillar: Institutions	<b>Basic Requirements</b>
Second pillar: Infrastructure	
Third pillar: Macroeconomic stability	
Fourth pillar: Health and primary education	
Fifth pillar: Higher education and training	<b>Efficiency Enhancers</b>
Sixth pillar: Goods market efficiency	
Seventh pillar: Labor market efficiency	
Eighth pillar: Financial market sophistication	
Ninth pillar: Technological readiness	
Tenth pillar: Market size	
Eleventh pillar: Business sophistication	<b>Innovation and Sophistication Factors</b>
Twelfth pillar: Innovation	

According to WEF, the *basic requirements subindex* classifies those pillars most critical for countries in the factor-driven stage. The *efficiency enhancers sub index* includes those pillars critical for countries in the efficiency-driven stage. The *innovation and sophistication factors subindex* includes the pillars critical to countries in the innovation-driven stage (Global Competitiveness Report, 2009).

For the logistics data World Bank's Logistics Performance Index (LPI) is used in the analysis. 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 to comparisons across 155 countries, the index can help countries identify challenges and opportunities, and improve their logistics performance. The World Bank conducts the survey every two years. With the LPI, the World Bank aims to focus attention on an issue of global importance and provide a platform for dialogue among government, business, and civil society. The LPI survey contains detailed information on countries' logistics environments, core logistics processes and institutions, and performance time and cost data. Researchers can find additional information on methodology and variables on the World Bank's official website (Connecting to Compete, 2010).

Two huge datasets are gathered and merged in one table for analysis. After merging datasets, some of the countries were excluded because of missing variables. In the analysis, SPSS 10.0 package program is used.

#### 4.2 Clustering Countries up to their Competitiveness

Before testing research questions, we decided to cluster the countries with regard to competitiveness. In order to find the distinguishing variables, we should determine the most competitive and the least competitive groups first. Clustering application could simplify our interpretations in further analysis.

Cluster analysis divides a large group of observations into smaller groups so that the observations within each group are relatively similar and the observations in different groups are

relatively dissimilar (Lattin et al., 2003:264). There are two main types of analytical clustering techniques: hierarchical and non-hierarchical (Sharma, 1996:188).

In clustering world countries, we firstly performed hierarchical clustering analysis with  $k=1$ ,  $k=2$ ,  $k=3$ ,  $k=4$ ,  $k=5$ ,  $k=6$  and  $k=7$  ( $k$  as number of clusters) and found the clusters. Following this, we performed discriminant analysis to find which classification was more appropriate than others. According to the classification success, we ordered the alternatives and then decided on the appropriate group number. We clustered countries in two groups, as this was the most appropriate number, as seen in Table 2.

Tab. 2 – Classification Successes of Groups. Source: own research

Number of Clusters	Classification Success
7	97,0%
6	93,2%
5	87,2%
4	95,5%
3	96,2%
2	98,5%

Tab. 3 – ANOVA Test Results for Clusters. Source: own research

	Cluster		Error		F	Sig.
	Mean Sq.	df	Mean Sq.	df		
Institutions	63,695	1	,354	131	180,108	,000
Infrastructure	124,013	1	,514	131	241,469	,000
Macroeconomic Stability	22,187	1	,683	131	32,470	,000
Health and Primary Education	41,815	1	,526	131	79,461	,000
Business Sophistication	43,025	1	,203	131	212,249	,000
Innovation	48,842	1	,301	131	162,281	,000
Higher Education and Training	64,695	1	,319	131	202,617	,000
Goods Market Efficiency	26,966	1	,140	131	192,808	,000
Labor Market Efficiency	12,267	1	,215	131	57,179	,000
Financial Market Sophistication	29,649	1	,282	131	105,008	,000
Technological Readiness	103,506	1	,403	131	256,935	,000
Market Size	36,822	1	1,114	131	33,061	,000

We performed ANOVA to test whether there is a significant difference between clusters. Results of ANOVA can be seen in Table 3. According to the ANOVA results, it can be said that there is a statistically significant difference between clusters. However, it was also necessary

to determine the high competitive and low competitive groups. For determining competitive capacity of groups we interpreted the final cluster centers.

It can be seen in Table 4 that values of first cluster are greater than second. Thus, we can say that the countries in first cluster are more competitive. Finally, we implemented discriminant analysis to determine which competitiveness variable(s) affect two-group discrimination.

Tab. 4 – Final Cluster Centers. Source: own research

	Cluster	
	1	2
Institutions	4,96	3,55
Infrastructure	5,08	3,11
Macroeconomic Stability	5,10	4,26
Health and Primary Education	5,90	4,76
Business Sophistication	4,82	3,65
Innovation	4,11	2,88
Higher Education and Training	4,89	3,46
Goods Market Efficiency	4,80	3,88
Labor Market Efficiency	4,76	4,14
Financial Market Sophistication	4,80	3,84
Technological Readiness	4,91	3,11
Market Size	4,44	3,36

Discriminant Analysis (DA) is a statistical technique which allows the researcher to study the differences between two or more groups of objects with respect to several variables simultaneously (Klecka, 1980:7). In DA there are some assumptions. Multivariate normality and equality of covariance matrices assumptions are commonly tested.

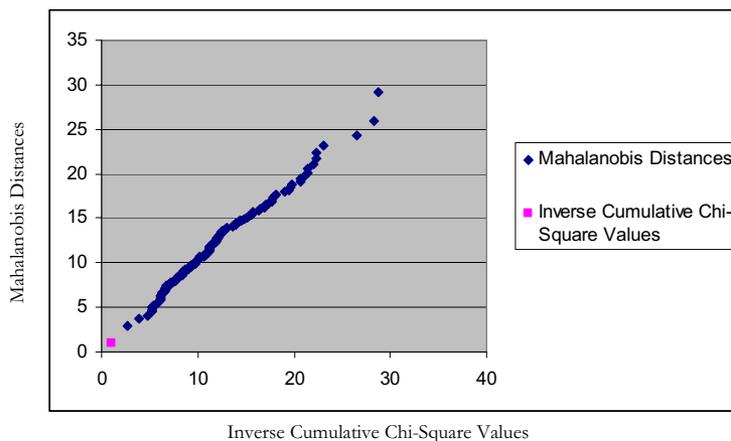


Fig. 4 – Correlations between Mahalanobis Distances and Chi-Square Values for Competitiveness Data. Source: own research

There are many methods used to assess the multivariate normality assumption. One frequently used method is constructing a chi-square plot (Sharma, 1996; Johnson & Wichern, 1998). The plot can be graphed with the Mahalanobis distances and chi-square values. The plot should resemble a straight line through the origin. In other words, the Pearson correlation coefficient of chi-square values and Mahalanobis distances should be as close as possible to one. The plot drawn for the examined data group is presented in Figure 4. The value of the Pearson correlation coefficient is 0.9945. This value is very close to one. Furthermore, through this graph, it can be accepted that the relation is linear. The data set which has been examined shows multivariate normal distribution.

The tests developed to investigate the equality of the variance–covariance matrix are very sensitive to multivariate normality (Johnson & Wichern, 1998). In practice, the frequently used test is Box-M. This test is also very sensitive to deviations from normalcy. According to Box M test, the significance level of test statistics obtained for the two groups is (0.068), and the assumption has been proved.

We developed the model and found the eigenvalue as 2.569, canonical correlation as 0.848 and Wilks' Lambda as 0.280 ( $\chi^2=159.053$ , Sig.=0.000). From these statistics, we interpreted the discriminant model as being statistically significant. Function coefficients and variables' correlation with discriminant function (values of structure matrix) are shown in Table 5.

Tab. 5 – Discriminant Function Coefficients and Values of Structure Matrix. Source: own research

	<b>Function Coefficients</b>	<b>Values of Structure Matrix</b>
Institutions	0.561	0.731
Infrastructure	0.333	0.847
Macroeconomic Stability	0.174	0.311
Health and Primary Education	-0.257	0.486
Business Sophistication	0.735	0.794
Innovation	-0.538	0.694
Higher Education and Training	0.627	0.776
Goods Market Efficiency	-0.073	0.757
Labor Market Efficiency	0.141	0.412
Financial Market Sophistication	-0.130	0.559
Technological Readiness	0.486	0.874
Market Size	0.091	0.313
(Constant)	-8.765	

We coded the high and low competitive groups as 1 and 2 respectively. So as positive discriminant function coefficients increase, countries will move towards the low competitive group. Correspondingly, as negative discriminant function coefficients increase, countries will move towards the high competitive group. It is therefore necessary for countries wishing to join the

high competitive group to develop negative impact variables.

The correct classification rate of Discriminant Analysis is 98.5% (Table 6). Maximum chance criterion has been calculated in order to determine whether the proper classification rate is valid or not. The maximum chance criterion is calculated by means of the group which has maximum number of cases. In the study, the number of cases is 53 for the first group and 80 for the second group. The second group has the maximum number of cases. Thus, maximum chance criteria is 0.60. In order to obtain a valid and effective proper classification rate, the correct classification rate should be higher, according to maximum chance criteria (Hair et al., 1998). In Table 6, correct classification rate is 98.5% and this rate is more than 60%; thus it can be stated that the classification is successful.

Tab. 6 – Classification Results. Source: own research

		Cluster Number of Case=2	Predicted Group Membership		Total
			1	2	
Original	Count	1	51	2	53
		2	0	80	80
	%	1	96.2	3.8	100.0
		2	0	100.0	100.0

### 4.3 Testing Research Questions

As mentioned earlier, the aim of this study is to find the national logistics core competence which most affects competitiveness. Using binary competitiveness grouping, discriminant analysis was performed to find the discriminating logistics variables. Before beginning the analysis, assumptions of discriminant analysis were tested again for logistics data. Multivariate normality test was performed and the correlation coefficient was found to be 0.94299 ( $r=0.94299$ ). Because the value of the Pearson correlation coefficient is very close to one, it was accepted that distribution has multivariate normality. The correlation diagram can be seen in Figure 5.

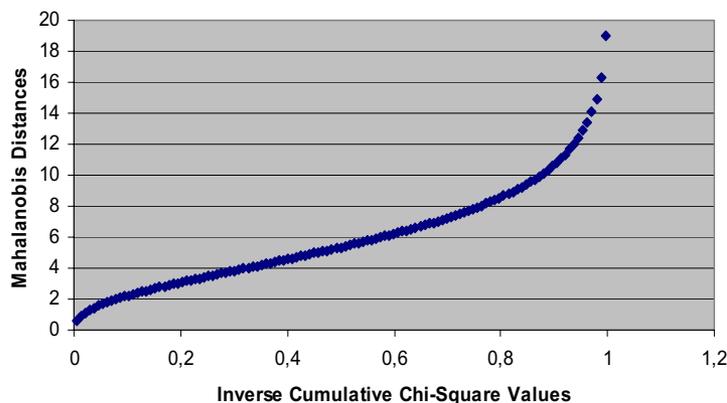


Fig. 5 – Correlation between Mahalanobis Distances and Chi-Square Values for Logistics Data. Source: own research

Also, equality of covariance matrices assumption is tested using Box's M test. According to the Box's M results it can be seen that covariance matrices are not equal ( $p < 0.05$ ), so quadratic terms are used in the analysis. Discriminant function has 2.268 eigenvalue and can explain 100% of total variance. These values can be seen in Table 7.

Tab. 7 – Eigenvalue of Discriminant Function. Source: own research

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.268	100.0	100.0	0.833

Significance of discriminant function is tested by using Wilks' Lambda statistic. The statistics of significance test is demonstrated in Table 8. It can be seen that value of Wilks' Lambda is 0.306. This means that the proportion of 30.6% of variance can not be explained by the difference between the groups and this statistic is statistically significant ( $=137,379$ ;  $p < 0.05$ ).

Tab. 8 – Significance Test of Discriminant Function. Source: own research

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	0.306	137.379	6	0.000

Finally developed discriminant function coefficients can be seen in Table 9. According to these values, the model can be demonstrated as in equation (1).

$$Z = -7.131 + 1.244 * \text{Customs} + 2.352 * \text{Logistics Infrastructure} + 0.154 * \text{International Shipments} - 0.857 * \text{Logistics Competence} - 0.352 * \text{Tracking \& Tracing} + 0.065 * \text{Timeliness}$$

Tab. 9 – Canonical Discriminant Function Coefficients (Unstandardized Coefficients). Source: own research

Customs	1.244
Logistics Infrastructure	2.352
International shipments	0.154
Logistics competence	-0.857
Tracking & tracing	-0.352
Timeliness	0.065
(Constant)	-7.131

We coded the high and low competitive groups as 1 and 2 respectively. So, a country will become closer to the low competitive group as the positive discriminant function coefficients increase. Correspondingly, when negative discriminant function coefficients increase, a country will move closer to the high competitive group. It is therefore necessary for countries aiming to join the high competitive group to develop negative impact variables. Variables' effects on discriminant function can be measured by interpreting structure matrix (Table 10).

Tab. 10 – Structure Matrix. Source: own research

Logistics Infrastructure	0.961
Customs	0.922
Logistics competence	0.815
Tracking & tracing	0.702
Timeliness	0.675
International shipments	0.549

In Table 10, it can be seen that logistics infrastructure and customs has the biggest impact on discriminant function. It means that logistics infrastructure and customs variables are the most discriminating variables between high and low competitive countries, followed by, logistics competence and tracking&tracing variables.

Tab. 11 – Significance Test of Discriminant Function. Source: own research

		Cluster of Competitiveness	Predicted Group Membership		Total
			1	2	
Original	Count	1	44	6	50
		2	3	68	71
	%	1	88,0	12,0	100,0
		2	4,2	95,8	100,0

The correct classification rate of Discriminant Analysis is 92.6% (Table 11). In the study, the number of cases is 50 for the first group and 71 for the second group, which has the maximum number of cases. Thus, maximum chance criteria is  $71 / (71+50) = 0.5867$ . In order to obtain a valid and effective proper classification rate, the correct classification rate should be higher according to maximum change criteria (Hair et al., 1998). In Table 11, the correct classification rate is 92.6% and this rate is more than 58.67%; thus it can be said that the classification is successful.

## 5. CONCLUSIONS AND IMPLICATIONS

In this study, we analyzed the logistics competencies, which are utilized to obtain competitive advantage by countries that are integrated to global economy, in strategic view. By doing so we tried to analyze how countries can develop a national logistics strategy to increase their competitive power and logistics competences. Results indicate that the variable that is most effective in discriminating between high and low competitive countries is logistics infrastructure, which contains all transportation modes and Information and Communication Technologies (ICT). As a result of supply chain management and information age, in addition to transportation modes, ICT plays an important role in logistics infrastructure. So, hardware improvements in logistics infrastructure can gain innovative value only with ICT. Thus, gaining a success in logistics infrastructure mostly depends on ICT.

We have determined that customs is another important discriminating variable. Customs' infrastructure, regulations and services in customs play an important role for a country to attach

to the global economy. In particular, the time spent in customs and delays may yield negative impacts in dealing with other countries.

Another implication of this study is that logistics competence and tracking&tracing variables which have negative coefficients in discriminant function, enable countries to be classified as high competitive group. To improve the logistics competence, the public and private sector must be considered together on a national basis. As the public sector already plays a critical role in preparation of legal regulations and allocation of investments to improve competencies, additionally there must be some private sector firms (freight forwarders, logistics service providers, etc.) which have global competitive power or enhance strategies for global competition in the country. As a result, providing better quality logistics services will help to increase the volume of the trade of a country and will add value to the country's competitiveness.

The other discriminating variable which tracking & tracing has an important role in sustaining is the supply chain reliability. Naturally, all countries and international trading firms desire to monitor their imported and exported products continuously, and to update their plans accordingly. As a result of the absence of the tracking&tracing, in countries with high uncertainty, stock policy of firms will be affected adversely and transportation costs will be increased because of longer lead times. By changing and improving this negative situation, a country should be able to develop a reliable supply chain structure and this reliability could contribute to competitiveness by decreasing many of the costs.

As a result, countries with lower competitiveness must improve their logistics infrastructure as a priority and should take measures in customs to facilitate the international trade in order to increase their competitive power. Only when these two absolute requirements, logistics infrastructure and customs, are satisfied, can a country be classified as high competitive. Later on, to maintain the competitive advantage in logistics, a country has to make further improvements in logistics competence and tracking&tracing. Thus, while the logistics infrastructure and customs are the essential factors for joining the high-competitive group, competence and the tracking&tracing are the core competences for sustaining the competitive advantage. With these results, we have updated our proposed model and obtained Figure 6.

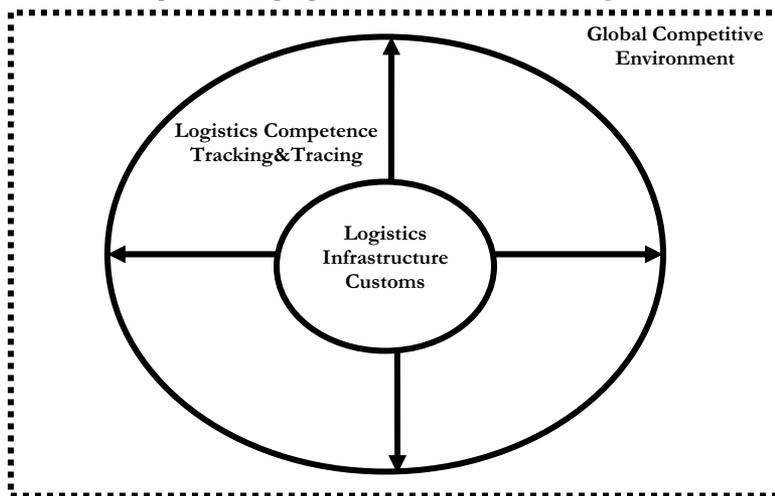


Fig. 6 – Updated Model. Source: own research

According to Figure 6, we determine that the national logistics performance can be developed by improving logistics infrastructure and customs, and this makes a country a high competitive one. After reaching this position, a country must focus on the logistics competence and the tracking&tracing areas to improve its competitive power and gain value in the global competitiveness environment. If this is not the case, the country may lose its competitive position in logistics in the long term.

From the strategic management perspective, we believe that the core logistics abilities to sustain competitive advantage in the global market are the logistics competence and the tracking&tracing since the logistics infrastructure and the customs are the absolute factors. In this manner, under the assumptions of the strategic management literature we incline to the view that without the core logistics abilities, nations cannot achieve any real position in the logistics market. If any nation aspires to being an innovative or low-cost leader, the position must depend on some internal abilities. Without these core abilities, it seems that a sustainable position in the logistics market is simply impossible.

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