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Evaluation of the effect of transport networks on the kemalpaşa logistics center in logistics site selection

Lojistik yer seçiminde ulaşım ağlarının etkisi: Kemalpaşa lojistik merkezi örneği

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Highlights

- *Logistic Site Selection*
- *The effect of transportation networks*
- *Kemalpaşa logistics center*
- *Logistics activities*
- *Comparison of Zaragoza and Kemalpaşa*

Graphical Abstract

In this study, the literature review on transportation modes for logistics centers was taken into consideration and transportation networks for Kemalpaşa logistics center were examined and future provisions were introduced.

	2007	2010	2012	2014	2016	2018
Turkey	2.94	3.08	3.62	3.53	3.49	3.21
Spain	3.51	3.58	3.74	3.77	3.72	3.84

Figure. Spain – Turkey Logistic Infrastructure Values

Aim

This study aims to support the steps taken for the transformation from transportation to logistics in our country where logistics activities are perceived as transportation and intends to improve existing logistics centers and set an example by showing the impact of transportation networks to newly planned centers.

Design & Methodology

In order to determine the load potentials that the center can attract on the basis of transportation networks for the Kemalpaşa logistics center, data that could directly and indirectly affect the logistics center from the leading transportation companies, regional and country-wide public institutions were obtained. In comparison of logistics centers, Logistics Performance (LPI) Index method was used.

Originality

The literature review on transportation modes for logistics centers was taken into consideration and transportation networks for Kemalpaşa logistics center were examined and future provisions were introduced.

Findings

Customs clearance is considered to be important in terms of analyzing both area and bureaucracy under one roof within Kemalpaşa logistics center. When all these evaluations and the estimated load amount of Kemalpaşa logistics center are considered it can be assumed that Kemalpaşa logistics center has a large share in Turkey taking part in the first twenty five country that is evaluated within the framework of the development plan.

Conclusion

Global marketing companies such as Alibaba and Amazon, and companies such as BASF and Dupont, one of the world's chemical giants, are also likely to be at the Kemalpaşa Logistics Center. With the Istanbul-İzmir highway to be fully opened and operational in 2020, it will be ensured that the logistics activities of the national loads that will come via Istanbul will take place at the Kemalpaşa Logistics Center.

Declaration of Ethical Standards

The author(s) of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

Evaluation of the Effect of Transport Networks on the Kemalpaşa Logistics Center in Logistics Site Selection

Araştırma Makalesi / Research Article

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ABSTRACT

In a globalizing world, economic parameters are in line with the competitiveness of countries in every field. The foreign trade activities of the countries are at the top of these parameters. Foreign trade activities are provided through the entry points of foreign countries. These entry points should be supplied with a certain discipline. This is only possible with logistics centers. Therefore, logistics center location selection is very important. Although there are many parameters in the logistics center location selection, transportation networks are the most important parameters to be emphasized. The effect of transportation networks in the logistics center location selection, which is the subject of this study, has been evaluated specifically for the Kemalpaşa logistics center, which is being established within the borders of İzmir province. In this study, the literature review on transportation modes for logistics centers was taken into consideration and transportation networks for Kemalpaşa logistics center were examined and future provisions were introduced.

Keywords: Transportation networks, logistics center, intermodal transportation, multimodal and combined transportation.

Lojistik Yer Seçiminde Ulaşım Ağlarının Etkisi: Kemalpaşa Lojistik Merkezi Örneği

ÖZ

Küreselleşen dünyada, ekonomik parametreleri her alanda ülkelerin rekabet gücüyle paralellik göstermektedir. Bu parametrelerin başında ise ülkelerin dış ticaret aktiviteleri gelmektedir. Dış ticaret aktiviteleri ülkelerin dışa açılan kapıları ile sağlanmaktadır. Bu kapılar belirli bir disiplinle tedarik edilmelidir. Bu da ancak lojistik merkezler ile mümkündür. Dolayısıyla lojistik merkez yer seçimi oldukça önemlidir. Lojistik merkez yer seçiminde birçok parametre bulunmakla birlikte ulaşım ağları üzerinde durulması gereken en önemli parametredir. Bu çalışmanın konusu olan lojistik merkez yer seçiminde ulaşım ağlarının etkisi, İzmir il sınırları içerisinde kurulmakta olan Kemalpaşa lojistik merkezi özelinde değerlendirilmiştir. Bu değerlendirme yapılırken lojistik merkezler için ulaşım modlarını konu alan literatür araştırması dikkatte alınarak Kemalpaşa lojistik merkezi için ulaşım ağları incelenmiş ve geleceğe yönelik provizyonlar ortaya konulmuştur.

Anahtar Kelimeler: Ulaşım ağları, lojistik merkez, intermodal taşımacılık, multimodal ve combine taşıma.

1. INTRODUCTION

One of the most important activities that determine the development levels of countries is foreign trade activities. Both academics and industry experts have demonstrated that it will not be possible for countries to develop and compete with other countries without these activities [1] [2] [3].

While our country, which is making breakthrough moves in different sectors every day, has emerged from the status of developing countries as soon as possible and has been included in the category of developed countries within the framework of development plans, it has demonstrated the importance it places on the logistics sector with its export target strategy of five hundred billion dollars [4].

Logistic activities not only provide economic added value for a country, but also provide social, cultural, strategic and political added values. Thanks to these added values, countries are constantly trying to increase their competitiveness by investing in the logistics sector in the global world, which is constantly evolving and transforming [5] [6] [7].

In this context, the trend towards the logistics industry in the globalizing world has almost become the necessity of the countries. This necessity has become inevitable in Turkey. The process that begun in the 2000s with the logistics village concept in Turkey has continued with implementation studies under the leadership of Turkish State railways since 2006. Twenty-five locations were selected for the establishment of a logistics center and

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eleven of them were implemented while two are still under construction.

For the establishment and implementation of transportation networks, both essential transformation network existing routes and easy integration of transportation types has also been taken into account. Certainly, the load potentials such as load stations where the transportation networks will be fed and organized industrial zones were taken into consideration.

This study aims to support the steps taken for the transformation from transportation to logistics in our country where logistics activities are perceived as transportation and intends to improve existing logistics centers and set an example by showing the impact of transportation networks to newly planned centers. In line with these targets, investigations were carried out on the sample of İzmir Kemalpaşa logistics center, which is under construction, and the forecasts for the twenty-five years ahead revealed three load modes.

2. LOGISTICS CENTER AND TRANSPORTATION NETWORKS

In this part of the study, it has been tried to form the basis of this study by considering the previous academic studies on the national and international level that examine the relationship between logistics center and transportation networks.

The concept of logistics, which deals with all the activities that take place in the process of delivering a manufactured goods and services without any sectoral distinction, from the producer to the final consumer, requires that multidisciplinary fields work together.

For this reason, logistics has become the new keyword of the scientific studies and modern economy of today's world. In fact, considering the developed countries in the globalizing world, they perceived the logistics sector as an independent variable of the management function and best defined the visionary hinterland of this variable. These perceptions and definitions have contributed to the competitiveness of countries in the globalizing world [7] [8].

While logistics investments generally constitute 1.5-2% of the GSMH of the countries, thanks to the correct logistics investments, they grew 7-9% in Europe, 15% in North America and 20% in Asia [9].

When the logistics performance index (LPI) which has been published every year by the world bank to reveal the logistics performance of the countries are analyzed, it is seen that the transportation networks are an important parameter of the performance [10] .

The regulation of the flows of goods and services in the logistics sector, in other words, to be sustainable is directly related to the transportation infrastructure of the logistics areas. This relationship is of great importance for both the revision of existing logistics centers and the logistics centers to be established. It is clear that this importance will play an important role in increasing the internal and external logistics activities of the countries [11] [12].

European logistics village and logistics center association (Europlatforms) stated that it should be accessible with different types of transportation in the selection of areas where logistics activities will be carried out. This requirement coincides with the fact that countries will contribute to the foreign trade volume. This fact can only be achieved with logistics centers with different transportation infrastructure [13].

In logistics centers, infrastructure systems that allow transition between modes of transportation should be established by using optimization techniques instead of uniform traditional transportation. These systems are defined in the transportation literature under the name of intermodal, multimodal and combined transportation. These three modes of transportation are not only in the literature today, but also multimodal transportation systems have been widely used in practice (Commision, 2011) [15] [16] [17].

Among the countries that use multimodal transportation infrastructure effectively, the Netherlands realizes 27% of the road transportation in eastern Europe, and it is an undeniable fact that Europe and 50% of the sea cargoes are shipped thanks to the ports of Rotterdam and Amsterdam. In this way, the Netherlands has managed to attract European and World giants to its country in terms of logistics activities. In particular, the city of Amsterdam stands out as a city with the main distribution centers of multinational companies in Europe. Along with Amsterdam Schiphol Airport, it has an important place in terms of logistics, storage and distribution with both air, land and sea facilities [18].

Considering international load corridors in the choice of logistics center location, determining logistics future visions for countries reveal as a sensitive criterion. It is seen that this criterion is taken into consideration by Poland among European countries. The cities of Warsaw, Lodz, Poznan, Katowice, Gliwice, Szczecin and Gdansk are successful examples of this.

Sea transportation, which is one of the biggest and most important transportation modes of foreign trade, is indispensable for countries whose geography is available. Countries that have a coast to the Baltic Sea use their geographical position at a maximum level in their logistics activities. Among these countries, especially Latvia aims to develop its logistics network with Russia and become the logistics base of the Baltic region. Of course, in line with this goal, it is stated that it is investing in integration with other modes of transportation [19].

The locomotive countries of the Asian region, which has succeeded in integrating the logistics activity it has achieved in the past with the Silk Road and has appear to succeed in the Sea trade and technological developments today, are China and Japan. Especially China performs a large part of its trade over the Chinese sea compared to

other Asian countries. It tries to overcome this situation with its investments in air and railways [20].

For the Asian region, again its closeness to the ports of Thailand and Vietnam, the Singapore-Kunming railway project and being located at a major junction point with the roads connecting Vietnam, involving Laos which is located at the key point of a busy commercial network, all reveal that it is better than Nepal and Mongolia if compared to countries surrounded by land. It is seen that having various transportation networks increases regional logistics activities in general, and national logistics activities in private terms [20].

In the constantly evolving and transforming world brought by technology, artificial waterways are one of the transportation routes of today and it is inevitable to be accepted as a new mode of transportation. The best example of the waterway is Panama, which contributes 20% to its economy through the Panama Canal. Of course, this contribution is an undeniable fact that the Panama channel embodies the multimodal transportation sector [21].

Besides acting as a bridge between Asia and Europe because of its geopolitical position, having shores of the sea from three sides places Turkey in a very advantageous position for logistics industry and multimodal transportation. It has recently been attacked by efforts to turn this position into logistics potential and increase logistics performance. Although eleven logistics centers have already been launched, there are no logistics centers that allow to switch between modes of transport yet. In order to eliminate this problem and take place in the logistics sector, Kemalpaşa logistics center investments, which envisage road, rail and port connections, have been made [22] [23].

To make the right investments related to Turkey logistics sector, efforts have been made within the frame of Medium Term Program (2017-2019) that was published by the Ministry of Development to improve transportation networks and logistics infrastructure, to make the existing and under construction logistics centers more efficient and to increase competition [24].

Within the scope of similar logistics master plans, development plans and strategic plans, it is aimed to carry out transportation safely, quickly and economically [24]. In line with these goals, TCDD has made restructuring efforts in the railway sector to improve load and passenger transportation [25]. Turkey has started studies for the use of renewable energy sources for road transportation that has been sitting in the first row in transportation industry. Similar studies are also involved in maritime transport. These studies for seaway have taken seaway security as the main issue [9]. A project supported by the European Union was carried out to determine the transportation infrastructure needs throughout the country and to ensure integration into international corridors. Integration into the international corridors has brought the issue of intermodel transportation and a project called “Development of Intermodal Transportation in Turkey” was carried out about this issue [26]. In order to strengthen intermodality, a Transport Operation Program (UOP) has been realized. [9]. All these developments make it clear that the country closely follows the developments in the logistics sector.

Theoretical studies have started to be implemented as a logistic village since 2000s. Logistics village site selection commercial activities have been set up nearby [27] [28]. Turkey's logistics centers beginning from 2020 are also given (Figure 1) [29]

Figure 1. Turkey's regional logistics bases

3. CURRENT STATUS OF TRANSPORTATION NETWORKS AND HINTERLAND

Considering the previous studies and application examples for logistics centers, it has been observed that the transition between more than two modes of transportation is an important factor that increases efficiency in the logistics center location selection. As such, the location selection of Kemalpaşa Logistics Center includes maritime, highway, airline and railway infrastructures in terms of transportation modes. Besides the modes of transportation, being close to the organized industrial zones will also provide an important advantage to the center.

The logistics center area is 1.3 km^2 and it is 3 km^2 with the expansion area. The superstructure of the center, whose infrastructure has been completed, will start as of 2020. Logistics center provides transportation opportunities to the important ports of the country such as Alsancak, Aliağa (Nemrut) Region Ports and Çandarlı Port; and also State Highways, Izmir-Cesme, Izmir-Aydin highway (at the planning stage), Istanbul-Izmir Highway (under construction), Balikesir-Izmir railway, Izmir-Aydin-Denizli and Izmir-Candarli Railways (at the planning stage) and Izmir Adnan Menderes Airport (Table 1)

In terms of logistics location selection, Kemalpaşa logistics center is not only suitable for its geographical location and transportation infrastructure, but also its effective position in terms of hinterland (impact area) (Figure 2)

If the hinterland is considered as a 150 km diameter circle at a micro level, İzmir, Manisa and Aydın provinces can be considered as the supply and distribution center within the scope of the center. If the hinterland at the macro level is accepted as a circle with a diameter of 450 km, it is evaluated that all of the Marmara Region and Turkey's significant cities such as İstanbul, Bursa, Eskişehir and Antalya are likely to remain in the impact areas of the center

Table 1. Kemalpaşa Logistics Center Transportation Distances

Area Size (approximately)	1.3 km^2
Area Size + Expansion Area	3 km^2
Kemalpaşa Organized Industrial Zone (KOSBİ)	6.5 km
Izmir City Center (Highway)	29 km
Adnan Menderes Airport	49 km
Kemalpaşa-Torbalı-Alsancak Port (Train Road)	71 km
Kemalpaşa-Aşağı Çobanisa-Menemen (Railway)	72 km

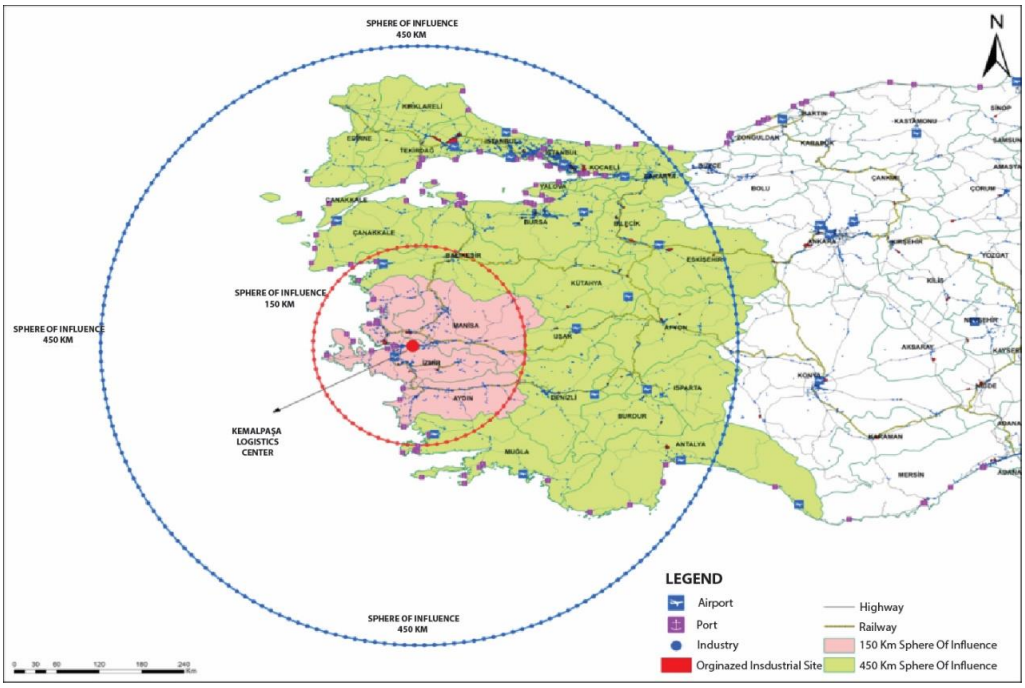

Figure 2 .150 km and 450 km impact areas of Kemalpaşa Logistics Center

4. WORLD SAMPLE SELECTION

Since Kemalpaşa logistics center is under construction, in this part of the study, a successful sample in terms of both location and logistics activities has to be addressed. In this context, Zaragoza logistics center of Spain has been examined on-site.

As a result of reviews;

- Its location is directly linked to other logistics centers and transportation networks,
- It provides functionality and efficiency for logistics stakeholders,
- It has an area of 13.117.977 m^2,
- It has intermodal logistics infrastructure,
- It provides equal facilities and common service to all stakeholders,
- Companies prefer to buy instead of renting space.

It has been determined in the on-site inspections that while the highway is preferred most in transportation, this mode of transportation followed by the railroad with 120 train flights per week. The location of the Zaragoza Logistics Center can be seen in Figure 3 [30]

5. FIELD STUDIES AND GENERATION OF DATA SETS

In order to determine the load potentials that the center can attract on the basis of transportation networks for the Kemalpaşa logistics center, data that could directly and indirectly affect the logistics center from the leading transportation companies, regional and country-wide public institutions were obtained.

In this context, the socio-economic data of the provinces close to the Kemalpaşa logistics center was determined: in the first stage these finding are "Gross Domestic Product (GDP), per capita Gross Domestic Product (GDP / population), the amount of cargo carried by rail, road, seaway and airline" and in the second stage, these findings include the load mobility of the provinces (İzmir, Aydın and Manisa) entering the 150 km hinterland. In the third stage, the target years of the transportation network investments are determined. While the target years are generally evaluated for twenty for highways and thirty for railways, twenty five years of logistics center investments are taken into account. The load potential estimates were made for 2030, 2040 and 2045 based on the modes of transportation, based on 2020 for the logistics center start year

Figure 3. Location of Zaragoza – Kemalpaşa Logistics Center

6. LOAD POTENTIAL ESTIMATION OF TRANSPORTATION NETWORKS

In this part of the study, load potential forecasts for 2030, 2040 and 2045 are given on the basis of 2020 that may draw loads to transportation networks of Kemalpaşa Logistics center.

Load potential estimates have been calculated separately for the modes of transport that provide the load attraction infrastructure to the logistics center. Data that gave information for the calculation has been obtained from Turkey transportation master plan, gross domestic products (GDP)'s of the provinces where logistics center remains in the center of the micro hinterland, load quantities that are transported with Republic of Turkey State Railways (TCDD) and Marmaray capacity analysis. Using the obtained data, the potential load quantities that can be transported to the provinces entering the micro hinterland of the logistics center were determined. An increase of 3% was accepted between 2018-2030 and 2.5% between 2030-2045 for the estimation of load amounts. Within the framework of these assumptions, the load potential of Kemalpaşa logistics center was estimated according to the transportation modes (Figure 5)

Seaway load potential has been estimated by considering the ports (Aliağa, Dikili, Çeşme) in the Kemalpaşa logistics center micro-hinterland. This estimate has been made based on the assumptions used in the load potential estimates of other modes. As the retail trade of oil and derivative products is in question at Aliağa port, it is not included in the potential load estimates.

The construction process in the Çandarlı port, which enters the logistics center hinterland, does not continue. The capacity of Çandarlı port is taken as reference in estimating the amount of load quantity that can be transported by seaway. It is assumed that the port will function at 30% capacity in the first stage, and its capacity will increase to 50% in 2030 and 75% by 2045. (See Figure 5)

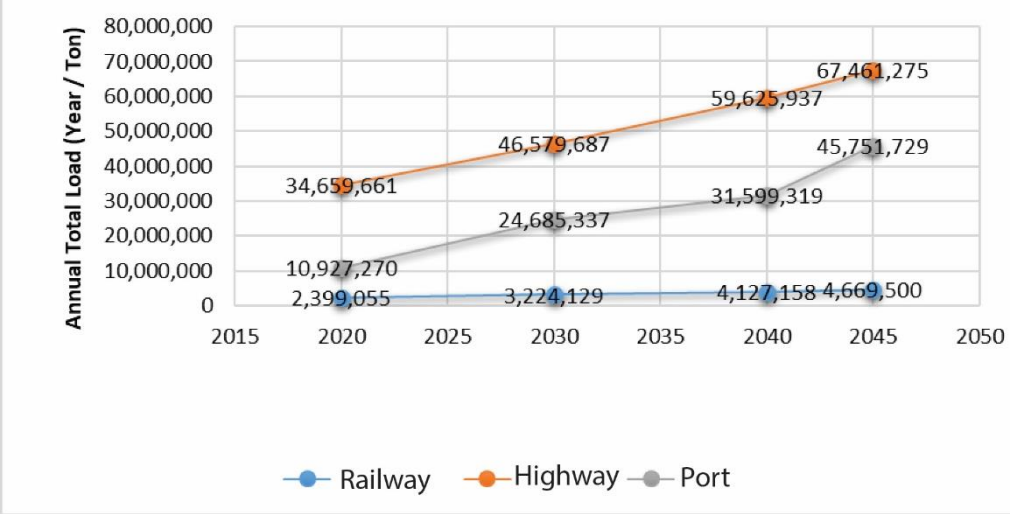

Figure 5. Estimated Load Potential of Kemalpaşa Logistics Center According to Transportation Modes

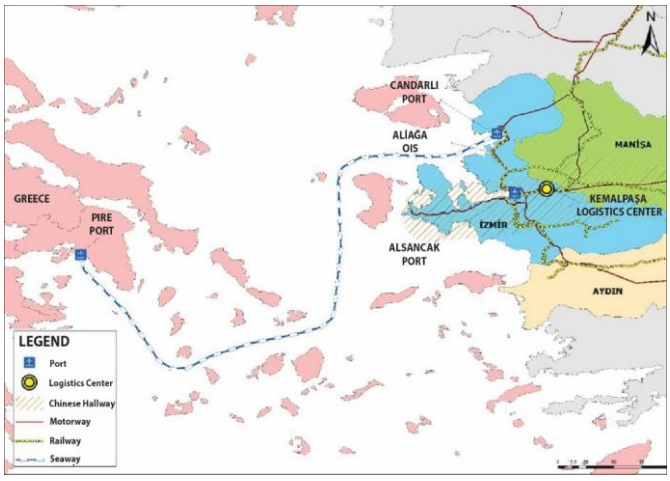

Figure 6. Kemalpaşa Logistics Center Existing Transport Network

While it is estimated that the load amounts that transportation modes can attract to the Kemalpaşa logistics center will be as in Table

2 in 2020 as the starting year, the future target years are estimated as in Table 3

clearly stated that Kemalpaşa logistics center has a suitable transportation infrastructure system for the use of multiple transportation systems.

Table 2. The Amount of Load that Kemalpaşa Logistics Center can Attract in 2020, the Opening Year

	Annual Potential Load Amount It Can Attract (Year / Ton)	**Annual Potential Load (%)**
Highway	693.193	67.2
Sea-Ports	218.545	21.2
Railway	119.953	11.6
Total	1.031.691	100.0

Table 3. Future Load Potential of Kemalpaşa Logistics Center

	2020	**2030**	**2040**	**2045**
Annual Total Load (Year / Ton)	1.032.000	3.000.000	5.100.000	5.550.000

Kemalpaşa logistics center has similarities with the logistics and distribution centers in Amsterdam and Rotterdam with its location and transportation links. Amsterdam has a significant place in European load transport and trade with its commercial port, railway and Schiphol Airport. Due to Kemalpaşa logistics center being in Turkey's 3rd largest city and its closeness to the country's major trading point, it is observed that it has the potential to become an important logistics point in the Mediterranean, Black Sea, Middle East and European trade.

As mentioned in the literatue, when we investigate the countries that stand out in the logistics industry and foreign trade, advantages of using multiple transportation systems in logistics activities are obvious. It has been

6.1. Comparison of Zaragoza and Kemalpaşa

When logistics performance index (LPI) which is published biennially by the World Bank is examined Spain that exhibits similar behavior in terms of logistics infrastructure value in 2012 is thought to be a good example for our country in the context of logistics infrastructure (Figure 7)

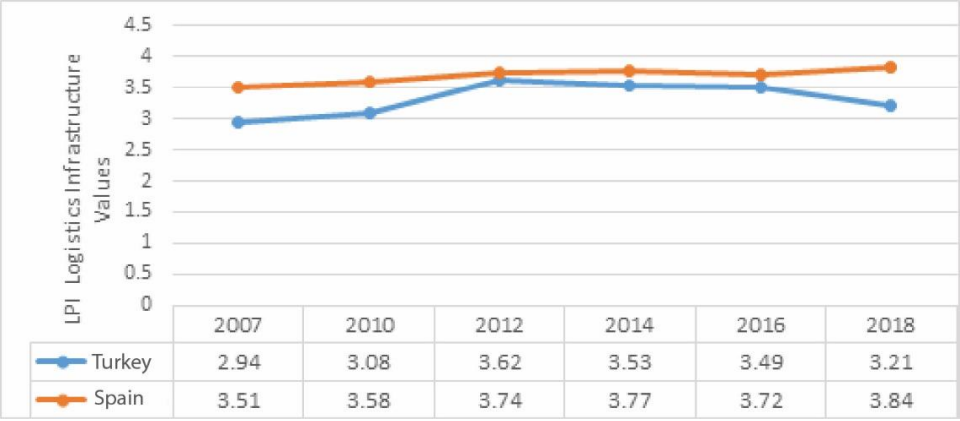

Figure 7. Spain – Turkey Logistic Infrastructure Values

It was seen that it would not be sufficient to make Spain's infrastructure a basis for comparison alone and other criteria of LPI index were also taken into consideration (Table 4)

When LPI index criteria are analyzed, obvious differences are observed especially in customs and time

Table 4. Spain –Turkey LPI Index Value (28)

Country	LPI Ranking	LPI Score	Customs	Infrastructure	International indicators	Logistics Qualifications	Tracing	Time
Turkey	47	3.15	2.71	3.21	3.06	3.05	3.23	3.63
Spain	17	3.83	3.62	3.84	3.83	3.80	3.83	4.06

criteria. These differences can be diminished by applying new regulations in Turkey's customs strategy and decreasing bureaucracy. It is anticipated that the time difference will be closed with a more active implementation of the strategy of transformation from transportation to logistics. In addition, it is considered that the time and customs factor difference will be closed either with port logistics or with a logistics center in a nearby location that can support port logistics. In this context, Kemalpaşa logistics center is a good example in terms of supporting port logistics.

Kemalpaşa logistics center not only supports port logistics, it also breaks a new ground in Turkey with intermodal transportation. This will play an important role in closing the LPI index criteria between the two countries. When the land use within the Zaragoza logistics center is examined, the size of the area reserved for customs clearance within the regions reserved for departments is remarkable. Customs clearance is considered to be important in terms of analyzing both area and bureaucracy under one roof within Kemalpaşa logistics center. These conclusions have been reached as a result of on-site inspections at the Zaragoza logistics center.

When all these evaluations and the estimated load amount of Kemalpaşa logistics center are considered it can be assumed that Kemalpaşa logistics center has a large share in Turkey taking part in the first twenty five countries that is evaluated within the framework of the development plan.

7. RESULTS

The investments made by the countries in the logistics sector not only increase the commercial competition, but also increase the social, cultural and strategic added value. Since 2000s, Turkey has shown a remarkable progress both in theory and practice. It is seen that the logistic performance evaluation of the transportation networks is the most important parameter in the selection of the logistics center location. For the transition from transportation to logistics, infrastructure systems that allow transition between modes of transportation are required by using various optimization techniques. These techniques not only took their place in the literature but also gave successful results in practice. It has been observed that transportation networks should support intermodal transportation not only in logistics center location selection but also in the logistics center internal transportation circulation. This situation positively affects the logistics companies' demand to the center. International load corridors need to be taken into account for their future visionary assignments and strategies.

It is revelaed that within the framework of all these determinations, the transportation infrastructure of Kemalpaşa Logistics Center can compete with a high value added logistics center such as Zaragoza considering Kemalpaşa logistics center being suitable for intermodal transportation, its closeness to Aegean sea Turkish ports and having an area that can provide storage facilities. There is a potential to compete not only with the Zaragoza logistics center, but also in the world logistics sector.

If the Kemalpaşa logistics center becomes operational, opening the railway connection between Aliağa-Alsancak-Kemalpaşa-Çandarlı will largely eliminate the need for the railway transportation network of the logistics center. Operationalizing of the highway, which is under construction between Çandarlı Port and İzmir, will serve the same requirement. This will also significantly ease the urban traffic caused by load mobility. The industrial zone, which is planned to be established in the port hinterland of Çandarlı, will exhibit an important intersection point in the Asian-Western Europe and the Mediterranean-Black Sea line. After the Kemalpaşa Logistics Center becomes operational, it will create the possibility for Chinese companies that purchase the Piraeus Port of Greece, especially in the region, to bring their load by Central Asia, especially through the Caspian Sea, and via the newly planned Iran-Iraq line within the scope of the New Silk Road Project. This will increase the probability of the Chinese government to finance the Iran-Iraq corridor. Global marketing companies such as Alibaba and Amazon, and companies such as BASF and Dupont, one of the world's chemical giants, are also likely to be at the Kemalpaşa Logistics Center. With the Istanbul-İzmir highway to be fully opened and operational in 2020, it will be ensured that the logistics activities of the national loads that will come via Istanbul will take place at the Kemalpaşa Logistics Center.

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DECLARATION OF ETHICAL STANDARDS

The author(s) of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

AUTHORS' CONTRIBUTIONS

Kürşat YILDIZ: Performed the experiments and analyse the results.

Mehmet Akif YERLİKAYA: Wrote the manuscript.

Büşra Nur KESKİN: Performed the experiments and analyse the results.

CONFLICT OF INTEREST

There is no conflict of interest in this study

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