



COMPARISON OF DOMESTIC LOGISTICS PERFORMANCES OF TURKEY AND EUROPEAN UNION COUNTRIES IN 2018 WITH AN INTEGRATED MODEL

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ABSTRACT. Background: The Logistics Performance Index (LPI), created by the World Bank, is a benchmark tool used to determine the threats and opportunities faced by countries in their logistics performances and to improve their performances. Countries aim to increase their LPI scores and rank higher on the LPI list while developing their strategies. **Methods:** In this study, it was aimed to compare the domestic logistics performances of Turkey and the European Union countries with an integrated model using the domestic logistics performance index data for 2018, which was recently published by the World Bank. In this direction, firstly, the importance levels of the criteria were determined with the CRITIC (Criteria Importance Through Intercriteria Correlation) method, and then, using the importance levels of the criteria, the countries were ranked according to the domestic logistics performance score with the COPRAS (Complex Proportional Assessment) method.

Results: As a result of the CRITIC method, the most important criterion in the ranking according to the importance levels of the criteria was “without physical examination”, which is the sub-criterion of the customs clearance period, while the Netherlands was the country with the best performance in the ranking performed by the COPRAS method, using the importance levels of the criteria determined by the CRITIC method.

Conclusions: The study differs from current studies in the literature in that it is the first study to perform a domestic logistic performance comparison using CRITIC and COPRAS methods with an integrated model. The results of the current study can be compared with the results obtained by using different integrated models and different data in the studies to be conducted.

Key words: Logistics Performance Index (LPI), Multi Criteria Decision Making (MCDM), CRITIC, COPRAS.

INTRODUCTION

With the rise of world trade as a result of factors such as globalization, technological developments, widespread use of the internet, increase in virtual market and e-commerce, changing consumption habits and urbanization, companies and countries have entered the race to gain competitive advantage. As a result of increasing competition in the global dimension today, logistics has become one of the most important sectors for countries to come to the forefront in international trade. Logistics, which provides cost savings as well as

facilitating the mobility of goods, creates an important service network for both companies and countries and plays a key role in gaining competitive advantage in international markets [Civelek et al., 2015; Erkan, 2014].

Germany’s logistics sector, which has the largest logistics service sector in Europe, accounts for about 7% of annual Gross Domestic Product (GDP), the United States’ logistics sector accounts for about 8% of annual (GDP) [Dijkman, 2009]. Effective logistics activities in international trade not only increase the reliability of the supply chain of countries, but also contribute to the

development of commercial relations between countries by helping countries to compete globally [Rashidi, Cullinane 2019]. In addition, the logistics sector also plays a vital role in environmental and social aspects. In many countries, about 3-5% of the total workforce is employed in logistics [Rashidi and Cullinane, 2019].

Inefficient logistics services, on the other hand, can damage the foreign trade balance of countries and cause disruption to the activities of all sectors of the economy. This can mean increased operational costs for both firms and countries and disrupted relationships in the supply chain [Marti et al., 2014]. Therefore, the performance of logistics needs to be assessed and improved.

The objective of the LPI developed by the World Bank is to reveal differences in logistics activities between countries. LPI ranks countries in terms of their logistics performances and guides them to improve it. Countries that analyze LPI scores in detail can identify challenges and opportunities in their logistics supply chains and improve their performances [Işik et al., 2020].

The World Bank evaluates logistics performance from two different perspectives, international and domestic. International LPI; ranks countries according to six trade dimensions as “customs performance, infrastructure, ease of arranging shipments, quality of logistics services, tracking and tracing, timeliness”. Domestic LPI provides both qualitative and quantitative assessments of a country by logistics experts of 100 countries. To measure performance, four main determinants of overall logistics performance are used as “infrastructure, services, boundary procedures and time, supply chain reliability”.

In the literature, there are many different studies evaluating the international logistics performances of countries. However, it has been determined that there is no study comparing the domestic logistics performances of the countries. This study contributes to the current literature at two points. First, it is the first study to compare the domestic logistics performances of Turkey and the European Union countries, and second, it is the proposal

of CRITIC and COPRAS methods with an integrated model for logistics performance evaluation. In the literature; there is no study that compares domestic logistics performances with an integrated model using CRITIC and COPRAS methods.

This study consists of five main sections, first section is introduction, review of the literature in the second section, methodology in the third section, research findings in the fourth section, and finally conclusion and recommendations in the fifth section.

REVIEW OF THE LITERATURE

In the literature, there are many and different studies on the LPI.

Sofyalioglu and Kartal [2013] compared performance index of Turkey and Eurasian Economic Community countries.

Uca et al. [2015] examined the relationship between Gross National Product (GNP) and logistics performance index and the impact of logistics performance indicators on the GNP of countries.

Başar [2017] addressed the logistics performance of the Central Asian Turkic Republics.

Yapraklı and Unalan [2017] examined Turkey's position in the international market in terms of logistics with the global status of logistics on a country-by-country basis according to LPI data between 2007-2016.

Imamoglu [2019] identified similarities and differences between countries by comparing the logistics performance of Turkey with the member countries of the Shanghai Cooperation Organization.

Çatuk [2019] used LPI data to identify the factors that negatively affect Turkey's logistics performance and the areas that needed to be improved, and examined the impact of highway on logistics performance.

Erturgut and Gürlür [2019] found Austria in the fourth place and Denmark in the eighth place in terms of LPI sub-components in the last LPI published.

Yangınlar [2019] used annual data between Turkey and G7 countries, and examined logistics performances and GDP ratios.

Emanet [2017] examined the logistics performances of the Central Asian Turkish Republics (Azerbaijan, Kazakhstan, Kyrgyz Republic, Turkmenistan, Uzbekistan) within the scope of LPI.

Bozkurt and Mermertas [2019] addressed the current situation of Turkey and G8 countries in the LPI, and advantages and disadvantages of countries.

Kılınç et al. [2019] evaluated the main logistics activities of Turkey, China and the Russian Federation according to LPI data and

examined the development strategies over the years.

Yıldız et al. [2020] determined Turkey's international LPI position between 2012-2018.

Görgün [2020] revealed the situation of Turkey in the LPI assessment and determined the reasons for the poor performance shown.

Aksungur and Bekmezci [2020] aimed to determine the changes in Turkey's LPI position as of 2007-2018 and improvements that can be made according to the LPI score in 2018.

In Table 1, the studies assessed especially the LPI by using MCDM methods are shown. These studies cover OECD countries, European Union countries, G20 countries, Asian countries, Balkan countries and selected Central and Eastern European countries. It is noticeable that studies covering OECD countries are more common.

Table 1. Literature Review

Author (s)/Year	Aim	Method	Criteria	Finding
Marti et al. (2017)	Calculating the overall logistics performance (DEA-LPI) and to propose a DEA approach to compare the LPI with the logistics performance of countries, to analyze the differences when using different variables such as income and geographic area	DEA	Customs Infrastructure Logistics competence Timeliness Tracking and tracing International shipments	It has been determined that logistics performance is largely influenced by revenue and geographical area, high-income countries are in the group of best-performing countries, and the group of ten best-performing countries is highly managed by the European Union.
Bayır and Yılmaz (2017)	Measuring the logistics performance of 20 European countries with LPI data for 2016	AHP, VIKOR	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	Among the criteria, timeliness was found to be more important than other criteria; Luxembourg, Germany, Sweden, Netherlands and Austria are ranked as the top five countries in logistics performance, respectively.
Çakır (2017)	Measuring the logistics performance of OECD countries according to World Bank 2014 LPI data	CRITIC, SAW, Fuzzy Regresyon	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	The most important criterion was tracking and tracing, while the most insignificant criterion was logistics competence. According to the ranking results of the countries, it was determined that the ranking of Peters' FLR model did not resemble the ranking of MCDM methods.
Rezaei et al. (2018)	Finding the weights of six components used in LPI with a survey with 107 experts from different countries using BWM, which is the MCDM method.	BWM	Customs Infrastructure Logistics competence Timeliness Tracking and tracing International shipments	According to the results, infrastructure has been recognized as the most important criterion for logistics performance.

Author (s)/Year	Aim	Method	Criteria	Finding
Candan (2019)	Assessing the logistics performance of 10 OECD member countries	Fuzzy AHP, Gray Relational Analysis	Export delivery time Import delivery time Quality of infrastructure related to trade and transportation Frequency of shipments reaching the recipient within the planned or expected time Ability to track shipments	While export delivery time was the most important criterion by weight obtained, Australia was the country with the highest Logistics Performance. Australia was followed by Austria, Germany, Belgium, the United Kingdom, Turkey, Italy, Greece, Spain and the Czech Republic respectively.
Orhan (2019)	Comparing the logistics performance of Turkey and European Union countries using World Bank 2018 LPI data	ENTROPI, EDAS	Customs Infrastructure International shipments Logistics competence Timeliness Tracking and tracing	The most important criterion has been determined as the customs criterion. Germany ranked first in the logistics performance ranking of countries.
Kısa and Ayçin (2019)	Assessing the logistics performance of OECD countries between 2012 and 2018	SWARA, EDAS	Customs Infrastructure International shipments Logistics service quality Tracking and tracing Timeliness	While the most important criteria are logistics service quality, infrastructure and international shipment, Germany, the Netherlands and Sweden are the top three countries in the logistics performance ranking.
Oğuz et al. (2019)	Ranking the logistics performance of selected Asian countries (South Korea, Hong Kong, Singapore, Indonesia, Malaysia, Taiwan and Thailand)	TOPSİS	Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	In the logistics performance ranking, the country with the best performance is Singapore, and the country with the worst performance is Indonesia.
Ulutaş and Karaköy (2019a)	Proposing a model for ranking G20 countries according to the logistics performance index	SD, TOPSIS	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	While the most important criterion is the efficiency of the customs clearance process; Germany, Japan, United Kingdom, United States of America and France ranked in the top five in logistics performance ranking.
Karaköy and Ölmez (2019)	Comparing the logistics performance indices of Balkan countries	OCRA, ENTROPI	Customs Infrastructure International shipments Logistics quality and competence Tracking and tracing Timeliness	According to the entropy method, the most important criteria are logistics quality and competence, and according to the OCRA method, the top three countries with the best logistics performance are identified as Slovenia, Greece and Turkey.
Ozmen (2019)	Evaluating the logistics competitiveness of OECD countries	MD, TODIM	Customs Infrastructure International shipments Logistics quality and competence Tracking and tracing Timeliness Freight transport volume Container transport volume Passenger transport volume	While the most important criterion in Group A was logistics quality and competence, the most important criterion in Group B was freight transport volume. Differences occurred in the order of countries obtained with Traditional TODIM and Improved TODIM. In both methods, Germany ranked first and France second in logistics performance ranking.
Ulutaş and Karaköy (2019b)	Integrating SWARA and CRITIC methods in determining the weights of the criteria in the logistics performance index of the European Union countries and making the logistics performance ranking of the countries with the PIV method	SWARA, CRITIC, PIV	Tracking and tracing Logistics competence International shipments Customs Timeliness Infrastructure	While the most important criterion in the criteria weights obtained by combining CRITIC and SWARA methods is infrastructure, the top ten countries in logistics performance ranking are Germany, Sweden, Netherlands, Austria, Belgium, United Kingdom, Denmark, Finland, France and Spain.
Yıldırım and Mercangöz (2020)	Analyzing the logistics performance of OECD countries between 2010 and 2018 and comparing them with current logistics performance index rankings	ARAS-G, Fuzzy AHP	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	Among the criteria, the most important criterion is infrastructure, the most insignificant criterion is tracking and tracing; the top five countries in the logistics performance ranking are Germany, the Netherlands, Sweden, Japan and the United Kingdom.
Mer-cangöz et al. (2020)	Ranking the member states of the European Union and the 5 candidate countries of the European Union by COPRAS-Gray method according to the logistical performance scores	COPRAS-G	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	According to the logistic performance ranking results, Germany ranked first, Holland second and Sweden third.

Author (s)/Year	Aim	Method	Criteria	Finding
Işik et al. (2020)	Analyzing and ranking the logistics performance of 11 selected Central and Eastern European countries	SV, MABAC	Customs Infrastructure International shipments Logistics competence Tracking and tracing Timeliness	Timeliness has been identified as the most important, infrastructure as the least important performance criteria. In the performance ranking of the countries according to the MABAC method, the first three places were Czech Republic, Poland and Hungary.

In some studies in the literature, the importance levels of the criteria are considered equal; in others, the importance levels of the criteria were determined by methods based on subjective evaluations (AHP, SWARA, Fuzzy AHP) or by methods based on objective evaluations (ENTROPI, CRITIC).

Turkey and European Union countries according to domestic logistics performances by using COPRAS method and to compare the logistics performances of countries. The findings of this study will be useful in terms of improving of Turkey's logistics performance.

Sample

2018 domestic LPI data for Turkey and the European Union which was published by the World Bank is used in this study. Estonia, the Greek Cypriot Administration of Southern Cyprus, Hungary, Ireland, Malta, Slovakia and Croatia were excluded due to the lack of data.

METHODOLOGY

Purpose and Importance

In the study, the importance levels of criteria are determined by CRITIC method using domestic LPI data published by World Bank every two years. It is aimed to rank

Table 2. Data On Criteria Used

Criteria	Export time and distance				Import time and distance				% of shipments meeting quality criteria	Number of agencies		Number of forms		Clearance time (days)		Physical inspection	Multiple inspection
	Port or airport supply chain		Land supply chain		Port or airport supply chain		Land supply chain			Imports	Exports	Imports	Exports	Without physical inspection	With physical inspection		
	Distance (km) (K1)	Lead time (days) (K2)	Distance (km) (K3)	Lead time (days) (K4)	Distance (km) (K5)	Lead time (days) (K6)	Distance (km) (K7)	Lead time (days) (K8)	% of shipments meeting quality criteria (K9)	(K10)	(K11)	(K12)	(K13)	(K14)	(K15)	% of import shipments (K16)	% of shipments physically inspected (K17)
	Min	Min	Min	Min	Min	Min	Min	Min	Max	Max	Max	Min	Min	Min	Min	Min	Min
Countries																	
Austria	332	2	496	3	344	3	486	3	86	2	2	2	2	0	1	2	2
Belgium	160	2	245	3	186	3	216	3	82	1	1	2	2	1	1	3	1
Bulgaria	438	2	1136	3	276	2	1256	3	86	2	2	3	3	1	1	7	3
CzechRepublic	300	7	750	3	474	5	300	3	88	1	1	2	2	1	1	1	1
Denmark	43	3	75	2	52	3	75	3	92	1	1	1	1	1	2	1	1
Finland	230	2	785	5	172	3	553	5	93	1	1	2	1	0	1	2	1
France	261	2	673	3	177	3	439	3	79	2	2	2	2	1	1	3	2
Germany	212	2	569	2	350	2	559	3	95	1	1	1	1	1	1	2	2
Greece	219	3	841	3	302	3	783	7	95	2	2	3	3	1	2	2	1
Italy	269	3	541	5	210	4	519	5	90	2	2	3	2	1	2	3	2
Latvia	25	1	2000	46	25	1	3500	53	89	3	2	2	2	0	1	4	11
Lithuania	150	2	1581	4	43	2	1581	4	97	3	3	2	2	0	1	6	2
Luxembourg	96	2	471	3	101	2	393	3	89	2	2	2	2	1	1	3	2
Netherlands	48	2	265	1	99	1	453	2	82	2	1	1	1	0	0	2	1
Poland	75	1	750	4	300	1	750	5	73	2	1	3	3	1	2	3	1
Portugal	141	3	1601	3	157	3	1738	6	82	3	2	3	3	1	2	6	2
Romania	203	2	835	3	482	2	1249	4	86	2	2	4	5	1	2	8	5
Slovenia	300	1	256	2	300	3	474	3	96	3	3	2	2	0	1	4	2
Spain	143	2	298	2	101	3	326	2	75	2	2	2	2	1	2	4	2
Sweden	474	1	1025	1	300	3	1025	5	97	2	2	3	3	1	2	2	1
Turkey	252	3	1267	6	332	3	1087	6	77	3	3	4	4	1	2	12	6

Data Collection Method and Tool

The indicators contained in the domestic LPI of World Bank were used as criteria in this study. Domestic LPI data of Turkey and European Union countries was obtained from the World Bank website (<https://lpi.worldbank.org/domestic>) and it is shown in Table 2. In this study, CRITIC and COPRAS methods were used for finding the weights of criteria and ranking the countries in terms of their LPI. First, the importance levels of the criteria were determined by the CRITIC method, and then the comparison was made by the COPRAS method according to the domestic logistics performance rankings of Turkey and the European Union countries using the determined criteria importance levels.

CRITIC Method

The CRITIC method was introduced into the literature in 1995 with a study by Diakoulaki et al [Diakoulaki et al., 1995]. It is a weighting method in which the standard deviation of the criteria and the correlation values between the criteria are used together. Both the standard deviation of each criterion of the normalized matrix and the correlation relationship between other criteria are used in calculating the significance levels of the criteria [Ayçin, 2019].

The variables in the application stages of the method are defined as follows.

The variables in the application stages of the method are defined as follows.

i. decision alternative ($i = 1, 2, \dots, m$)

j. evaluation criteria ($j = 1, 2, \dots, n$)

z_{ij} : j. according to the evaluation criteria i. the value of the alternative

z_j^{\max} : j. maximum value of decision alternatives according to criteria

z_j^{\min} : j. minimum value of decision alternatives according to criteria

r_{ij} : j. according to the evaluation criteria i. normalized value received by the alternative

σ_j : j . standard deviation value of the criterion ($j = 1, 2, \dots, n$)

y_{jk} : correlation coefficients of criteria j and k relative to each other

w_j : j. weight of evaluation criteria ($j = 1, 2, \dots, n$)

CRITIC method consists of 3 steps (Madić and Radovanović, 2015):

Step 1. The decision matrix with all alternatives and criteria is organized. The decision matrix is shown in equation 1 below.

$$C = [Z_{ij}]_{m \times n} = \begin{bmatrix} z_{11} & z_{12} & \dots & z_{1n} \\ z_{21} & z_{22} & \dots & z_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ z_{m1} & z_{m2} & \dots & z_{mn} \end{bmatrix} \quad (1)$$

Step 2. All values in the decision matrix are normalized with the help of equation 2 (utility-based criteria) and equation 3 (cost-based criteria).

$$r_{ij} = \frac{z_{ij} - z_j^{\min}}{z_j^{\max} - z_j^{\min}} \quad (2)$$

$$r_{ij} = \frac{z_j^{\max} - z_{ij}}{z_j^{\max} - z_j^{\min}} \quad (3)$$

Step 3. The weight (w_j) of each criterion is calculated with the help of equation 4, taking into account the standard deviation of the criterion and the correlations of the criteria with each other.

$$w_j = \frac{s_j}{\sum_{k=1}^n s_k} \quad j=1, 2, \dots, n \quad (4)$$

The (s_j) value in the above equation is calculated with the help of equation 5.

$$s_j = \sigma_j \sum_{k=1}^n (1-y_{jk}) \quad j=1,2, \dots, n \quad (5)$$

COPRAS Method

The COPRAS method was introduced into the literature in 1996 with a study by Zavadskas and Kaklauskas [Zavadskas and Kaklauskas, 1996]. The most important feature that makes the COPRAS different from other MCDM methods is that when comparing decision alternatives to each other, it gives a percentage of how good or bad one alternative is than the other [Ayçin, 2019]. COPRAS method can be used to evaluate quantitative and qualitative criteria, maximizing useful criteria in terms of criteria evaluation and minimizing useless criteria [Özbek, 2017].

The variables in the application stages of the method are defined as follows.

i. decision alternative (i = 1,2,...,m)

j. evaluation criteria (j = 1,2,...,n)

w_j : j. weight of the evaluation criterion (j = 1,2,...,n)

x_{ij} : j. according to the evaluation criteria i. the value of the alternative (j = 1,2,...,n)

d_{ij} : j. according to the evaluation criteria i. normalized value received by the alternative (j = 1,2,...,n)

COPRAS method consists of 6 steps (Kaklauskas et al., 2010) :

Step 1. The decision matrix is organized. This matrix is shown in equation 1.

$$D = [x_{ij}]_{m \times n} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

Step 2. The decision matrix is normalized with the help of equation 2.

$$x_{ij}^* = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}}, \forall j = 1, 2, \dots, n \quad (2)$$

Step 3. The weighted normalized decision matrix (D') is calculated with the help of equation 3 by multiplying the weight value (w_j) of each evaluation criterion with the elements of the normalized decision matrix.

$$D' = \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1n} \\ d_{21} & d_{22} & \dots & d_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ d_{m1} & d_{m2} & \dots & d_{mn} \end{bmatrix} \quad (3)$$

Equation 4 is used for weighting the normalized decision matrix.

$$d_{ij} = x_{ij}^* \cdot w_j \quad (4)$$

Step 4. For the criteria in the decision problem, the sum of the values in the weighted normalized decision matrix is found. The sum of the values in the normalized decision matrix weighted for maximization-oriented criteria is calculated using (S_{+i}) equality 5, and the sum of the values in the normalized decision matrix weighted for minimization-oriented criteria is calculated using (S_{-i}) equality 6.

$$S_{+i} = \sum_{j=1}^k d_{+ij}; j = 1,2, \dots, k \quad (5)$$

$$S_{-i} = \sum_{j=k+1}^n d_{-ij}; j = k + 1, k + 2, \dots, n \quad (6)$$

Step 5. The relative importance value (Q_i) for each decision alternative is calculated with the help of equation 7.

$$Q_i = S_{+i} + \frac{S_{-min} \sum_{i=1}^m S_{-i}}{S_{-i} \cdot \sum_{i=1}^m \frac{S_{-min}}{S_{-i}}} \quad (7)$$

Step 6. Performance index values (P_i), for each decision alternative are calculated with the help of equation 8.

$$P_i = \frac{Q_i}{Q_{max}} \cdot 100 \quad (8)$$

RESEARCH FINDINGS

The significance levels of the criteria used to compare the domestic logistics performances of the countries were determined with the CRITIC method using the domestic LPI data of 2018, and then, the domestic logistics performances of the countries were ranked with the COPRAS method by using the

criterion significance levels determined by the CRITIC method, and the results obtained were presented.

CRITIC Method Results

The CRITIC method was used to objectively determine the importance levels of criteria used in comparing domestic logistics performance levels of countries. The importance levels of the CRITIC method are given in Table 3. As a result of the ranking among the criteria according to importance levels, the most important criterion was determined as "without physical inspection" (K14), which is the sub-criterion of the customs clearance period. It has been found that physical inspection is much more common in underperforming countries.

Table 3. Criteria Significance Levels

	w_j
K1	0,060604
K2	0,046264
K3	0,051099
K4	0,045472
K5	0,059181
K6	0,055446
K7	0,045032
K8	0,045669
K9	0,067671
K10	0,092936
K11	0,088799
K12	0,050275
K13	0,044904
K14	0,093868
K15	0,057992
K16	0,048216
K17	0,046571

COPRAS Method Results

Evaluation scores and rankings of domestic logistics performances of Turkey and European Union countries are shown in Table 4. According to the results, the country with the best performance at the domestic logistics performance level was the Netherlands. Slovenia ranked second, third place in Denmark, while Turkey was ranked 18th in the ranking.

Table 4. Assessment Scores and Rankings of Countries

Countries	P_i	Ranking
Austria	50,91754	7
Belgium	46,14621	9
Bulgaria	36,86953	17
Czech Republic	34,12591	19
Denmark	54,51353	3
Finland	51,05663	6
France	45,51814	10
Germany	44,59158	11
Greece	39,92498	14
Italy	39,96112	13
Latvia	28,85904	21
Lithuania	53,042	4
Luxembourg	52,08858	5
Netherlands	99,99969	1
Poland	41,84792	12
Portugal	38,55304	16
Romania	33,84727	20
Slovenia	58,6326	2
Spain	47,86049	8
Sweden	39,16315	15
Turkey	35,55607	18

CONCLUSIONS AND RECOMMENDATION

In the world where global economies affect each other, one of the most important factors that enable countries to compete in national or international trade is the efficiency and productivity of their logistics performance. Logistics is one of the fastest growing sectors in the world, which has significant positive effects on a country's economic and social development. It is very important to make regulations in the logistics sector in order to improve the trade capability of countries and increase international competitiveness [Çakır, 2016: 185; Yıldız et al., 2020].

LPI, created by the World Bank, is a comparing tool created to identify the threats and opportunities countries face in their logistics performance and improve their performance. Countries aim to increase their LPI scores and rank higher on the LPI list as they develop their strategies [Yildirim and Mercangoz, 2019]. LPI 2018 data of European Union countries and Turkey published by the World Bank was used in order to compare the performance of the domestic logistics of these countries by using CRITIC and COPRAS methods. Although there are many studies related to international LPI in the literature, no other studies using CRITIC and COPRAS

methods have been found based on domestic LPI data. This aspect of the study is thought to make a new contribution to the literature.

Using the CRITIC method, the most important criterion was determined as "without physical examination", which is the sub-criterion of the customs clearance period. Countries with low logistics performance need to reduce bureaucratic procedures, physical inspections and excessive and non-transparent procedures. In addition, in order to improve the performance of these countries, it is necessary to improve customs practices in particular and to reform non-customs institutions.

As a result of the domestic logistics performance ranking obtained by the COPRAS method, the top three countries have been found to be the Netherlands, Slovenia and Denmark, while Turkey was 18th. Domestic logistics performance ranking of 18th among 20 European Union countries located in Turkey, unfortunately, is not at the desired level logistics performance in the domestic rankings. The desired level can be reached by eliminating the coordination deficiencies in state institutions, having sufficient training level of logistics personnel, ensuring efficient and fast operations by reducing customs procedures, widespread use of information technology and eliminating infrastructure deficiencies.

In Turkey, especially many ports and organized industrial zones do not have railway connections, about 95% of the transportation is carried out by road. The use of railways in the transportation of cargo handled in Hamburg Port is 70%, in Anvers Port 19%, and 1% in Alsancak Port. Due to the lack of infrastructure, combined transport, which allows fast and economical transport, cannot be made, and road-weighted transport, which is the most expensive mode of transport, becomes a necessity. At this point, the share of rail freight transport should be increased, the shortcomings of the sea and airline should be eliminated and combined transport, which is the cheapest and most economical transport model in transport, should be made more common. However, adapting to the logistics sector of the industry 4.0 technology and logistical advantages which have naturally

within the scope of the work carried out by the Logistics Master Plan of Turkey, it will be possible to take more market share in international trade and logistics.

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REFERENCES

- Aksungur M., Bekmezci M., 2020. Logistics Performance Evaluation of Turkey: A Dimensional Research. *Toros University Faculty of Economics and Administrative Sciences Journal of Social Sciences*,7(12), 20-40.
- Ayçin E., 2019. Multi Criteria Decision Making: Computer Applied Solutions. Nobel Academic Publishing.
- Başar S.İ., 2017. Evaluation of Logistic Performance of Central Asian Turkish Republic. *TURAN-SAM*, 9(35), 192-198, <http://dx.doi.org/10.15189/1308-8041>.
- Bayır T., Yılmaz Z., 2017. Assesment of Logistic Performance Indexes of EU Countries By AHP And VIKOR Methods. *Middle East Journal of Education (MEJE)* 3(2), 73-92.
- Bozkurt C., Mermertaş F., 2019. Comparison of Turkey and the G8 Countries According to the Logistics Performance Index. *Journal of Business and Economics Studies*, 7(2), 107-117.
- Candan G., 2019. Integrated Approach of Fuzzy AHP and Grey Relational Analysis For Logistic Performance Evaluation. *Anemon Muş Alparslan University Journal of Social Sciences*, 7(5), 277-286, <http://doi.org/10.18506/anemon.506769>.
- Civelek M.E., Uca N., Cemberci M., 2015. The Mediator Effect of Logistics Performance Index on the Relation Between Global Competitiveness Index and Gross Domestic Product. *European Scientific Journal* 11 (3), 368–375.

- Çakır S., 2017. Measuring Logistics Performance of OECD Countries via Fuzzy Linear Regression. *Journal of Multi-Criteria Decision Analysis*, 24(3-4), 177-186, <http://doi.org/10.1002/mcda.1601>.
- Çatuk C., 2019. The Effect of Highway on Logistics Performance in International Trade. *Al Farabi International Journal of Social Sciences*, 3(4), 120-125.
- Diakoulaki D., Mavrotas G., Papayannakis L., 1995. Determining Objective Weights in Multiple Criteria Problems: The CRITIC Method. *Computers and Operations Research*, 22(7), 763-770, [http://doi.org/10.1016/0305-0548\(94\)00059-H](http://doi.org/10.1016/0305-0548(94)00059-H).
- Dijkman J., 2009. Germany Real Estate Yearbook 2009: Assets, Industry Trends and Market Players. Real Estate Publishers BV.
- Emanet H., 2017. Analysis of Logistics Performances of Central Asian Turkish Republics within the Context of Logistics Performance Index. *International Conference on Eurasian Economies, Session 2C*, 302-309.
- Erkan B., 2014. The Importance and Determinants of Logistics Performance of Selected Countries. *Journal of Emerging Issues in Economics, Finance and Banking*, 3(6), 1237-1254.
- Ertugut R., Gürler H.E., 2019. The Relationship Between Civilization and Logistics Performance of the Countries in the Logistics Performance Index: The Example of Denmark-Austria. In *8th Eurasian Conference on Language and Social Sciences*, 252, <http://doi.org/10.35578/eclss.52775>.
- Görgün M.R., 2020. The Situation of Turkish Logistics Sector in Logistics Performance Criteria. *EKEV Academy Journal*, 24(81), 229-246.
- İmamoğlu İ.K., 2019. Comparison by Turkey and Logistics Performance of The Shanghai Cooperation Organization (Sco) Member Countries. *The Journal*, 12(68), 1143-1154, <http://doi.org/10.17719/jisr.2019.3901>.
- Isik O., Aydın Y., Kosaroglu S.M., 2020. The Assessment of The Logistics Performance Index of CEE Countries with the New Combination of SV And MABAC Methods. *LogForum*, 16(4), 549-559, <http://doi.org/10.17270/J.LOG.2020.504>.
- Kaklauskas A., Zavadskas E.K., Naimavicienė J., Krutinis M., Plakys V., Venskus D., 2010. Model for a Complex Analysis of Intelligent Built Environment. *Automation in Construction*, (19), 326-340, <http://doi.org/10.1016/j.autcon.2009.12.006>
- Karaköy Ç., Ölmez U., 2019. Evaluation of the LPI Values of Balkan Countries. *SETSCI Conference Proceedings* 4 (8), 178-180, <https://doi.org/10.36287/setsoci.4.8.031>.
- Kılınc E., Fidan O., Mutlu H.M., 2019. Comparison of Turkey, China and Russian Federation According to the Logistics Performance Index. *International Journal of Economic Studies*, 5(2), 17-34.
- Kısa A.C.G., Ayçin E., 2019. Evaluation of the Logistics Performance of OECD Countries with EDAS Method Based on SWARA. *Çankırı Karatekin University Faculty of Economics and Administrative Sciences Journal*, 9(1), 301-325, <http://doi.org/10.18074/ckuiibfd.500320>.
- Madic M., Radovanović M., 2015. Ranking of Some Most Commonly Used Nontraditional Machining Processes Using ROV and CRITIC Methods. *UPB Sci. Bull., Series D*, 77(2), 193-204.
- Martí L., Puertas R., García L., 2014. The Importance of the Logistics Performance Index in International Trade. *Applied Economics* 46 (24), 2982-2992, <http://doi.org/10.1080/00036846.2014.916394>.
- Martí L., Martín J.C., Puertas R., 2017. A DEA-Logistics Performance Index. *Journal of Applied Economics*, 20(1), 169-192, [http://doi.org/10.1016/S1514-0326\(17\)30008-9](http://doi.org/10.1016/S1514-0326(17)30008-9).
- Mercangoz B. A., Yildirim B., Yildirim S.K., 2020. Time Period Based COPRAS-G Method: Application on The Logistics Performance Index. *LogForum*, 16(2), 239-250, <http://doi.org/10.17270/J.LOG.2020.432>.
- Oğuz S., Alkan G., Yılmaz B., 2019. Evaluation of Logistics Performance of

- Selected Asian Countries' by TOPSIS Method. *IBAD Journal of Social Sciences*, (Special Issue), 497-507, <http://doi.org/10.21733/ibad.613421>.
- Orhan M., 2019. Comparison of the Logistics Performance Between Turkey and European Union Member Countries with ENTROPY Weighted EDAS Method. *European Journal of Science and Technology*, (17), 1222-1238, <http://doi.org/10.31590/ejosat.657693>.
- Ozmen M., 2019. Logistics Competitiveness of OECD Countries Using an Improved TODIM Method. *Sādhanā*, 44(5), 108, <http://doi.org/10.1007/s12046-019-1088-y>.
- Özbek A., 2017. Performance Evaluation of Turkey Diyanet Foundation By SAW, COPRAS and TOPSIS Method. *Journal of Management and Economics Studies*, 15(1), 66-84, <http://doi.org/10.11611/yead.277484>.
- Rashidi K., Cullinane K., 2019. Evaluating the Sustainability of National Logistics Performance Using Data Envelopment Analysis. *Transport Policy*, (74), 35-46, <http://doi.org/10.1016/j.tranpol.2018.11.014>
- Rezaei J., van Roekel W.S., Tavasszy L., 2018. Measuring the Relative Importance of the Logistics Performance Index Indicators Using Best Worst Method. *Transport Policy*, (68), 158-169, <http://doi.org/10.1016/j.tranpol.2018.05.007>
- Sofyalıoğlu Ç., Kartal B., 2013. A Comparison and Some Suggestions for Turkey's and Eurasian Economic Community Countries' Logistic Performance Index Scores. In *International Conference on Eurasian Economies*, Session 7B, 524-531, <http://doi.org/10.36880/C04.00766>.
- Uca N., Civelek M.E., Çemberci M., 2015. The Effect of the Components of Logistics Performance Index on Gross Domestic Product: Conceptual Model Proposal. *Eurasian Business & Economics Journal*, (1), 86-93, <http://doi.org/10.17740/eas.econ.2015-V1-04>.
- Ulutaş A., Karaköy Ç., 2019a. The Measurement of Logistics Performance Index of G-20 Countries with Multi-Criteria Decision Making Model. *Cumhuriyet University Journal of Economic and Administrative Sciences*, 20(2), 71-84.
- Ulutaş A., Karaköy Ç., 2019b. An Analysis of the Logistics Performance Index of EU Countries with an Integrated MCDM Model. *Economics and Business Review*, 5(4), 49-69, <http://doi.org/10.18559/ebr.2019.4.3>.
- Yangınlar G., 2019. The Comparison Logistics Performance and GDP Between G7 Countries and Turkey. V. *European Congress on Economic Issues 2019 Proceedings Book*, 68-80.
- Yapraklı T.Ş., Ünalın M., 2017. The Global Logistics Performance Index and Analysis of The Last Ten Years Logistics Performance of Turkey. *Journal of Economic and Administrative Sciences*, 31(3), 589-606.
- Yildirim B.F., Mercangoz B.A., 2020. Evaluating the Logistics Performance of OECD Countries by Using Fuzzy AHP and ARAS-G. *Eurasian Economic Review*, 10(1), 27-45, <http://doi.org/10.1007/s40822-019-00131-3>.
- Yıldız A., Aydoğan K., Kartum G., 2020. An Investigation of Turkey's Position in International Logistics Performance Index By Cluster Analysis. *Turkish Studies - Social*, 15(3), 1659-1679, <http://doi.org/10.29228/TurkishStudies.41640>.
- Zavadskas E., Kaklauskas, 1996. *A Multiple Criteria Evaluation of Buildings; Technika: Vilnius, Lithuania.*

PORÓWNANIE KRAJOWEJ DZIAŁALNOŚCI LOGISTYCZNEJ W TURCJI ORAZ KRAJACH UNII EUROPEJSKIEJ W 2018 W STOSUNKU DO ZINTEGROWANEGO MODELU

STRESZCZENIE. Wstęp: Wskaźnik Logistics Performance Index (LPI), utworzony przez Bank Światowy, służy do benchmarkingu w określaniu zagrożeń i możliwości dla krajów w ich działalności logistycznej oraz dla działań w celu poprawy tej działalności. Państwa dążą do poprawy wartości swojego wskaźnika LPI poprzez ciągłą poprawę swojej strategii działania.

Metody: Celem pracy jest porównanie wskaźników krajowej działalności logistycznej Turcji oraz krajów Unii Europejskiej ze zintegrowanym modelem w oparciu dane za 2018 rok, opublikowane niedawno przez Bank Światowy. W tym celu wpiery określono ważność poszczególnych kryteriów przy pomocy metody CRITIC (Criteria Importance Through Intercriteria Correlation), a następnie utworzono ranking krajów dotyczących ich działalności logistycznej przy użyciu metody COPRAS (Complex Proportional Assessment).

Wyniki: Używając metodę CRITIC, ustalono, że najważniejszym kryterium w ranking było kryterium „bez badania fizycznego”, które jest podkryterium w okresie odpraw celnych. Holandia umiejscowiła się na pierwszym miejscu rankingu stworzonego przy użyciu metody COPRAS.

Wnioski: Prezentowana praca różni się od prac obecnie publikowanych użyciem metody porównawczej, wykorzystującej metody CRITIC oraz COPRAS w odniesienie do zintegrowanego modelu. Jednak otrzymane wyniki mogą być porównywane z wynikami uzyskanymi przy zastosowaniu innych modeli zintegrowanych oraz na podstawie innego zestawu danych.

Słowa kluczowe: Logistics Performance Index (LPI), wielokryterialne podejmowanie decyzji (MCDM), CRITIC, COPRAS

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