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A comparison of logistics infrastructure development level of European Union countries using TOPSIS and VIKOR methods

Porównanie poziomu rozwoju logistyki w krajach Unii Europejskiej z zastosowaniem metod TOPSIS i VIKOR

Abstract. The purpose of the research was to compare the logistics and logistic infrastructure development level in EU countries. To evaluate overall rank of each country in term of that traits, it was used eight variables which describes logistic characteristics. In this purpose, two of the multi-criteria models of decision making: a Multicriteria Optimization (VIKOR) and Compromise Solution and a Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) were applied and the results obtained by those two methods were compared. The results showed that VIKOR is more preferable method in comparison to TOPSIS methods and the countries where the logistic is developed the most according to the scores in created rankings are Germany, France and Poland.

Key words: logistics, UE countries, TOPSIS, VIKOR, rankings comparison, linear ordering

Synopsis. Celem badnia było porówanie poziomu logistyki oraz infrastruktury logistycznej w poszczególnych krajach Unii Europejskiej. Do zbudowania rankingu i określenia w nim pozycji poszczególnych państw pod względem cech logistycznych użyto ośmiu zmiennych opisujących obecny stan infrastruktury. Do obliczeń zastosowano dwa modele wielokryterialnego podejmowania decyzji, mianowicie Multicriteria Optimization (VIKOR) i Compromise Solution and a Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS), a wyniki uzyskane za pomocą obu metod zostały porównane. Z badań wynika, że w świetle zastosowanego zestawu danych metoda VIKOR jest bardziej skuteczna w podejmowaniu decyzji i wyboru najlepiej rozwiniętego logistycznie kraju, jednak obie metody jednakowo wysoko w rankingu wykazały Niemcy, Francję oraz Polskę.

Słowa kluczowe: logistyka, kraje Unii Europejskiej, TOPSIS, VIKOR, porównanie rankingów, porządkowanie liniowe

Introduction

The development of logistics services and communication technologies has revolutionised production and distribution processes and created a global market. Shippers require efficient logistics services that can move their goods to the right place, at the right time, in the right condition, and at the right price so can drive the rapid development of this field. From theoretical point of view it can be stated that growth in transport at infrastructure corresponds to growth in the economy. There is a number of publications proving that transportation and logistics has substantial direct and indirect effects on economic efficiency and economic growth [Vilko 2011, Sánchez 2017, Skorobogatova and Kuzmina-Merlino 2017, Vulevic 2018]. Therefore the logistics development is very important for the national economy of each country. Currently, at the regional markets, there is a disproportion between the growing demand for transportation and logistics services and the availability of facilities needed for their implementation. It is estimated that European freight transport will increase in 2050 by about 80% in compared to 2005, while passenger traffic will increase by 51% [Krysiuk and Zakrzewski 2013]. Transport infrastructure, due to constantly increasing price competition and the need to guarantee considerable flexibility of supplies, is the main criterion for location decisions of business entities [Kauf and Tłuczak 2017] which resulted in economic development of the region.

Components of the country's logistic potential include transport infrastructure, i.e. the length of the road and rail network and the density of transport points (e.g. airports, sea ports) and is influenced by the geographical location. On the other hand the diversity of transport intensity in European Union countries is also often associated with geographical location and other factors e.g. economic. To evaluate and compare countries in order to many different characteristics connected with logistics and transportation it is possible to use one of the MCDA methods.

Multiple-criteria decision analysis (MCDA) also known as Multiple-criteria decision making (MCDM) is a scientific area and matured branch of operations research that is concerned with designing mathematical and computational tools to support the subjective evaluation of a limited number of decision alternatives under a limited number of performance criteria by a single evaluator (or decision maker) or by group of evaluators [Opricovic and Tzeng 2004]. To support the subjective evaluation the MCDA incorporates knowledge from different fields, including behavioral science theory, mathematics, economics, computer technology and information systems. It can be stated that MCDA/MCDM is an active research area with many theoretical and practical papers and books. The main goal of MCDA/MCDM is to designate to select the most preferable alternative, classify them into small number of categories or rank considered alternative in a subjective preference order. The main steps in multi-criteria decision making are the following [Roszkowska 2011]:

- establish system evaluation criteria that relate system capabilities to goals,
- develop alternative systems for attaining the goals (generating alternatives),
- evaluate alternatives in terms of criteria,
- apply one of the normative multiple criteria analysis methods,
- accept one alternative as "optimal",
- if the final solution is not accepted, gather new information and go to the next iteration of multiple criteria optimization.

In general, the MCDM problems can be split into two distinctive types due to the different problems solving: the first type of problem considers a finite number of alternatives and the second type considers an infinite number of alternatives. Considering classical problem associated with selection of the best alternative, the number of potential alternatives is limited. On the other hand, considering problems related to design, selected variables may take any value in a range resulting in infinite number of potential alternatives. Results presented in this paper consider only the first type – with a finite number of alternatives.

Many authors have proposed several analytical models to support decision making process in conflict management situations. Nowadays, with the help of computer software, proposed methods have become more and more popular and easier to use by the end-users. Considering the most popular set of multi-criteria techniques like SAW, MAXMIN, MAXMAX, AHP, TOPSIS, VIKOR, SMART, ELECTRE and PROMETHEE seem to be the most frequently used methods [Roszkowska 2011], but in many statistical software package it is nowadays available some build in models and methods of MCDM calculation. In this paper were chosen two multi-criteria techniques: TOPSIS and VIKOR.

In the light of the aforementioned reasons, the main purpose of the research was to compare the logistics and logistic infrastructure development level in European Union countries. It is important goal which may give guidelines for governments supporting their decision which countries the special financial programs should be directed to in order to improve their logistic infrastructure development level.

The second purpose was to compare two multi-criteria techniques: TOPSIS and VIKOR. The goal was set based on the review of results presented by Opricovic and Tzeng in 2004 where theoretical aspects of the considered methods were presented. This research also tried to provide answer the advantage of one method over the other on the basis of that kind of empirical data collection.

Data source and methods

The analysis was conducted based on the data collected by European Commission and available in Eurostat database for 2016 [Eurostat database 2019] (it was the last year for which information for each selected country is available) and also obtained from Polish statitics [Statistics Poland 2019]. Diagnostic data collection were determined based on the article of Pinar Hayaloglu [2015] who was evaluating the impact of developments in logistic sector on economic growth for 32 OECD countries. He had analyzed panel data and the variables of inland transport infrastructure investments, railway transportation, road transportation, airline transport were used as proxy of development of logistics sector. In our study we also used diagnostic variables for three branches of transport: sea, land and air transport. All variables are strongly connected to the aim of the study. Some variables have been recalculated relative to the country's area for comparability. Countries differ in area size so for example length of roads or railways cannot be compared in absolute units, only in relative to the country land surface area.

The second important factor for the variable selection was data availability. Because of many cases of the missing values for some countries the variable could not be selected to the analysis. Diagnostic variables adopted for analysis are as follows (Table 1).

Table 1. Characteristics of variables
Tabela 1 Charakterystyka zmiennych

X_1	Index 2010 = 100	Volume of freight transport relative to GDP. Index of inland freight transport volume relative to GDP, 2010 = 100 updated annually. Indicator defined as the ratio between tons-kilometers (inland modes) and GDP (chain-linked volumes, at 2010 exchange rates) indexed on 2010. Inland freight transport includes rail and inland waterways transport based on movements on national territory, road transport based on all movements of vehicles registered in the reporting country.
X_2	km/100 km^2	Railway lines operated.
X_3	million t/km	Railway transport of goods. Data on transport of goods and passengers by railway transport include domestic and international transport on railway lines within the boundaries of individual countries.
X_4	km/100 km^2	Length of roads.
X_5	million t/km	Roads-goods transported. Data on transport of goods by road transport cover transport in domestic and international traffic. Data concern road transport for hire or reward, i.e. the execution of services for remuneration carried out both by entities for which road transport is the basic economic activity.
X_6	thousand t	Goods loaded in seaports. Data on transshipment at sea ports relate to the loading and unloading of goods in international trade on ships and ships of all flags at the ports of the country, including trans-shipment from customs warehouses.
X_7	thousand t	Goods unloaded in seaports. Data on transshipment at sea ports relate to the loading and unloading of goods in international trade on ships and ships of all flags at the ports of the country, including trans-shipment from customs warehouses. The figures do not include: luggage of passengers, mail, supply ships.
X_8	million t/km	Air transport of goods. Data on transport of goods and passengers in air transport relate to the scheduled transport carriers registered in the country.

Source: own calculation on the basis on Eurostat Data and Statistics Poland.

All variables were classified into the stimulant set. The numerical characteristics of diagnostic variables are presented in Table 1. In the analysis the following countries were selected all European Union countries (state for 2016). The special situation is on the Cyprus and Malta. Variables connected to the railway transport (X_2, X_3) in those countries are equal to 0 because railways were not operating since 1931 in Malta, and since 1951 in Cyprus. Also for these countries values of X_5 variable were lack of current data. In case of X_6 and X_7 minimum value equal to 0 concerns countries without access to the sea.

The compared methods were selected based on the following literature: [Hellwig 1968, Hwang and Yoon 1981, Kukuła and Luty 2015a]. In this research it is assumed that each diagnostic variable brings the same amount of information to final rankings [Kukuła and Luty 2015b]. The linear ordering is based on the creation of a ranking of compared objects, i.e. this is based on juxtaposition of the objects from the best one to the worst one in the analyzed research context [Kaczmarczyk 2018]. Variables to be ordered should be comparable. When they are measured on a range or quotient scale, they need to be normalized.

Table 2. Selected characteristics of adopted diagnostic variables
Tabela 2. Wybrane cechy przyjętych zmiennych diagnostycznych

Specification	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Mean	93.8	5.1	15532.3	156.5	66484.9	22.2	28.0	1355.8
Q25	85.2	2.7	2562.2	57.4	12665.7	0.0	0.0	2.4
Q75	105.3	6.8	16173.8	167.0	46881.3	30.8	28.6	1168.3
Median	98.2	4.6	9248.5	129.3	34145.8	5.2	7.8	176.6
Min	45.7	0.0	0.0	12.2	0.0	0.0	0.0	0.003
Max	122.1	11.9	129361.0	903.8	348559.0	115.7	207.6	7901.7
Std	16.0	3.2	24881.9	174.6	91117.6	32.1	50.3	2382.7
Skewness	–1.0	0.6	3.5	3.0	2.0	1.7	2.5	1.8

Source: own elaboration.

Two linear ordering procedures were selected to determine the synthetic variable. The first method is TOPSIS [Hwang and Yoon 1981]. The TOPSIS selects the alternative closest to the ideal solution and farthest from the negative ideal alternative [Roszkowska 2011]. The second method is Compromise Ranking Method, also known as the VIKOR method (VlseKriterijumska Optimizacija I Kompromisno Resenje in Serbian means Multicriteria Optimization and Compromise Solution). VIKOR is an effective methods and this method introduces the multi-criteria ranking index based on the particular measure of 'closeness' to the 'ideal' solution. An important advantage of the classic TOPSIS method is its computational simplicity, the ability to analyze quantitative and qualitative quantities but VIKOR method is also widely accepted among researchers studying and using MCDM tools [Bulgurcu 2016]. Other methods (for example Electre II) are much more algorithmically complex what hinders its implementation and makes the calculation time depend on the data characteristics and can be very long.

TOPSIS

Based on the literature review, TOPSIS is one of the most popular methods used in MCDM. The fundamental idea of TOPSIS is that the best solution is the one which has the shortest distance to the ideal solution and the furthest distance from the anti-ideal solution [Yoon 1980, Hwang and Yoon 1981, Lai et al. 1994). The TOPSIS algorithm is one of the more convenient and well-known methods for resolving multi-criteria problems. These types of issues can be found in many areas of life, in particular in the broadly understood financial and economic planning. In logistics it can be important to determine the best route for a truck or ship, in trade and production – choosing the best supplier of goods or raw materials – in both the TOPSIS method would be helpful. On the stock market it is necessary to build the most effective investment portfolio, in computer science – recognition of the best computer network model – again we can use TOPSIS for resolve those problems.

In the TOPSIS method, the only subjective parameter are the weights associated with the criteria. The procedure of TOPSIS is as follows:

1. Determine the decision matrix $X = [x_{ij}]$ where x_{ij} are the values for $i = 1, ..., n$ alternatives (in this paper: countries) and $j = 1, \dots m$ criteria (in this paper: variables).
2. Calculate the normalized decision matrix $Z = [z_{ij}]$ where z_{ij} are the normalized values for $i = 1, ..., n$ alternatives (in this paper: countries) and $j = 1, \dots m$ criteria (in this paper: variables). Various standardization methods are given in the literature [Chakraborty and Yeh 2009, Ishizaka and Nemery 2013). In this case, it was used Ideal Normalization:

   for stimulant: $z_{ij} = \frac{x_{ij}}{f_j^+}$, where: $f_j^+ = \max_j (x_{ij})$

   for destimulant: $z_{ij} = \frac{x_{ij}}{f_j^-}$, where: $f_j^- = \min_j (x_{ij})$

   In this study, the variables were only stimulants.

   $$w_{ij} = w_j \cdot z_{ij}, \quad \text{for: } \sum_{j=1}^{m} w_j = 1$$

3. Calculate normalized weighted decision matrix $W = [w_{ij}]$, the normalized decision matrix Z multiplied by determined weights $w_j \in [0,1]$, where:

   In this study there were adopted equal weights $w_j = 1/m$
4. Determine the positive ideal and anty-ideal solutions.

   $A_j^+ = [w_j^+, \dots, w_m^+]$ for ideal solution

   $A_j^- = [w_j^-, \dots, w_m^-]$ for anty-ideal solution

   The literature [Ishizaka and Nemery 2013] presents three ways to determine w_j^+ and w_j^-:

   a) Method I:

   for stimulant: $\begin{cases} w_j^+ = \max_j (w_{ij}) \\ w_j^- = \min_j (w_{ij}) \end{cases}$ for destimulant: $\begin{cases} w_j^+ = \min_j (w_{ij}) \\ w_j^- = \max_j (w_{ij}) \end{cases}$

   b) Method II:

   for stimulant: $\begin{cases} w_j^+ = 1 \\ w_j^- = 0 \end{cases}$ for destimulant: $\begin{cases} w_j^+ = 0 \\ w_j^- = 1 \end{cases}$

   This method for determining w_j^+ and w_j^- was used in this paper

   c) Method III: the ideal and anti-ideal point are defined subjectively
5. Calculate the distance measure of each alternative from positive ideal solution d_i^+ and negative ideal solution d_i^-.

   $$d_i^+ = \sqrt{\sum_{j=1}^{m} \left(w_{ij} - w_j^+\right)^2} \quad \text{and} \quad d_i^- = \sqrt{\sum_{j=1}^{m} \left(w_{ij} - w_j^-\right)^2}$$

6. Calculate the relative closeness to the positive ideal solution:

$$C_i = \frac{d_i^-}{d_i^- + d_i^+} \quad \text{where: } C_i \in [0,1]$$

The relative proximity ratio closer to 1 is the preferred solution. Since for a solution closer to an ideal C_i strives to 1, while for a solution closer to an anti-ideal, C_i approaches 0, the C_i indicator can be the basis for creating a ranking of decisions [Opricovic and Tzeng 2004].

VIKOR

In the last time it can be observed increasing number of studies have employed the VIKOR method to solve different multi-criteria decision problems. The VIKOR methods was created/invented to determine a compromise solution for a problem with conflicting criteria. In this methods, the solution combines a maximum group utility and a minimum individual regret of the opponent.

The procedure of VIKOR is as follows [Sayadi et al. 2009, Sanayei et al. 2010, Bazzazi et al. 2011, Crist´obal, 2011, Kim 2013]:

1. Determine the decision matrix $X = [x_{ij}]$ where x_{ij} are the values for $i = 1, ..., n$ alternatives (in this paper: countries) and $j = 1, \ldots m$ criteria (in this paper: variables).
2. Determine the positive ideal $f+$ and negative ideal $f-$ solutions for every criteria:

$$\text{for stimulant: } \begin{cases} f_j^+ = \max_j (x_{ij}) \\ f_j^- = \min_j (x_{ij}) \end{cases} \quad \text{for destimulant: } \begin{cases} f_j^+ = \min_j (x_{ij}) \\ f_j^- = \max_j (x_{ij}) \end{cases}$$

In this study, the variables were only stimulants.

3. Determine the weights $w_j \in [0,1]$ associated to the different criteria, where:

$$\sum_{j=1}^{m} w_j = 1$$

In this study, to ensure comparability of results were adopted equal weights $w_j = 1/m$

4. Compute the values S_i and R_i for each of the alternatives (in this paper – countries):

$$S_i = \sum_{j=1}^{m} w_j \frac{(f_j^+ - f_{ij})}{f_j^+ - f_{ij}} \qquad R_i = \max_j \left(w_j \frac{(f_j^+ - f_{ij})}{f_j^+ - f_{ij}} \right)$$

5. Compute the values Q_i for each of the alternatives (in this paper – countries):

$$Q_i = v \frac{(S^i - S^+)}{S^- - S^+} + (1 - v) \frac{(R_i - R^+)}{R^- - R^+}$$

where $S^+ = \min_i S_i$, $S^- = \max_i S_i$, $R^+ = \min_i R_i$, $R^- = \max_i R_i$..

$v \in [0,1]$ is a weight of strategy of 'the majority criteria' (or 'the maximum group utility'), in this study $v = 0.5$ (which means the preference of consensus). The coefficient v can also be determined differently – which will not be considered in this paper.

6. Rank the order of preference by the value Q. The alternative with the smallest Q value is determined to be the best value.

VIKOR is a useful tool in multi-criteria decision making. The VIKOR method provides compromise solution because it provides a maximum "group utility" (represented by min S_i) of the "majority", and a minimum of the individual regret (represented by min R_i) of the "opponent" [Opricovic and Tzeng 2004].

Research results

Variables were selected based on the available information from Eurostat and the final results are presented in Tables 3 and 4.

Table 3. Results for TOPSIS method
Tabela 3. Wyniki dla metody TOPSIS

Country	C_i	Rank	Country	C_i	Rank	Country	C_i	Rank	Country	C_i	Rank
DE	0.1054	1	GB	0.0566	8	AT	0.0448	15	GR	0.0384	22
FR	0.0789	2	SI	0.0494	9	DK	0.0441	16	PT	0.0378	23
PL	0.0672	3	MT	0.0492	10	FI	0.0426	17	RO	0.0367	24
LU	0.0663	4	HU	0.0492	11	HR	0.0414	18	LV	0.0364	25
BE	0.0625	5	ES	0.0482	12	IT	0.0404	19	CY	0.0274	26
CZ	0.0592	6	SE	0.0476	13	LT	0.0399	20	IE	0.0272	27
NL	0.0567	7	SK	0.0453	14	BG	0.0392	21	EE	0.0216	28

Source: own preparation.

Considering output from TOPSIS analysis, the best worst three countries were Estonia, Ireland and Cyprus (with C_i on the levels: 0.0216, 0.0272, 0.0274 respectively) while the best three countries are: Germany, France and Poland. The values of C_i for the most developed countries are as follows: 0.1054, 0.0789, 0.0672. It can be observed that value of C_i or the Germany is much higher in comparison to the second and third alternatives, but France and Poland alternatives had C_i values with slight difference.

Table 4. Results for VIKOR method
Tabela 4. Wyniki dla metody VIKOR

Country	Q_i	Rank	Country	Q_i	Rank	Country	Q_i	Rank	Country	Q_i	Rank
FR	0.1653	1	FI	0.8273	8	IT	0.9011	15	LV	0.9281	22
DE	0.3377	2	NL	0.8292	9	LT	0.9049	16	HR	0.9301	23
PL	0.6675	3	CZ	0.8514	10	GR	0.9091	17	BG	0.9301	24
SE	0.7520	4	HU	0.8839	11	SK	0.9111	18	MT	0.9384	25
LU	0.8147	5	ES	0.8850	12	DK	0.9161	19	IE	0.9893	26
BE	0.8160	6	SI	0.8864	13	PT	0.9198	20	EE	0.9980	27
GB	0.8171	7	AT	0.8999	14	RO	0.9201	21	CY	1.0000	28

Source: own preparation.

In contrast, the best three countries for VIKOR method are the same countries but in different order: France, Germany and Poland. The values of Q_i for these countries are as follows (the smallest value, the higher position in ranking): 0.1653, 0.3376, 0.6675. The differences between those values are significant for the first 4 countries in the ranking. The worst in order were again Cyprus, Estonia and Ireland (Q_i equal to 1.0000, 0.9980 and 0.9893 respectively). The low rank in case of Estonia is connected to its weak air and road transport of goods and small volume of freight transport relative to GDP. In Ireland case there it is mainly because of amount of goods loaded and unloaded in seaports.

It is quite interesting that all three best countries were selected as the best alternatives alike by VIKOR and TOPSIS method. Additionally, the set of top three and the last three countries selected by VIKOR and TOPSIS are very similar. The differences appears in the other ranks, where in TOPSIS the fourth and fifth country was Luxembourg and Belgium, but in VIKOR method the fourth country was Sweden and fifth Luxembourg, while Sweden in TOPSIS methods is on the 13th place. The high rank in Luxembourg case is quite surprising, because it is very small country without the sea access, but when we consider length of tracks and roads in relations to area and number of passengers, it turns out that Luxembourg is one of the best alternatives. The worst three alternatives – the last countries in the VIKOR ranking, which means the least developed in term of logistic (26, 27 and 28th position), were Ireland, Estonia and Cyprus (the last one is excused while the whole country lies on the island), and in TOPSIS method: Cyprus, Ireland and Estonia. So again the end of the final rankings both by TOPSIS and VIKOR are the same countries but in different order.

Visualization of final rankings resulted from TOPSIS and VIKOR can be found on Figure 1.

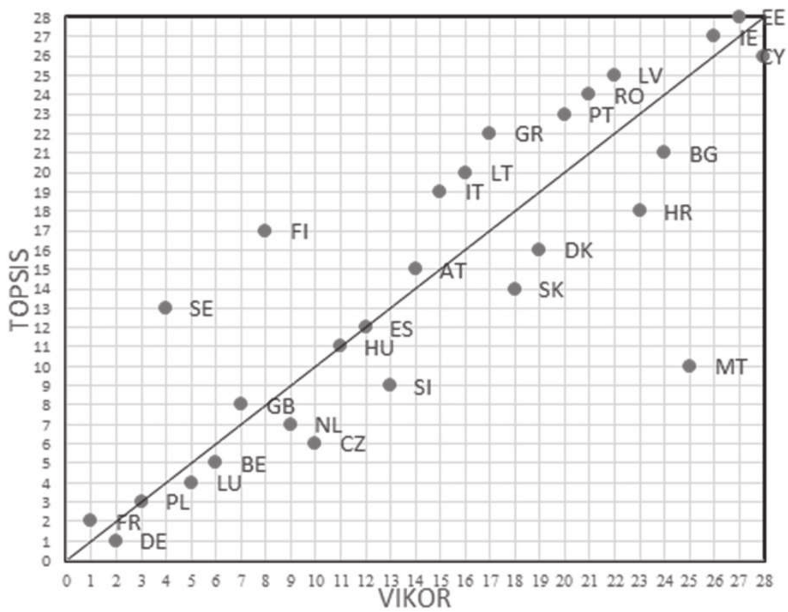

Figure 1. Positions of countries obtained by the TOPSIS and VIKOR method
Rysunek 1. Pozycje krajów uzyskane za pomocą metod TOPSIS i VIKOR

Source: own elaboration.

Correlation coefficient value between both rankings is p_s = 0.8418. Differences of countries ranks are subtle although in case of some countries quite visible. The biggest differences between rankings is shown for Malta (15 ranks of difference), Sweden and Finland (nine ranks of difference) or Greece and Croatia (five ranks of difference). For the rest of the countries difference did not exceed four ranks. In both rankings there were a lot similarities, some countries had exactly the same locations like Poland (third), Hungary (11th) and Spain (12th).

Summary

Based on the previous results it may be stated that VIKOR and TOPSIS are very similar methods constructed based on the "closeness to the ideal" solution. The hidden assumption of TOPSIS is that the selected alternative should have the "shortest distance" from the ideal alternative and at the same time the "farthest distance" from the "anti-ideal" alternative. It should be highlighted that TOPSIS considers two "reference" points without providing any weights for these points. In contrast, in VIKOR method is constructed based on the "shortest distance" from the ideal alternative and input of individual regret.

It should be stated that selected methods use different kinds of normalization methods. The TOPSIS method considers vector normalization, whereas the VIKOR method considers the linear normalization. The vector normalization may impact final normalized values depending on the evaluation units. Whereas, the linear normalization do not impact the final normalized values. To overcame the problem with vector normalization, in scientific literature it could be found the modified TOPSIS methods incorporating the linear normalization as interesting alternative to the previous one.

In the searched literature there is no such comparative studies of logistics development each countries report their own achievements or compare to the neighbor countries, however the most papers analyze the implication of transport infrastructure development of European countries on sustainable economic growth [Cigu et al. 2019] The aim of this paper was to order European Union countries in terms of logistic infrastructure characteristics and to indicate the countries with the lowest development requiring attention and possible funding. Results of the research on the basis of the available data proved high positions of Germany, France, Poland, Luxembourg and Belgium in rankings of best logistics infrastructure developed countries in European Union. They are all transit countries with high development of road and rail networks. Poland is on the third position in both rankings because of its fortunate location between large European countries, commercial ports and bordering Russia and other eastern countries as well. Luxembourg, which achieved high rank in both rankings, is a separate case. The good logistic development characteristics of this country is primarily determined by road density, good rail network and air transport of goods. In this study, all variables were treated equally, which also unfairly disadvantages countries without access to the sea, while two variables are based on the seaport loads.

Sweden or Finland have a low population density, are relatively large in area and therefore the values for some variables, especially those calculated per km^2 of land, may be lower in comparison to the rest European regions. Neither they are countries with the key location for transit in the European Union, in particular by road and rail, so despite good sea communication the final rank was not so high and there were big differences in ranks obtained by those two methods (outliers in correlation).

The least logistic developed countries in European Union were Ireland, Estonia and Cyprus. Non-continental countries like Cyprus and Malta (lying completely on islands), are a special case – both have not operating railways and the transport of goods is also not so large which is resulted by the area of the land and inhabiting population. But surprisingly Ireland and Estonia are on the end of the list and it can be concluded that those countries need to be focused on and some funds to ensure sustainable development in logistics.

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