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Факултет за туризам и бизнис логистика

Goce Delchev University Shtip

Faculty of Tourism and Business Logistics

Четврта Меѓународна Научна Конференција

Fourth International Scientific Conference

ПРЕДИЗВИЦИТЕ ВО ТУРИЗМОТ И БИЗНИС ЛОГИСТИКАТА ВО 21 ВЕК

CHALLENGES OF TOURISM AND BUSINESS LOGISTICS IN THE 21ST CENTURY

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Социо-економски импликации на КОВИД-19: намалување на разликите и справување со дистрибутивните влијанија во различни сектори

Претседавач на сесијата: Татјана Бошков, вон. професор и декан на Факултетот за туризам и бизнис логистика, Универзитет „Гоце Делчев“ – Штип, РС Македонија.

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Втора сесија: Туризам, угостителство и гастрономија
д-р Наташа Митева, доцент и продекан за настава, Факултет за туризам и бизнис логистика, Универзитет „Гоце Делчев“ – Штип, РС Македонија.

Panel session
Socio-economic implications of COVID-19: reducing disparities and addressing distributional impacts in different sectors

Session chair: Tatjana Boshkov, Assoc.professor and Dean at Faculty of tourism and business logistics, ,,Goce Delcev University – Stip, N. Macedonia

Panelists

1. Gligor Bishev, University professor and Management Board Chairman, Sparkasse Bank, N. Macedonia
2. Zarko Radjenovic, PhD, Research Associate, Innovation Center, University of Nis, Serbia
3. Natasha Miteva, PhD, Vice-Dean for Education, Faculty of Tourism and Business Logistics, Goce Delcev University – Stip, N. Macedonia

Moderators

First session: Business logistics and business administration
Tatjana Boshkov, PhD, Dean at Faculty of Tourism and Business Logistics, Goce Delcev University – Stip, N. Macedonia

Second session: Tourism, hospitality and gastronomy
Natasha Miteva, PhD, Vice-Dean for Education, Faculty of Tourism and Business Logistics, Goce Delcev University – Stip, N. Macedonia

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FACULTY OF TOURISM AND BUSINESS LOGISTICS

ЧЕТВРТА МЕЃУНАРОДНА НАУЧНА КОНФЕРЕНЦИЈА

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TRANSPORTATION MANAGEMENT SYSTEMS: LOGISTICS PERFORMANCE INDEX APPROACH

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Abstract

The role of transportation management systems in modern logistics is extremely important from the cost- efficiency point of view at all levels of the supply chain. Considering that, the aim of this research is to examine the correlation, partial contribution and relationship structure among indicators of which Logistics performance index is composed and to group countries according to its value using cluster analysis. The development and implementation of transportation management systems aimed to increase the flexibility and functionality of the entire supply chain and logistics systems, especially in terms of reducing inventory costs and monitoring real-time flows of materials. Also, the mentioned systems reduce the costs of projecting the transport route and the way of delivering goods, as well as reducing the costs of goods manipulation, goods storage and asymmetry of information among the participants in the supply chain.

Kew words: *Transportation management systems, Business logistics, Performance index, Cluster analysis*

Introduction

Transportation management systems are a set of activities in the organization that support the execution of its basic task (production or provision of services) and enable the smooth running of the reproduction process. TMS can be interpreted as the success of the delivery of materials and products and maintaining the stability and continuity of that delivery. In economics, transportation management systems cover all those activities that are aimed at overcoming the spatial and temporal mismatch between production and consumption. Logistics as its integral part is everything that accompanies the basic activity to which it refers and without which the basic activity cannot be performed or is performed with great difficulty. The logistics system is a set of elements of technical, technological, organizational, economic and legal nature with the aim of optimizing the flow of materials, goods, information, energy and people in a particular geographical area in order to achieve the greatest economic effects.

New strategies and trends in logistics are aimed at creating an optimal ratio of logistics services and logistics costs while achieving certain goals such as: increasing the level of quality of logistics services - shorter delivery times, higher frequency, greater reliability, greater degree of approach to the customer, reduction of logistics costs, primarily stocks in logistics chains, concentration of supply chains, optimization of user and provider participation in the creation of a complete service, development and application of technologies in accordance with the requirements of ecology and safety.

The consequence of the existence of these goals is the creation and development of new concepts and strategies in the field of logistics: integration, concentration, coordination and specialization. In order to see the importance of logistics as a business function and its impact on the development of transportation management systems, especially from the point of view of cost efficiency, the paper analyzes the Logistics Performance Index. This indicator was formed by the World Bank with the aim of providing an insight into the real state of the logistics apparatus in individual countries. By applying a cluster analysis over the countries of the European Union and countries in the region, we will be able to

conclude which Balkan countries are the most compatible with EU countries when we take into account supply chain management and how their future logistical convergence can be implemented.

Literature Review

The contribution of logistics as well as the entire distribution and transport system of a country is reflected in the integration of the country into world logistics flows and global trade. Consequently, many researchers in the field of logistics believe that at the moment there is no universal model for evaluating the efficiency of a logistics system capable of taking into account all variables, all nuances, and all possible situations (Beysenbaev, 2018).

Trade liberalization has led to greater efficiency in the placement of goods by applying the postulates of transportation management system, which opens new opportunities for market development at both local and global levels. Therefore, the authors found out that, to increase trade, it is more beneficial to implement policy measures that affect the LPI scores than to apply other measures, such as tariff barriers and known non-tariff measures (Dang & Yeo, 2018).

Because the logistics sector accounts for almost 5% of GDP, it is very important the development of a national logistics system which requires significant investment by credit loans, the private sector, the national budget, and international donors. To use investment capital effectively and avoid wastefulness, it is necessary to prioritize the investment (Duško & Božica, 2016).

It is clear that logistics is an important link in economic transactions when it comes to reducing costs at all levels of the supply chain. A further decline in transport costs, improved quality of transport service, increasing speed and increasingly reliable transport, have led to the competition on the international market on equal terms with manufacturers from almost all countries (Gani, 2017). To a large extent, the competitive advantage based on the proximity of the market has disappeared.

The formation of an efficient logistics infrastructure at all levels of the supply chain contributes to the reduction poor logistics services such as limited co-ordination among countries on border procedures; inefficiency of customs clearance process at the ports; fragmented and poor quality of transportation related infrastructure; costly and infrequent shipping (with long and indirect shipping routes); delays in tracking and tracing consignments; delays in terminal handling and clearance of goods; absence of cool storage facilities at ports; and the inability to certify product quality; amongst others; can cause significant hindrance to international trade (Rezaei et al., 2018).

Methodology

The methodology used in this research relates primarily to the implementation of cluster analysis in statistical software, which aims to group selected European countries by Logistics Performance Index. Actually, Logistics Performance Index (LPI) is calculated by the World Bank based on a basis of a global survey of global freight forwarding companies and logistics carriers and its values for this research are taken from World Bank's report for 2018 year.[1] It measures productivity across the entire supply chain of logistics within a country. The index can help countries identify logistic systems' problems and find opportunities to improve logistics efficiency. LPI descriptive statistics for European union countries and countries from Balkan will be given in Table 1. Logistics performance index (Overall) which will be analyzed in this paper contains several indicators:

- Competence and quality of logistics service
- Easy of arranging competitively priced shipments
- Frequency with which shipments reach consignee within scheduled or expecting time
- Quality of trade and transport

[1] https://data.worldbank.org/indicator/LP.LPI.TRAC.XQ (visited 13.09.2021)

- Efficiency of custom clearance process.

Table 1: Descriptive statistics for LPI of analyzed countries

Descriptive Statistics							
	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
LPI	34	2.56	4.31	115.43	3.3950	.52422	.275
Valid N (listwise)	34						

Source: Author's calculation

The main hypotheses in the paper are:
H1: *The analyzed European countries differ in logistics performance and accordingly belong to different clusters.*
H2: *Countries with the most well-balanced values of logistics performance index gravitate to each other in order to form separate cluster.*

Cluster analysis is the name for a set of multivariate techniques which primary purpose is to group objects based on the common characteristics they possess. Multivariation is a feature of cluster analysis that is used to analyze multiple variables simultaneously and together that are part of a single whole. Unlike other multivariate statistical techniques, cluster analysis does not evaluate variables empirically, but rather these variables are set by the researcher himself. The agglomerative hierarchical approach used in cluster analysis is in fact an accumulative approach that starts the bottom-up analysis and systematically combines objects and groups until each of the objects is in a group or cluster.

Within this agglomerative approach, the variance method used is Ward's method, which is a typical representative of this group of variance methods. In the Ward procedure, the average value for each variable (center of the cluster) is calculated for each cluster, and then the square of Euclidean distance from the center of the cluster is calculated for each object, after which the distance for the objects is summed.

The biggest change in the pattern of agglomeration (Table 2 - black rectangle) occurs in the last four steps where is the progressive growth of coefficients values, which implies the number of clusters. In the aforementioned agglomeration scheme in Table 2, important information for country clustering is that related to the first column of this table, which is the Stage column, which shows the number of successive iterations (steps) taken in the grouping process.

Table 2: Agglomerative approach

Agglomeration Schedule						
Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	5	25	.000	0	0	22
2	11	32	.000	0	0	19
3	15	30	.000	0	0	7
4	2	27	.000	0	0	15
5	18	19	.000	0	0	9
6	23	31	.000	0	0	17
7	15	33	.000	3	0	16
8	24	26	.001	0	0	17
9	18	29	.001	5	0	26
10	9	34	.001	0	0	24
11	20	28	.002	0	0	21

12	7	22	.003	0	0	21
13	6	21	.004	0	0	23
14	10	13	.004	0	0	20
15	2	14	.005	4	0	18
16	15	16	.006	7	0	23
17	23	24	.008	6	8	25
18	2	3	.010	15	0	24
19	11	17	.013	2	0	27
20	10	12	.016	14	0	30
21	7	20	.020	12	11	26
22	4	5	.025	0	1	28
23	6	15	.035	13	16	27
24	2	9	.047	18	10	29
25	1	23	.065	0	17	28
26	7	18	.086	21	9	30
27	6	11	.119	23	19	31
28	1	4	.158	25	22	31
29	2	8	.213	24	0	32
30	7	10	.283	26	20	32
31	1	6	.790	28	27	33
32	2	7	1.378	29	30	33
33	1	2	9.068	31	32	0

Source: Author's calculation

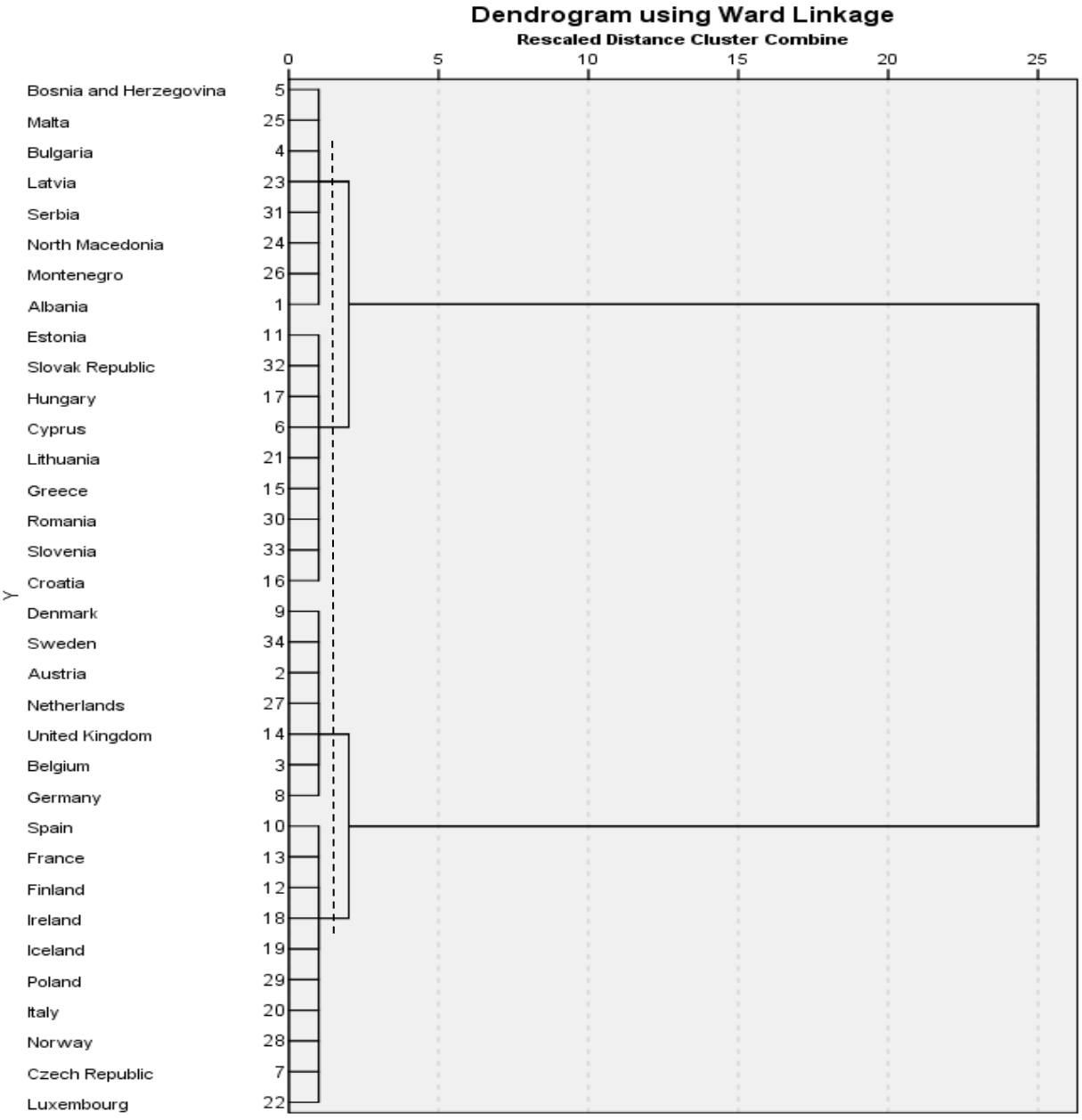
The second and third columns (Table 1) within the Cluster Combined section show the number of countries (objects) that have entered the clustering process into a new, unique cluster. In this case it is Bosnia and Herzegovina (5) and Malta (25). As for the next Coefficients column it shows value of the calculated square of the Euclidean distance between the given countries. The following Stage Cluster First Appears column shows the iteration in which the cluster was first formed. The last column Next stage shows in the first place in which iteration merging one country with another into mentioned cluster occurred. In the specific case, we have code 22, which means that in step 22th, the country under number 5 (Bosnia and Herzegovina) merged with the country under number 25 (Malta) and formed a cluster.

Results and Discussion

The dendogram is a result of a cluster analysis in the form of a tree that shows the objects grouped together. The vertical axis of the dendogram gives the ordinal number of the state. The horizontal axis of the dendogram shows the distance where the states or states are grouped together. For practical reasons the distance was calculated (Soldić- Aleksić & Krasava- Chroneos, 2009). The vertical lines show the countries that are grouped (number of clusters).

Objects that are more similar to each other are grouped at a lower height, while objects that deviate more from each other are at a higher level of the dendogram. The division of objects into a certain number of groups in the dendogram can be done in vertical sections at a certain height, with one possible solution for grouping. The number of horizontal lines at lower altitudes which are intersected by a vertical line (black dashed line - Figure 1) closer to the initial dendogram showing the actual number of clusters. The number of times a vertical line cuts a horizontal line is the number of clusters - in this case four clusters (Figure 1).

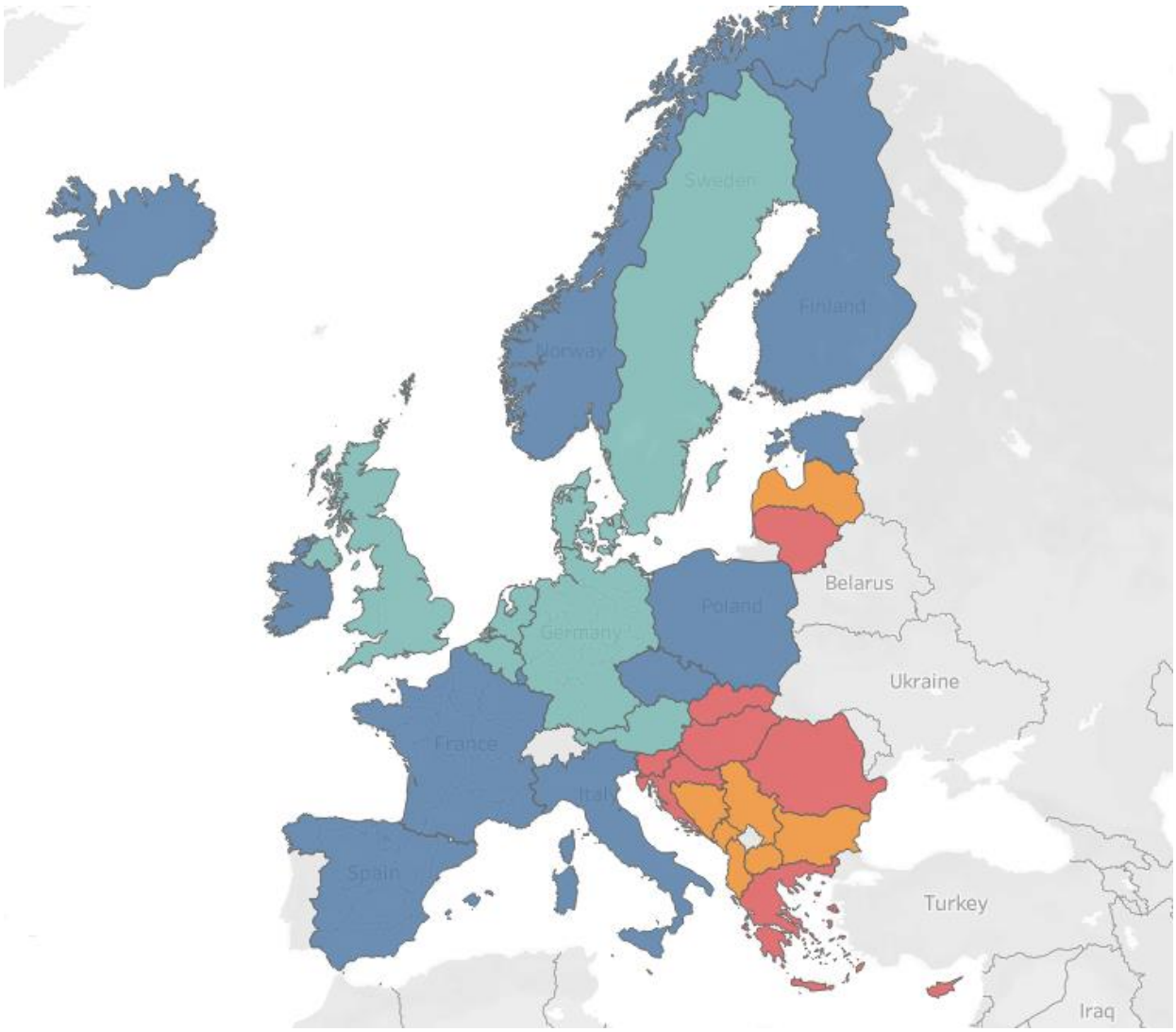
Figure 1: Dendogram



Source: Author's calculation

Following the analysis, clusters were formed with appropriate number of countries. As can be seen in Figure 2, the first cluster (orange colored countries) contains Bosnia and Herzegovina, Malta, Bulgaria, Latvia, Serbia, North Macedonia, Montenegro, Albania, while the second cluster (red colored countries) consists Greece, Croatia, Slovenia, Hungary, Romania, Slovakia, Lithuania, Estonia and Cyprus. In the third cluster (green colored countries) Denmark, Sweden, Austria, Netherlands, Belgium, United Kingdom [2]and Germany and in the fourth cluster (blue colored countries) are Spain, France, Finland, Ireland, Iceland, Poland, Italy, Norway, Czechia and Luxembourg (Figure 2).
Figure 2: Clusters' map

[2] This country was taken into account even UK is not the member of European union nowadays.



Source: Author's calculation

Different statistical techniques can be applied to further cluster analysis interpretation and to confirm its validity and correctness. Here, the ANOVA procedure for checking the statistical significance of differences in the average values of variables between clusters is particularly emphasized, with the application of the variance homogeneity test or the so-called Levene test. If one takes a closer look at the descriptive statistics (Table 3-Mean column), it can be seen that the average value of *Logistics Performance Index*, for example, for the first cluster is 2.73, for the second cluster 4.09, for the third cluster 3.08 and for the fourth cluster 3.71 respectively. Accordingly, it can be concluded that the countries in the fourth cluster, compared to the first cluster, are in the better position in terms of *Logistics Performance Index*.

Table 3: Descriptives of clusters

Descriptives							
LPI							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum

					Lower Bound	Upper Bound		
1	8	**2.7362**	.09531	.03370	2.6566	2.8159	2.56	2.88
2	7	**4.0929**	.10812	.04087	3.9929	4.1929	3.98	4.31
3	9	**3.0822**	.07742	.02581	3.0227	3.1417	2.96	3.21
4	10	**3.7150**	.10628	.03361	3.6390	3.7910	3.58	3.89
Total	34	3.3950	.52422	.08990	3.2121	3.5779	2.56	4.31

Source: Author's calculation

The test of statistical significance of differences between group means for individual variables is carried out by the test of homogeneity of variance, or so-called homoskedasticity. The best test for this is the so-called Levene test, which starts from the null hypothesis that the variance is the same in all samples, if $p > 0.05$. If $p > 0.05$, the null hypothesis is accepted and the alternative is rejected, which means that the variance is equal for at least one pair of samples. Formally, expressed by the formula, it looks like this:

$$H_0 : \sigma_1^2 = \sigma_2^2 = \ldots = \sigma_k^2,\ p > 0.05$$

$$H_1 : \sigma_1^2 \neq \sigma_2^2 \neq \ldots \neq \sigma_k^2,\ p < 0.05$$

From Table 4, it can be concluded, after the test, that there are no statistically significant differences between the variations of the given samples, that they are the same, which is observed in the column Sig. where it can be seen that is for the given sample and the variable $p > 0.05$ (Sig. = 0.785). This further implies that the null hypothesis is accepted, that is, there is homogeneity of variance for a given variable across groups.

Table 4: Levene statistics

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
LPI	Based on Mean	.356	3	30	**.785**
	Based on Median	.361	3	30	.781
	Based on Median and with adjusted df	.361	3	26.157	.781
	Based on trimmed mean	.351	3	30	.789

Source: Author's calculation

The results of the ANOVA procedure (Table 5) show that there are statistically significant differences in the average values for the variables as seen in the Sig. column where $p < 0.05$ for all indicators (Table 5).

Table 5: ANOVA

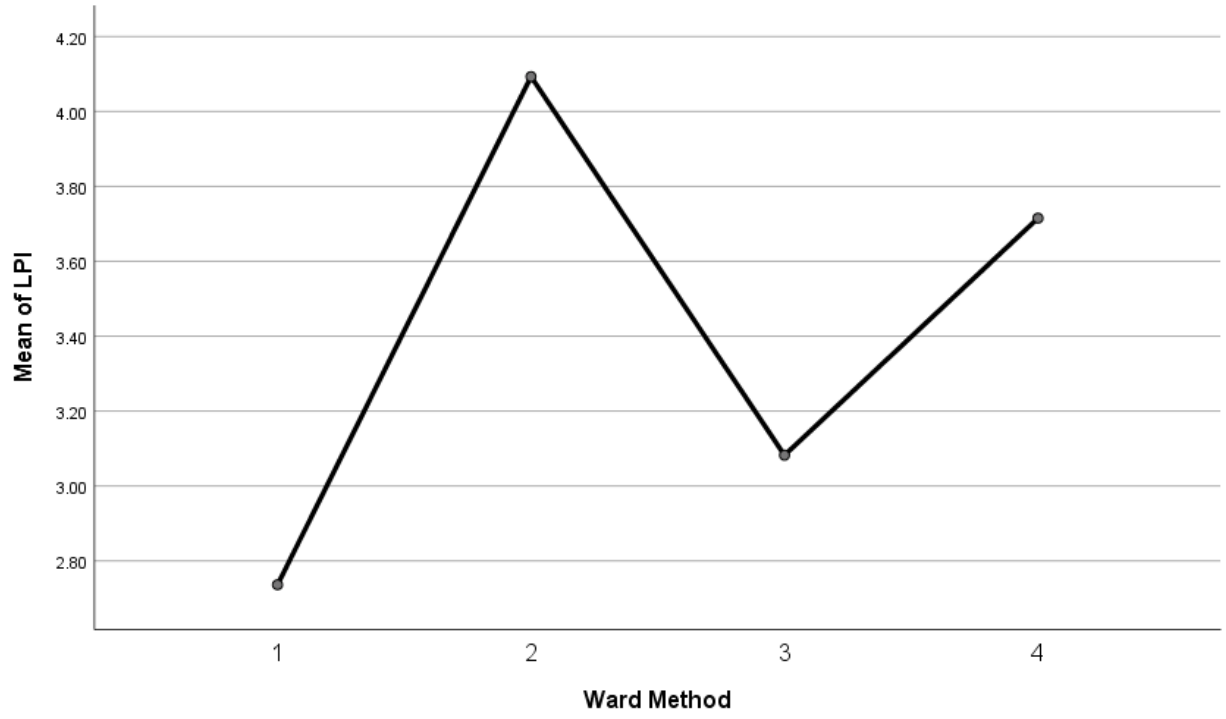
ANOVA					
LPI					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.785	3	2.928	310.060	**.000**
Within Groups	.283	30	.009		

Total	9.068	33			

Source: Author's calculation

Accordingly, Figure 4 shows the ratio of the average values of the variable Logistics Performance Index za sva 4 klastera.

Figure 3: Average values of LPI among clusters



Source: Author's calculation

Conclusion

Based on the structure of clusters obtained after grouping countries based on the value of the overall Logistics Performance Index, it can be concluded that the Balkan countries belong to the first undeveloped cluster. This primarily refers to the development of logistics infrastructure and distribution network. These are mostly countries that are not members of the European Union, such as Northern Macedonia, Serbia, Montenegro and Albania. Also, Bulgaria, Latvia and Malta belong to this cluster, which, regardless of the fact that they belong to the European Union, actually represent those countries that are at the lowest logistical development in relation to other EU members.

Inefficient logistics infrastructure is also embodied in descriptive cluster statistics where the first cluster has the lowest mean value of the Logistisc Performance Index. Although the fourth cluster does not have the highest mean value of LPI, it still groups economically strong EU member states that should give guidelines to the Balkan countries on how to build a successful supply chain and efficiently manage transport systems. The second cluster, which includes "young" EU member states such as Slovenia and Croatia, but also those that have gone through the transition process, has the highest average value of LPI, which means that their logistics infrastructure is rapidly evolving.

The compatibility of logistics flows is an extremely important factor in the trade exchange of the analyzed countries, and accordingly, the improvement of the management of transport systems would contribute to the transition of individual Balkan countries to higher levels of clusters.

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