Bölüm 1

Logistics and Innovation: Country Comparison

İlker İbrahim Avşar[1]

Abstract

The Global Innovation Index (GII) and the Logistics Performance Index (LPI) are indicators related to the innovation and logistics performance of countries. A high level of these two indicators gives countries an advantage in terms of economic development. This study aims to evaluate 108 countries using the Expectation–Maximization (EM) clustering method based on LPI and GII data for 2023. The clustering method shows the similarity and dissimilarity of alternatives within a set of criteria, with LPI and GII data being the criteria and countries as the alternatives. As a result of the clustering, the countries are grouped into 4 groups. This grouping is valuable for countries to see which other countries are similar and dissimilar to them. With this grouping, policy makers have the opportunity to compare their own country with other countries.

1. INTRODUCTION

In today's competitive environment, countries are emphasizing innovation, which is becoming increasingly prevalent across a wide range of economic activities. Innovation is a crucial component of sustainable development and is essential for all countries (Erbuğa & Gürsoy, 2024: 52). In a competitive environment, innovation is inevitable (Ayas, 2021: 3). Many countries are currently conducting studies to enhance their innovation processes, which is having a positive impact on their economies (Taş, 2017: 119).

In the Industry 4.0 era, countries need to seriously implement innovation policies to make a difference in the economy (Kitapçı, 2017: 134). Therefore,

1 Dr. Öğretim Üyesi, Osmaniye Korkut Ata Üniversitesi, iibrahimavsar[at]osmaniye.edu.tr, Orcid: 0000-0003-2991-380X

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companies need to engage in technology-oriented innovation according to the spirit of the times and make their business processes more efficient with visionary breakthroughs (Uzun, 2020: 289). In terms of this requirement, innovation is an issue that concerns almost all companies, not just those in certain sectors (Kavak & Köse, 2022: 15).

Innovation is necessary for economic growth and essential for societies seeking sustainable development. Business productivity can be increased through innovative approaches. Innovation-oriented approaches should be internalized as much as possible in order to seize future opportunities. It is essential to create an ecosystem that covers a wide range of areas, from the generation of new ideas to their commercialization (Keskin, 2018: 192). While customers demand new products every day, they also want companies to reduce costs. Consumers are not indifferent to products that make their lives easier. In an environment where innovative companies respond quickly to customer demands, it is inevitable that companies that do the opposite will struggle to compete (Dursun, 2017: 16; Özdokur, 2019: 297; Kılıç & Ay Türkmen, 2019: 290).

Among the academic studies, there are publications on the logistics sector and innovation. The research conducted by Burmaoğlu (2012) inspired this study. In the aforementioned study, innovation indicators and logistics performance indicators were analyzed within the framework of the European Union. To give examples of other studies on this topic, (1) Erdal & Korucuk (2018) on innovation priorities in the logistics sector, (2) Burmaoğlu et al. (2015) on the determinants of innovation in the logistics sector, (3) Yangınlar & Bal (2018) on the relationship between the formation of learning organizations and innovation in the logistics sector, (4) Can & Erciş (2013) on the impact of supply chain management on innovation, (5) Bekmezci & Aksungur (2018) on the importance of innovation in logistics, and (6) Dindarik & Fidan (2023) on the relationship between logistics employees and innovation.

Logistics also plays an important role in the process of launching a product on the global market and in after-sales processes. In order for logistics to deliver the expected competitive advantage, innovation should be emphasized. Therefore, innovation should be used to improve logistics performance indicators (Helvacıoğlu & Demirkol, 2023: 132). As briefly explained, innovation is important for the logistics sector. Therefore, this study analyses the logistics and innovation performance of countries. Cluster analysis was used to show the similarities and dissimilarities of countries' logistics performance. Secondly, 12 leading countries in terms of logistics

performance and innovation indicators were compared. As a result of the comparison, the top 12 countries in both criteria were identified.

The research consists of five chapters. The chapters are; first chapter introduction, second chapter conceptual framework, third chapter model, fourth chapter analysis and fifth chapter conclusion. In this research, countries are grouped as innovation oriented and logistics oriented. This grouping is valuable in terms of showing the position of countries in relation to other countries in these two areas.

2. CONCEPTUAL FRAMEWORK

2.1. Innovation

2.1.1. What is innovation?

In its simplest sense, innovation can be described as an innovation that provides added value (Esmer & Alan, 2019: 475). In other words, it is the practice of achieving the best results in business with innovative ideas (Zengin & Bekmezci, 2021: 25). Economies can be competitive with the power they receive from innovation technologies and information infrastructure (Hacıoğlu, 2019: 118). Innovation is one of the key factors in a country's development movement (Işık et al., 2015: 85; Arı, 2020: 379). This factor requires companies to be open to development and adapt to the innovations taking place around the world (Akyürek, 2020: 21). This is because customers' demands are changing in today's world. Customers demand more effective processes to be carried out through the use of information tools. In this environment, the basic rule to satisfy customers is to do business with innovative approaches (İlter et al., 2016: 50). The word innovation is increasingly entering our lives and this concept, which was previously considered specific to large companies, has now become important for all organisations (Yiğit, 2014: 7).

2.1.2. Innovation's importance

Innovation is the application of innovative ideas to achieve success in criteria such as efficiency and sustainability in business processes. Businesses need innovation to be competitive in critical areas, examples of which are given. Innovation is not only about increasing profits for companies, but also about the general characteristics of the products offered to society (Korucuk et al., 2020: 165).

The basic paradigm of competition for countries is innovation (Esen & Çetin, 2012: 10). Therefore, countries are making efforts to increase

their innovation power (Baykul, 2022: 53). In these efforts, the innovation investments of each country are at different levels. The budgets that countries allocate to innovation determine their position in science and technology in the world. Innovation is an opportunity for underdeveloped and developing countries. These countries have the opportunity to increase their welfare levels through innovation (Hancıoğlu, 2016: 152).

2.1.3. Innovation Indicators

Productivity and competitiveness are among the most important factors in national development. Competitiveness is only possible through progress in science and innovation. Innovation is a key concept here, and this concept needs to be measured (Murat, 2020: 223).

Innovation consists of many components, as innovation indicators cannot produce efficient results with a single component. Innovation indicators that assess many components can produce more accurate results and provide a more detailed picture of innovation. Multivariate innovation indicators use more than one variable such as patents, R&D and number of researchers. In this way, a more comprehensive representation is obtained compared to univariate indicators (Süt & Çetin, 2019: 307).

2.1.4. Innovation and Education

There are many components that influence innovation and one of them is education. With innovation-oriented education, it is possible to carry out R&D activities efficiently. If countries want to be successful in innovation processes, they need to design their education models accordingly and implement a business-oriented education model. Moreover, this model should provide a sufficient contribution to the intellectual capital of the country (Taş, 2017: 120). In other words, the new generation needs to learn innovative approaches (Tekin, 2023: 44).

2.1.5. Innovation Recommendations for the Turk Public Sector

Globalisation is forcing governments and public institutions to innovate. Institutions need to use new generation tools to meet the demands. Innovation is very important for the new generation of public understanding, but innovation processes are generally slow in the public sector. Public organizations have complex and large structures. They also have many units that are intertwined with society. Innovation in the public sector is necessary, but the innovation process in the public sector should proceed with good planning (Demir, 2016: 167).

Innovation practices in the public sector in Türkiye are insufficient, but it is expected that this problem will be solved in time. In order to solve the problem, new generations that are skilled in information technologies should have a say in the public sector. In addition, the public organization needs to be structured in a more flexible way in order to be open to innovation. At this point, it is important to employ people in the public sector who are open to innovation and equipped with technology. This is the only way to catch up with advanced countries in terms of innovation. It may be beneficial to study the innovative practices used in countries with high innovation competence and bring these practices to Türkiye. In order for Türkiye to compete with economically developed countries, it is absolutely necessary to strengthen its information technology infrastructure (Gökçe, 2015: 35-36).

2.1.6. Innovation and Technopark

Technopark's in Türkiye have been established to develop technology-oriented products in the country. Technopark structuring aims to reduce foreign dependence on technology-oriented products (Hocaoğlu & Altuğ, 2018: 84). Success stories such as 'Silicon Valley' are pushing countries towards Technopark structuring. For Technopark's to be successful, simple incentive practices need to be further developed. The dynamics between universities and the business world in Technopark's should be suitable for the innovation climate (Döner, 2016: 425).

2.1.7. Industry 4.0 and Innovation

Industry 4.0 is the fourth industrial revolution. This revolution is becoming more important every day. Industry 4.0 brings new processes to companies. Due to intense global competition, companies are following these new technology-driven processes. Otherwise, they may lose their competitiveness. However, technology is changing rapidly, and it can be difficult to keep up. No matter how difficult it is, the internalization of a technological innovation by companies before their competitors will give them a significant competitive advantage (Çetinkaya, 2021: 591). For the continuity of this advantage, it should not be forgotten that every innovative technology reshapes the game and keeping up with innovation requires continuity (Koç & Yavuz, 2011: 74). It is difficult to select and use technologies for innovation while ensuring continuity. It is necessary to use the right technology under the right conditions in order to really benefit (Şengün, 2017: 42).

2.1.8. Transformative Power of Digital Technology

Digital technologies are changing even the deep-rooted paradigms of the business world. In a global world, economic borders are disappearing, and businesses must keep pace with technological change in order to survive. Businesses need to keep up with the changing times and technology is in an important position at this time. With the impact of technology, customers are demanding more and more "good" products every day. In this atmosphere, "learning" companies will survive, but companies that cannot "keep up with the times" will struggle. Companies need to adapt quickly to the new digital era (Karaçuha & Pado, 2018: 129).

2.1.9. Innovation and Roadmap for Development

Countries are accelerating their innovation efforts as the importance of innovation for development grows by the day. Countries that understand the importance of innovation are adopting innovative approaches to education, encouraging collaboration between universities and the manufacturing sector, and supporting knowledge-intensive sectors. They also support R&D activities and emphasize branding. All these processes are linked to keeping pace with developments in information technologies and should therefore encourage innovative approaches to economic activity. Another key to the success of innovation is education. Education should be open to innovative approaches and age appropriate. In this way, innovation awareness that starts in educational institutions should spread to all segments of society (Yılmaz & İncekaş, 2018: 168). All these investments will pay off with the production of high-tech products, as these products have a high value-added ratio. Only in this way will it be possible to build an economy that can survive in global competition (Çitçi et al., 2020: 47).

2.1.10. Innovation and Employment

Companies' profits rise because innovation reduces costs and increases demand for their products. It also increases the number of new products introduced, making it easier to fail. While innovation can have a positive effect on organizations that are able to innovate, it can have a devastating effect on organizations that are not. Countries that do not want to have employment problems must carry out studies to encourage innovation, otherwise they are likely to have problems with other countries. Developing countries should undertake innovation-oriented studies, such as supporting R&D activities, in order to compete with developed countries. An educated workforce is important in this process, and innovation-oriented education is necessary to avoid employment problems. Innovation opportunities in

green energy, mathematics, engineering and services should be explored and initiatives should be taken to improve the quality of the workforce for the sectors deemed appropriate. These initiatives should result in individuals equipped with innovation skills with employment potential (Utlu Koçdemir & Özyıldız, 2022: 1066).

2.2. Logistics

2.2.1. Logistics and Innovation

It can be seen that the logistics sector is also affected by the increasingly competitive environment as a result of globalization. There has been an impressive change in the field of technology over the last decades and it can be seen that the logistics sector is experiencing innovation-oriented processes as a result of this change. Because logistics companies should adopt innovative approaches to meet changing customer demands in a competitive environment (Yangınlar & Bal, 2018: 10-11).

By its very nature, supply chain innovation requires all stakeholders to work in a coordinated way. Similarly, logistics innovation requires an interactive process. Logistics innovation requires advanced technology and innovative products. In logistics, only innovative technologies can fully meet customer needs (Burmaoğlu et al., 2015: 52).

Innovation plays an important role in sectors where profitability is low and there are non-wage factors in competition. One of these sectors is logistics, and companies in this sector need to be good at innovation in order to do more business. In order to survive in the harsh competitive environment of the logistics sector, companies rely on innovation (Erdal & Korucuk, 2018: 19). If the link between the manufacturer and the customer is low cost and high quality, the logistics company that provides this using technology will have a competitive advantage (Burmaoğlu, 2012: 202).

Innovation practices in logistics have a positive impact on both companies and countries. Innovation practices in logistics are therefore widely accepted. The positive approach to innovation by international companies that are pioneers in the sector has a positive impact on the attitude of other stakeholders towards innovation. Governments should increase their support for innovative ideas to help the logistics sector. R&D investment, patent studies and training of skilled workers are important (Bekmezci & Aksungur, 2018: 187).

2.2.2. Innovation in Logistics Management

Logistics is simply the planning of goods, capital, information and services. In addition to these processes, it is possible to speak of logistics management when production, information technologies, finance, human resources management, marketing and sales are involved. Successful coordination of all these processes is possible through logistics innovation (Bakan & Şekkeli, 2016: 57-58).

Suppliers support the use of new products by participating in the product development processes of companies. These products cause radical changes in supply chain management by directly affecting processes such as procurement, production, marketing and sales. These changes reduce uncertainty and conflict in business processes and create an environment of trust. In this environment of trust; stakeholders who are willing to innovate can support the process more effectively (Can & Erciş, 2013: 117-118).

3. RESEARCH MODEL

3.1. Cluster

EM (Expectation Maximisation) is a clustering method and in this study the value of "numClusters" is taken as -1 in clustering (Class EM). This allows Weka to calculate the optimal number of clusters. The clustering was done according to 2 different criteria for the year 2023. These criteria are LPI 2023 and GII 2023. The basic statistics of the clustering analysis according to the specified criteria are given in Appendix 1 and the clustering model is given below.

EM Clustering Model: weka.clusterers.EM -I 100 -N -1 -X 10 -max -1 -ll-cv 1.0E-6 -ll-iter 1.0E-6 -M 1.0E-6 -K 10 -num-slots 1 -S 100

Weka (Waikato Environment for Knowledge Analysis) software was used in the clustering process. This software is related to data mining and is available under the "Creative Commons Attribution-ShareAlike 2.5 License" (Frank et al., 2016).

3.2. Research Limitations

This research has limitations. Not all countries could be included in the study because logistics and innovation data were not available for some countries. The study uses data from 2023. The research can be extended by using more historical data.

4. ANALYSIS AND DATA

4.1. Logistic Clustering

Table 1 shows the EM clustering results obtained using the Weka software (a visual representation of this clustering analysis is shown in Figure 1.). It can be seen that the countries form 4 different groups as a result of the clustering. It can be seen that the countries with the best LPI score are grouped in the number 1 cluster. Regarding the clustering process, Appendix 1 contains the characteristics of the clustering process, Appendix 2 contains the LPI data and Appendix 3 contains the GII data.

Table 1 shows the distribution of countries according to the EM clustering. According to the EM model, there are 27 countries in the first group, 27 countries in the second group, 26 countries in the third group and finally 28 countries in the fourth group. According to the clustering result obtained, 108 countries are almost equally distributed between the groups.

Table 1. Clustering Result by Country

Cluster	Clustered Instances	Economy
0	27 (25%)	Bahrain, Brazil, Bulgaria, Croatia, Cyprus, Czech Republic, Greece, Hungary, India, Latvia, Lithuania, Malaysia, Malta, New Zealand, Oman, Philippines, Poland, Portugal, Qatar, Romania, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Thailand, Türkiye, Vietnam
1	27 (25%)	Australia, Austria, Belgium, Canada, China, Denmark, Estonia, Finland, France, Germany, Hong Kong SAR China, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Luxembourg, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States
2	26 (24%	Algeria, Angola, Bangladesh, Benin, Bolivia, Burkina Faso, Cambodia, Cameroon, Dominican Republic, El Salvador, Ghana, Guatemala, Guinea, Honduras, Madagascar, Mali, Mauritania, Namibia, Nicaragua, Nigeria, Paraguay, Rwanda, Tajikistan, Togo, Trinidad and Tobago, Zimbabwe
3	28 (26%)	Albania, Argentina, Armenia, Belarus, Bosnia and Herzegovina, Botswana, Chile, Colombia, Costa Rica, Georgia, Indonesia, Jamaica, Kazakhstan, Kuwait, Mauritius, Mexico, Moldova, Mongolia, Montenegro, North Macedonia, Panama, Peru, Russian Federation, Serbia, Sri Lanka, Ukraine, Uruguay, Uzbekistan

Türkiye ranks 38th with 3.4 points in the LPI ranking shown in Annex 2 and 39th with 38.6 points in the Innovation Index shown in Annex 3. As a result of the clustering created by evaluating logistics and innovation criteria together, it could not be placed in the best group, group number one. Türkiye is in group zero, which consists of countries with lower LPI and GII scores than group one. Türkiye needs to work on improving its logistics and innovation performance if it wants to improve economically.

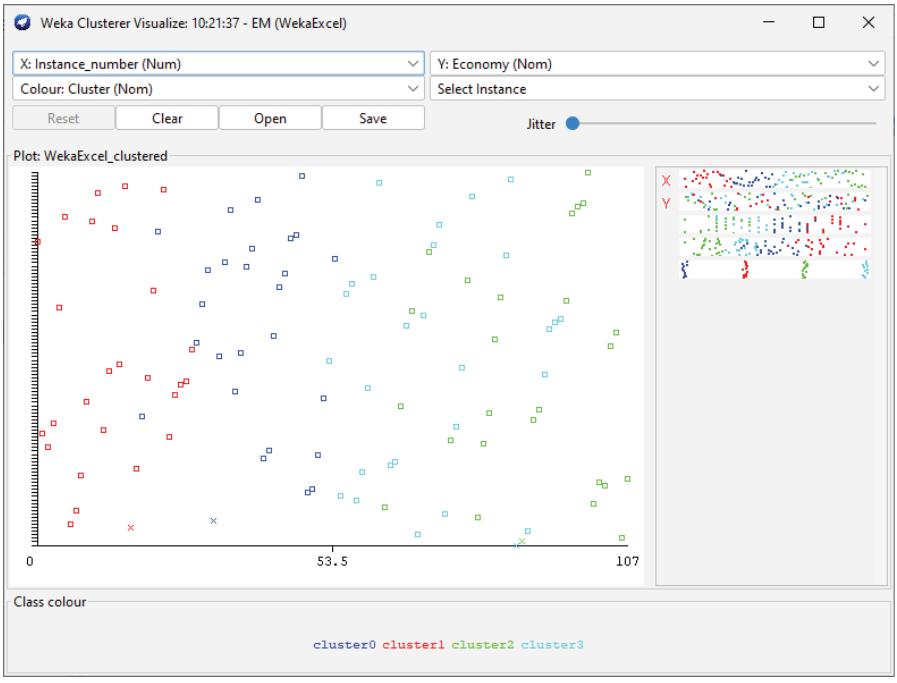

Figure 1. Cluster Placement of Countries

Figure 1 shows the Weka clustering screen of countries. This figure is a visual representation of the countries with cluster results in Table 1. Here we can see that the countries are divided into 4 different groups.

4.2. Logistics and Innovation

The LPI is published by Worldbak and has been released 6 times: 2007, 2010, 2012, 2014, 2018 and 2023. A country's logistics performance is analyzed under 6 different headings: "customs score", "infrastructure score", "international shipments score", "logistics competence and quality score", "timeliness score" and "tracking and tracing score". The LPI scores of the countries are then obtained by using the scores of these 6 headings (Worldbak LPI).

The Global Innovation Index (GII) measures the innovation performance of countries. In an environment of global uncertainty, these index data are crucial. The GII is reported for 132 countries and consists of some 80 indicators, including measures of each economy's infrastructure, policy environment, education and knowledge production (Wipo).

Innovation indicators that are calculated by taking into account many factors rather than a single factor, as is the case here (GII), have a good level of representativeness (Süt & Çetin, 2019: 302). Thanks to this indicator, countries can see their position in innovation and have the opportunity to compare themselves with other countries. This comparison is important for determining the country's competitive strategy with other countries (Karahan & Duran, 2023: 67).

Table 2. Top 12 Countries by LPI Ranking and GII Position

SN	Economy	Logistics Performance Index		Global Innovation Index	
		Score	Rank	Score	Rank
1	Singapore	4,3	1	61,5	5
2	Finland	4,2	2	61,2	6
3	Denmark	4,1	3	58,7	9
4	Germany	4,1	3	58,8	8
5	Netherlands	4,1	3	60,4	7
6	Switzerland	4,1	3	67,6	1
7	Austria	4	7	53,2	18
8	Belgium	4	7	49,9	23
9	Canada	4	7	53,8	15
10	Hong Kong SAR, China	4	7	53,3	17
11	Sweden	4	7	64,2	2
12	United Arab Emirates	4	7	43,2	32

Source: Worldbank LPI and GII2023

Table 2 shows the top 12 positions according to the LPI ranking. All countries in the top 12 are included in cluster 1 in the clustering analysis. Looking at the GII, 7 of the countries in the top 12 in the LPI ranking are also in the top 12 in the GII ranking. These countries are Singapore, Finland, Denmark, Germany, Netherlands, Switzerland and Sweden. On the other hand, there are countries that are in the top 12 in the LPI ranking but not in the top 12 in the GII ranking. These are Austria, Belgium, Canada, Hong Kong and the United Arab Emirates.

An analysis of Table 2 shows that Türkiye is not in the top 12 in either of these two areas. Türkiye should make a breakthrough in innovation and climb to the top. However, Çelik (2014) considers Türkiye's innovation scores to be insufficient and stresses that Türkiye should make efforts to reach the level of the European Union. Özden & Uysal (2020) highlight R&D expenditure, number of patents and number of researchers for Türkiye's progress in innovation. According to the researchers, Türkiye should invest in knowledge and strengthen its human capital. It should also make its mark on the global market with new technological products. Türkiye needs to develop an action plan on these issues and embark on a rapid development process. Terzioglu et al. (2021) identify innovation strategies as a remedy for regional income disparities and migration, which are the main problems facing countries. Innovation-oriented solutions to social problems such as regional inequality will also save Türkiye from some of its sociological problems.

5. CONCLUSION

A review of the literature on the subject shows that innovation is crucial for companies and countries. The globalized world economy has made competition more difficult. Innovation can be the improvement of a business process or the introduction of a new product. Either way, the ability to innovate is a competitive advantage. In the logistics sector, global competition is intense. As a result, innovation is critical in this sector. Companies that want to meet their customers' needs smoothly must work in an innovative way.

This study ranks countries in terms of logistics performance and innovation. The EM clustering method classifies the countries in the study into 4 different groups (Table 1). The clustering method shows which countries are similar and which are dissimilar. This grouping gives policy makers an idea for future planning.

An analysis of Table 1 shows that the EM clustering method divides 108 countries almost equally into 4 groups. Countries in the same cluster have similar characteristics. The analysis shows that Türkiye is in the zero group. In order for Türkiye to reach the same level as the countries in the top group, it should attach importance to planned innovation and make efforts to improve its logistics performance. This is because the leading countries in innovation and logistics in Table 2 are in the first group.

Secondly, the countries in the top 12 of the LPI indicator were compared with the GII (Table 2). The comparison shows that 7 countries are in

the top 12 for both indicators (Singapore, Finland, Denmark, Germany, Netherlands, Switzerland, Sweden). These 7 countries have an advantageous position in economic activities compared to other countries. On the other hand, Türkiye is not among the top 12 for the logistics and innovation indicators. This situation should be evaluated by policy makers and the future planning of logistics and innovation should be designed accordingly.

REFERENCES

Akyürek, M. İ. (2020). İnovasyon ve Liderlik. *Uluslararası Liderlik Çalışmaları Dergisi: Kuram ve Uygulama,* 3(1), 15-24.

Arı, F. (2020). Yerel Kalkınma ve İnovasyon. *Dicle Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 10(20), 369-381.

Ayas, A. N. (2021). Açık İnovasyon Uygulamaları Üzerine Bir Çalışma. *EUropean Journal of Managerial Research (EUJMR),* 5(Özel Sayı 1), 64-74.

Bakan, İ., & Şekkeli, Z. (2016). Lojistik Koordinasyon Yeteneği, Lojistik İnovasyon Yeteneği ve Müşteri İlişkileri (MİY) Yeteneği ile Rekabet Avantajı ve Lojistik Performans Arasındaki İlişki: Bir Alan Araştırması. *Kahramanmaraş Sütçü İmam Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 5(2), 39-68.

Baykul, A. (2022). İnovasyonun Belirleyicileri: Küresel İnovasyon Endeksi Üzerinde Bir Araştırma. *Finans Ekonomi ve Sosyal Araştırmalar Dergisi,* 7(1), 52-66. https://doi.org/10.29106/fesa.1052116.

Bekmezci, M., & Aksungur, M. (2018). Lojistikte İnovasyonun Önemi. *Toros Üniversitesi İİSBF Sosyal Bilimler Dergisi,* 5(9), 175-192.

Burmaoğlu, S. (2012). Relation Between National Innovation Indicators and National Logistics Performance: A Research on EU Countries. *Ege Academic Review,* 12(2), 193-208.

Burmaoğlu, S., Şeşen, H., & Kazançoğlu, Y. (2015). Determinants Of Logistic Sector Innovation Creating Common Value Nodes in Supply Chain. *LAÜ Sosyal Bilimler Dergisi,* 6(2), 37-58.

Can, P., & Erciş, A. (2013). Tedarik Zinciri Yönetiminin Inovasyon Stratejilerine Etkisi Üzerine Bir Araştırma. *Karabük Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* 3(2), 95-122. https://doi.org/10.14230/joiss37

Class EM, weka.clusterers, https://weka.sourceforge.io/doc.dev/weka/clusterers/EM.html, Access date: 20.09.2024.

Çelik, Y. (2014). Türkiye'nin Endüstriyel Performans Göstergeleri ve İnovasyon Faaliyeti. *Marmara Sosyal Araştırmalar Dergisi,* (1), 1-16.

Çetinkaya, F. F. (2021). Endüstri 4.0 Farkındalığının İnovasyon Üzerindeki Etkisi. *Anadolu Üniversitesi Sosyal Bilimler Dergisi,* 21(2), 571-598. https://doi.org/10.18037/ausbd.959277.

Çitçi, U. S., Dolu, A., & Ekinci, R. (2020). Kırılganlığa Esneklik Cevabı "İnovasyon" Olabilir Mi? Kırılgan Beşli İncelemesi. *Yorum Yönetim Yöntem Uluslararası Yönetim Ekonomi ve Felsefe Dergisi,* 8(1), 35-50. https://doi.org/10.32705/yorumyonetim.704863.

Demir, F. (2016). Avrupa'da Kamu Sektöründe İnovasyon ve Yenilikçi Yöntemler. *Yönetim Bilimleri Dergisi,* 14(27), 143-170.

Dindarik, N., & Fidan, Y. (2023). Lojistik İşletmelerin Çalışan Profili ile Yenilik Odaklılığı Arasındaki İlişki. *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi,* 22(48), 1124-1144. https://doi.org/10.46928/iticusbe.1358825.

Döner, A. S. (2016). İnovasyon Beşiği Teknoparklarda İlişki Dinamikleri. *Kastamonu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 12(2), 419-430.

Dursun, Ö. O. (2017). A Theoretical Investigation on Innovation. *International Journal of Management and Administration,* 1(1), 12-17. https://doi.org/10.29064/ijma.328112.

Erbuğa, G. S., & Gürsoy, A. (2024). Innovation for Economic Growth: G7 vs E7. *Verimlilik Dergisi,* 39-56. https://doi.org/10.51551/verimlilik.1321338.

Erdal, H., & Korucuk, S. (2018). Lojistik Sektöründe İnovasyon Önceliklerinin Belirlenmesi: Karşılaştırmalı Bir Analiz. *Kocaeli Üniversitesi Sosyal Bilimler Dergisi,* (36), 1-24.

Esen, Ş., & Çetin, S. (2015). Siyasi Parti ve Hükümet Programlarında Girişimcilik ve İnovasyon. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi,* (34), 1-10.

Esmer, Y., & Alan, M. A. (2019). Endüstri 4.0 Perspektifinde İnovasyon. *Avrasya Uluslararası Araştırmalar Dergisi,* 7(18), 465-478. https://doi.org/10.33692/avrasyad.595720.

Frank, E., Hall, M.A. and Witten I.H. (2016). *The WEKA Workbench. Online Appendix for "Data Mining: Practical Machine Learning Tools and Techniques"*, Morgan Kaufmann, Fourth Edition, 2016

GII2023, Global Innovation Index (2023). Innovation in the face of uncertainty, https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023-en-main-report-global-innovation-index-2023-16th-edition.pdf, Access date: 20.09.2024

Gökçe, S. (2015). Kamuda İnovasyon ve Türkiye'deki Uygulamaları. *Uluslararası Yönetim ve Sosyal Araştırmalar Dergisi,* 2(3), 28-37.

Hacıoğlu, V. (2019). İnovasyon Ekosistemleri ve Sürdürülebilir Kalkınma. *Girişimcilik ve Kalkınma Dergisi,* 14(2), 113-119.

Hancıoğlu, Y. (2016). Küresel İnovasyon Endeksini Oluşturan İnovasyon Girdi ve Çıktı Göstergeleri Arasındaki İlişkinin Kanonik Korelasyon Analizi ile İncelenmesi: OECD Örneği. *Bolu Abant İzzet Baysal Üniversitesi Sos-*

yal Bilimler Enstitüsü Dergisi, 16(4), 131-158. https://doi.org/10.11616/basbed.vi.455411.

Helvacıoğlu, İ., & Demirkol, İ. (2023). İnovasyon ve İhracat Performansı İlişkisi: Lojistik Performansın Aracı Rolü. *The International New Issues in Social Sciences,* 11(1), 107-136.

Hocaoğlu, A., & Altuğ, P. D. S. (2018). Teknoparkların İnovasyon Ekosistemindeki yeri ve İnovasyon başarısına katkısı: Teknopark İzmir Özelinde Bilişim Sektöründe Bir Şirket Örneği. *Izmir Democracy University Social Sciences Journal,* 1(1), 70-86.

Işık, N., Işık, H. B., & Kılınç, E. C. (2015). Girişimcilik ve İnovasyon İlişkisi: Teorik Bir Değerlendirme. *Ekonomi İşletme Siyaset ve Uluslararası İlişkiler Dergisi,* 1(2), 57-90.

İlter, B., Atrek, B., & İpek, İ. (2016). İnovasyon Faaliyetlerinde Kullanıcının Yeri ve Çevrimiçi Kullanıcı İnovasyon Araçları. *Yönetim ve Ekonomi Dergisi,* 23(1), 35-56. https://doi.org/10.18657/yecbu.85726

Karaçuha, E., & Pado, G. (2018). Dijital İnovasyon Stratejisi Yönetimi. *Uluslararası Bilimsel Araştırmalar Dergisi (IBAD),* 3(1), 118-130. https://doi.org/10.21733/ibad.370586.

Karahan, M., & Duran, S. (2023). Küresel İnovasyon Endeksi Verilerine Göre Türk Devletleri Teşkilatına Üye Ülkelerin İnovasyon Performanslarının Analizi. *Beykoz Akademi Dergisi,* 11(1), 51-70. https://doi.org/10.14514/beykozad.1179838

Kavak, U., & Köse, C. (2022). İnovasyon Sürecinde Liderin Rolü: Seramik Sektöründe Bir Araştırma. *Girişimcilik ve Kalkınma Dergisi,* 17(1), 1-16.

Keskin, S. (2018). Girişimcilik ve İnovasyon Arasındaki İlişki. *Gazi Üniversitesi Sosyal Bilimler Dergisi,* 5(13), 186-193.

Kılıç, F., & Ay Türkmen, M. (2019). Kavram ve Farkındalık Bağlamında Açık İnovasyon Üzerine Bir Uygulama. *Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi,* 6(3), 274-292.

Kitapçı, İ. (2017). Sosyal Sermayenin İnovasyon Üzerindeki Etkileri. *Ekonomik ve Sosyal Araştırmalar Dergisi,* 13(2), 119-137.

Koç, O., & Yavuz, Ç. (2011). İnovasyon ve Rekabet Açısından Kızıl Kraliçe Etkisi. *Kahramanmaraş Sütçü İmam Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 1(2), 65-78.

Korucuk, S., Memiş, S., & Ergün, M. (2020). Kobi'lerde İnovasyon Stratejilerinin Önceliklendirilmesine Yönelik Bir Uygulama: Giresun İli Örneği. *Karadeniz Teknik Üniversitesi İletişim Araştırmaları Dergisi,* 10(1), 156-168.

Murat, D. (2020). OECD Ülkelerinde İnovasyon Performansının Ölçülmesi. *Journal of Management and Economics Research,* 18(4), 209-226.

Özden, B., & Uysal, D. (2020). Türkiye'de İnovasyon ve Ekonomik Büyüme Arasındaki İlişki. *Uluslararası Ekonomi ve Siyaset Bilimleri Akademik Araştırmalar Dergisi,* 4(10), 53-64.

Özdokur, S. (2019). İstanbul Bölgesindeki Restoran Yöneticilerinin İnovasyon Anlayışı. *Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi,* 16(1), 279-303. https://doi.org/10.33437/ksusbd.440679.

Süt, E., & Çetın, A. K. (2019). İnovasyon Göstergesi Olarak İnovasyon Endeksleri. *Uluslararası Turizm Ekonomi ve İşletme Bilimleri Dergisi,* 2(2), 299-309.

Şengün, H. İ. (2017). A General Overview of Innovation And Innovation Strategies. *The Journal of Social Science,* 1(1), 35-43. https://doi.org/10.30520/tjsosci.341803

Taş, D. D. S. (2017). İnovasyon, Eğitim ve Küresel İnovasyon Endeksi. *Bilge Uluslararası Sosyal Araştırmalar Dergisi,* 1(1), 99-123.

Tekin, Y. (2023). Sosyal İnovasyon ve Türkiye Turizm Sektörü Uygulamaları. *Turizm ve İşletme Bilimleri Dergisi,* 3(1), 37-49.

Terzioğlu, M. K., Yücel, M. A., & Gençler, A. (2021). Sosyal İnovasyon ve Artımsal İnovasyon Çerçevesinde İç-Göç Olgusunun Dinamik Mekânsal Etkileşimi. *Sosyal Güvenlik Dergisi,* Cilt 11 Sayı 1(Sayı 1), 69-94. https://doi.org/10.32331/sgd.952548

Utlu Koçdemir, S., & Özyıldız, T. (2022). İnovasyon ve İstihdam İlişkisi: NIC Ülkeleri Örneği. *Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi,* 19(2), 1057-1068. https://doi.org/10.33437/ksusbd.1087468.

Uzun, C. (2020). Turizm İşletmelerinde İnovasyon Stratejileri. *Ankara Hacı Bayram Veli Üniversitesi Turizm Fakültesi Dergisi,* 23(2), 271-294.

Wipo, Global Innovation Index, https://www.wipo.int/web/global-innovation-index, Access date: 20.09.2024

Worldbank LPI, Logistics Performance Index, https://lpi.worldbank.org/international/global, Access date: 20.09.2024

Yangınlar, G., & Bal, N. (2018). Lojistik Sektöründe Öğrenen Örgüt Yapısı ile İnovasyon İlişkisi. *Uluslararası Yönetim ve Sosyal Araştırmalar Dergisi,* 5(10), 1-14.

Yılmaz, Z., & İncekaş, E. (2018). Türkiye'de İnovasyon ve Bölgesel Kalkınma. *Kırklareli Üniversitesi Sosyal Bilimler Dergisi,* 2(1), 154-169.

Yiğit, S. (2014). Kültür, Örgüt Kültürü ve İnovasyon İlişkisi Bağlamında "İnovasyon Kültürü". *Karamanoğlu Mehmetbey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi,* 2014(2), 1-7. https://doi.org/10.18493/kmusekad.26789.

Zengin, Ş., & Bekmezci, M. (2021). İşletmelerde Değişim Yönetimi ve İnovasyon. *Toros Üniversitesi İİSBF Sosyal Bilimler Dergisi,* 8(15), 10-28. https://doi.org/10.54709/iisbf.974183.

APPENDICES

Appendix 1.Cluster Attribute

Attribute	0	1	2	3
	(0.25)	(0.25)	(0.24)	(0.26)
LPI				
mean	3,39	3,8766	2,5278	2,81
std. dev.	0,1614	0,2077	0,2063	0,2264
GII				
mean	38,3682	55,0471	17,9628	28,7879
std. dev.	5,4761	6,1041	3,5055	2,9758

Appendix 2. LPI Score 2023 - 0

Economy	LPI Score	LPI Grouped Rank	Economy	LPI Score	LPI Grouped Rank
Singapore	4,3	1	Mexico	2,9	66
Finland	4,2	2	Namibia	2,9	66
Denmark	4,1	3	Argentina	2,8	73
Germany	4,1	3	Montenegro	2,8	73
Netherlands	4,1	3	Rwanda	2,8	73
Switzerland	4,1	3	Serbia	2,8	73
Austria	4	7	Solomon Islands	2,8	73
Belgium	4	7	Sri Lanka	2,8	73
Canada	4	7	Bahamas, the	2,7	79
Hong Kong SAR, China	4	7	Belarus	2,7	79
Sweden	4	7	Djibouti	2,7	79
United Arab Emirates	4	7	El Salvador	2,7	79
France	3,9	13	Georgia	2,7	79
Japan	3,9	13	Kazakhstan	2,7	79
Spain	3,9	13	Papua New Guinea	2,7	79
Taiwan, China	3,9	13	Paraguay	2,7	79
Korea, Rep.	3,8	17	Ukraine	2,7	79
United States	3,8	17	Bangladesh	2,6	88
Australia	3,7	19	Congo, Rep.	2,6	88
China	3,7	19	Dominican Republic	2,6	88
Greece	3,7	19	Guatemala	2,6	88

Italy	3,7	19	Guinea-Bissau	2,6	88
Norway	3,7	19	Mali	2,6	88
South Africa	3,7	19	Nigeria	2,6	88
United Kingdom	3,7	19	Russian Federation	2,6	88
Estonia	3,6	26	Uzbekistan	2,6	88

Appendix 2. LPI Score 2023 - 1

Iceland	3,6	26	Albania	2,5	97
Ireland	3,6	26	Algeria	2,5	97
Israel	3,6	26	Armenia	2,5	97
Luxembourg	3,6	26	Bhutan	2,5	97
Malaysia	3,6	26	Central African Republic	2,5	97
New Zealand	3,6	26	Congo, Dem. Rep.	2,5	97
Poland	3,6	26	Ghana	2,5	97
Bahrain	3,5	34	Grenada	2,5	97
Latvia	3,5	34	Guinea	2,5	97
Qatar	3,5	34	Jamaica	2,5	97
Thailand	3,5	34	Mauritius	2,5	97
India	3,4	38	Moldova	2,5	97
Lithuania	3,4	38	Mongolia	2,5	97
Portugal	3,4	38	Nicaragua	2,5	97
Saudi Arabia	3,4	38	Tajikistan	2,5	97
Türkiye	3,4	38	Togo	2,5	97
Croatia	3,3	43	Trinidad and Tobago	2,5	97
Czech Republic	3,3	43	Zimbabwe	2,5	97
Malta	3,3	43	Bolivia	2,4	115
Oman	3,3	43	Cambodia	2,4	115
Philippines	3,3	43	Gabon	2,4	115
Slovak Republic	3,3	43	Guyana	2,4	115
Slovenia	3,3	43	Iraq	2,4	115
Vietnam	3,3	43	Lao PDR	2,4	115
Brazil	3,2	51	Liberia	2,4	115
Bulgaria	3,2	51	Sudan	2,4	115
Cyprus	3,2	51	Burkina Faso	2,3	123
Hungary	3,2	51	Fiji	2,3	123
Kuwait	3,2	51	Gambia, the	2,3	123
Romania	3,2	51	Iran, Islamic Rep.	2,3	123
Botswana	3,1	57	Kyrgyz Republic	2,3	123

Egypt, Arab Rep.	3,1	57	Madagascar	2,3	123
North Macedonia	3,1	57	Mauritania	2,3	123
Panama	3,1	57	Syrian Arab Republic	2,3	123
Bosnia and Herzegovina	3	61	Venezuela, RB	2,3	123
Chile	3	61	Cuba	2,2	133
Indonesia	3	61	Yemen, Rep.	2,2	133
Peru	3	61	Angola	2,1	135
Uruguay	3	61	Cameroon	2,1	135
Antigua and Barbuda	2,9	66	Haiti	2,1	135
Benin	2,9	66	Somalia	2	138
Colombia	2,9	66	Afghanistan	1,9	139

Appendix 2. LPI Score 2023 - 2

Costa Rica	2,9	66	Libya	1,9	139
Honduras	2,9	66			

Source: Worldbank LPI

Appendix 3.Global Innovation Index 2023 Rankings - 0

GII rank	Economy	Score	Income group rank	Region rank	GII rank	Economy	Score	Income group rank	Region rank
1	Switzerland	67,6	1	1	67	Bahrain	29,1	46	9
2	Sweden	64,2	2	2	68	Mongolia	28,8	7	13
3	United States	63,5	3	1	69	Oman	28,4	47	10
4	United Kingdom	62,4	4	3	70	Morocco	28,4	8	11
5	Singapore	61,5	5	1	71	Jordan	28,2	16	12
6	Finland	61,2	6	4	72	Armenia	28	17	13
7	Netherlands	60,4	7	5	73	Argentina	28	18	6
8	Germany	58,8	8	6	74	Costa Rica	27,9	19	7
9	Denmark	58,7	9	7	75	Montenegro	27,8	20	36
10	Republic of Korea	58,6	10	2	76	Peru	27,7	21	8
11	France	56	11	8	77	Bosnia and Herzegovina	27,1	22	37
12	China	55,3	1	3	78	Jamaica	27,1	23	9

13	Japan	54,6	12	4	79	Tunisia	26,9	9	14
14	Israel	54,3	13	1	80	Belarus	26,8	24	38
15	Canada	53,8	14	2	81	Kazakhstan	26,7	25	3
16	Estonia	53,4	15	9	82	Uzbekistan	26,2	10	4
17	Hong Kong	53,3	16	5	83	Albania	25,4	26	39
18	Austria	53,2	17	10	84	Panama	25,3	48	10
19	Norway	50,7	18	11	85	Botswana	24,6	27	3
20	Iceland	50,7	19	12	86	Egypt	24,2	11	15
21	Luxembourg	50,6	20	13	87	Brunei Darussalam	23,5	49	14
22	Ireland	50,4	21	14	88	Pakistan	23,3	12	5
23	Belgium	49,9	22	15	89	Azerbaijan	23,3	28	16
24	Australia	49,7	23	6	90	Sri Lanka	23,3	13	6
25	Malta	49,1	24	16	91	Cabo Verde	23,3	14	4
26	Italy	46,6	25	17	92	Lebanon	23,2	15	17
27	New Zealand	46,6	26	7	93	Senegal	22,5	16	5
28	Cyprus	46,3	27	2	94	Dominican Republic	22,4	29	11
29	Spain	45,9	28	18	95	El Salvador	21,8	17	12
30	Portugal	44,9	29	19	96	Namibia	21,8	30	6
31	Czech Republic	44,8	30	20	97	Bolivia	21,4	18	13
32	United Arab Emirates	43,2	31	3	98	Paraguay	21,4	31	14
33	Slovenia	42,2	32	21	99	Ghana	21,3	19	7
34	Lithuania	42	33	22	100	Kenya	21,2	20	8

Appendix 3.Global Innovation Index 2023 Rankings - 1

35	Hungary	41,3	34	23	101	Cambodia	20,8	21	15
36	Malaysia	40,9	2	8	102	Trinidad and Tabago	20,7	50	15
37	Latvia	39,7	35	24	103	Rwanda	20,6	1	9
38	Bulgaria	39	3	25	104	Ecuador	20,5	32	16
39	Türkiye	38,6	4	4	105	Bangladesh	20,2	22	7
40	India	38,1	1	1	106	Kyrgyzstan	20,2	23	8
41	Poland	37,7	36	26	107	Madagascar	19,1	2	10
42	Greece	37,5	37	27	108	Nepal	18,8	24	9
43	Thailand	37,1	5	9	109	Nigeria	18,4	25	11
44	Croatia	37,1	38	28	110	Lao People's D.R.	18,3	26	16
45	Slovakia	36,2	39	29	111	Tajikistan	18,3	27	10
46	Viet Nam	36	2	10	112	Côte d'Ivoire	18,2	28	12

47	Romania	34,7	40	30	113	United Republic of Tanzania	17,4	29	13
48	Saudi Arabia	34,5	41	5	114	Togo	16,9	3	14
49	Brazil	33,6	6	1	115	Nicaragua	16,9	30	17
50	Qatar	33,4	42	6	116	Honduras	16,7	31	18
51	Russian Federation	33,3	7	31	117	Zimbabwe	16,5	32	15
52	Chile	33,3	43	2	118	Zambia	16,4	4	16
53	Serbia	33,1	8	32	119	Algeria	16,1	33	18
54	North Macedonia	33	9	33	120	Benin	16	34	17
55	Ukraine	32,8	3	34	121	Uganda	16	5	18
56	Philippines	32,2	4	11	122	Guatemala	15,8	33	19
57	Mauritius	32,1	10	1	123	Cameroon	15,3	35	19
58	Mexico	31	11	3	124	Burkina Faso	14,5	6	20
59	South Africa	30,4	12	2	125	Ethiopia	14,3	7	21
60	Republic of Moldova	30,3	13	35	126	Mozambique	13,6	8	22
61	Indonesia	30,3	5	12	127	Mauritania	13,5	36	23
62	Iran	30,1	6	2	128	Guinea	13,3	9	24
63	Uruguay	30	44	4	129	Mali	12,9	10	25
64	Kuwait	29,9	45	7	130	Burundi	12,5	11	26
65	Georgia	29,9	14	8	131	Niger	12,4	12	27
66	Colombia	29,4	15	5	132	Angola	10,3	37	28

Soruce: GII2023