International Journal of **Arts** & **Social Studies**
(**ASSTUDIES**) Dergisi
ISSN: 2667-436X / Dönem / Cilt: 7 / Sayı: 12
Research Article

INNOVATION BEHAVIOR AND TECHNOLOGY USE OF ORGANIZATIONS: EVIDENCE FROM EUROPEAN AND CENTRAL ASIAN COUNTRIES

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ABSTRACT

This study examines organizational innovation and technology use in 31 European and Central Asian countries using data from the World Bank Enterprise Survey of 2019. Using six key variables, the study compares the organizational innovation and technology adoption rates of various nations in the region. Also, the study seeks to address questions about geographical differences in technology use and innovation, notable differences in organizational innovation and technology usage, and which countries have the greatest and lowest rates. The results show that Slovenia had the highest ranking out of all the countries, followed by Latvia and the Czech Republic. On the contrary, Bulgaria, Lithuania, and Montenegro had the lowest scores. To fully understand the causes of the disparities in rates among the nations, additional study would be required, as the dataset does not provide information on the factors that contribute to the higher rates in the top-rated countries. In addition, taking into account the limitations, suggestions have been made based on the results. The findings would be helpful to researchers, policymakers, and executives in the region to better understand how technology adoption and innovation differ across countries.

Keywords: Organizational innovation, Technology use, Product innovation, Process innovation, R&D.

INTRODUCTION

The emergence of a more internationally linked, dynamic, and inventive private sector lies at the heart of Eastern Europe and Central Asia's economic transition (European Investment Bank, 2022:3). Nevertheless, in recent years, innovation and new technologies have grown in importance as drivers of economic development and competitiveness (Radu et al., 2013:16). While industrialized economies have typically led technological innovation, emerging and developing economies are gradually catching up as new technologies become more accessible and inexpensive (Broughel & Thierer, 2019:22–23;

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Witte, 2018:468). Given the significant variance in economic and institutional situations, as well as continuous attempts to modernize and diversify their economies, Europe and Central Asia countries have emerged as a particularly relevant region to examine from this perspective.

This research compares innovation and technology in 31 European and Central Asian nations using data from the 2019 World Bank Business Survey (Enterprise Survey, 2019). The data used in the study came from the most recent World Bank Enterprise Survey, which was performed at the time the study was done. Nevertheless, data for a few nations was only available until 2020. As a result, the year 2019 may be considered the most recent dataset available for these locations. The analysis focuses on six major indicators of technology adoption and innovation, which are highlighted in the study's data and sample section. These indicators have been used to compare innovation and technology use across the region's countries. Furthermore, the study was carried out in accordance with research and publishing ethics.

The study tries to answer the following questions: How do organizational innovation and technology use differ throughout Europe and Central Asia? Are there any notable disparities in the region's enterprises' organizational innovation and technology use? Which European and Central Asian nations have the greatest and lowest percentages of company technology adoption? What are the worldwide and regional averages for these rates? Each indicator has been evaluated and compared across nations to address these questions.

It is significant to note that certain nations have a small sample size, which can have an impact on the accuracy of the findings. Also, sample sizes differed throughout the nations, so it is conceivable that the outcomes may not be entirely indicative of each nation's actual circumstances. To completely comprehend the causes of the variations in rates among the nations, more study would be required, as the dataset does not provide information on the variables that lead to the higher rates in the top-rated countries. The findings have been thought to help policymakers and business leaders in Europe and Central Asia countries understand how technology adoption and innovation vary across the region. By comparing the adoption rates and innovation activity of different countries, we may gain valuable insights into the factors that drive technological progress and economic growth in the region.

The study continues as follows: Section two is a review of the literature on technology use and innovation, with a focus on the context of European and Central Asian countries. Section three describes the significance of the study and the sample of data used in the analysis. Section four includes the main findings, which are a comparison of rates across different countries. Finally, Section 5 concludes the paper and provides policy recommendations for improving technology adoption and innovation in European and Central Asian countries.

1. LITERATURE REVIEW

European and Asian countries represent a diverse range of economies, societies, and cultures, each with their own unique strengths, challenges, and development trajectories. In recent years, there has been accelerating interest in comparative analysis of these countries, with researchers seeking to understand the factors that contribute to their economic, social, and business development (Dao, 2022; Arthur & Stejskal, 2022; European Investment Bank, 2022; Link, 2021; Bigos & Michalik, 2020; Khatiwada & Arao, 2020; Cirera & Sabetti, 2019; Kabadurmus & Kabadurmus, 2019). Organizational innovation is one of the factors that has become a key focus of research in recent years as organizations strive to stay competitive in a rapidly shifting business environment. The use of technology has been identified as a key factor in driving organizational innovation, with many organizations investing heavily in the development and implementation of new technologies to improve their operations and increase their competitive advantage (Pál et al., 2022:61–63; Camisón & Villar-López, 2014:3; Freeman & Soete, 2007:5; Hamel, 2006:2).

Innovation refers to a wide range of assets, both physical and non-physical, that contain knowledge. These can include things like employee skills, company organization, research and development efforts, and even intellectual property rights. These different assets must be combined in order to create innovative outcomes such as new and improved products, better production methods, changes in business structure, and legally protected intellectual property (Cirera & Maloney, 2017:16). Organizational innovation, on the other hand, means creating new ways of managing a business or changing the way a company interacts with outside parties. These new methods can be introduced in the workplace or in how the company deals with customers, suppliers, or other stakeholders (OECD, 2005, as cited in Camisón & Villar-López, 2014:2). Improvements in organizational innovation enhance creativity and flexibility, thereby facilitating advancements in technological innovation (Le Bas et al., 2015:115). There are two different types of innovation: product innovation, which entails modifications to a company's products, and process innovation, which involves alterations to a company's procedures and/or processes. It is essential to mention that this definition is comprehensive, covering both products and processes that are novel to the economy as well as those that are new to the specific firms that implement them (Galindo-Rueda et al., 2020:9). In emerging markets and developing economies, the adoption of novel products and processes holds significance since companies have ample scope for advancement compared to the technological forefront (Pál et al., 2022:62).

The literature has also uncovered a variety of factors and elements that businesses may utilize to guarantee the effective adoption and application of new technology (Cresswell & Sheikh, 2013:82; Suebsin & Gerdsri, 2009:2641; Bruque & Moyano, 2007:241; Mirvis et al., 1991:136–137). Technology adoption can be considered an act of innovation if it meets the requirement that it offers a significant improvement for the company in terms of its operations and goods (Galindo-Rueda et al., 2020:10).

Organizations should be able to effectively communicate the potential benefits of new technologies to their employees and should have a clear understanding of these benefits (Ensminger et al., 2004:69). The literature has identified a number of external factors in addition to organizational ones that can affect the success of technology adoption (Abdullah et al., 2012:88). For instance, it has been determined that having access to external support, such as government grants and subsidies, is essential for the successful adoption of new technologies (Hooks et al., 2022:1). (Mohsen et al., 2021:24). Additionally, a strong network of suppliers and customers, in addition to a supportive external environment, can aid in the adoption of new technologies (Nguyen et al., 2019:15; Kaiming-Au & Enderwick, 2000:266).

2. METHOD

2.1. Purpose of the Study

The goal of the study is to examine average rates of introduction and sample sizes for each nation, as well as to compare and interpret the percentage of businesses that used technology and introduced innovation in various nations. Policymakers, researchers, and businesses could use the study to make decisions about innovation strategies and investments because it will help them comprehend the level of technology use, innovation, and competitiveness in various economies and regions.

The analysis seeks to conclude with the answers to the following questions: How do organizational innovation and technology use vary across different European and Central Asian countries? Are there any significant differences in organizational innovation and technology use among firms in the region? Which countries in Europe and Central Asia have the highest and lowest rates of technology adoption by firms? How do these rates compare to global and regional averages? To answer this question, each indicator has been examined and compared between countries.

2.1. Data and Sample

Comparing the usage of innovation and technology across 31 European and Central Asian nations was done using the 2019 World Bank Business Survey data (Appx. 1). From 45 (in Montenegro) to 1662 (in Turkey), the sample sizes across the observations are remarkably different. Throughout this dataset, there are around 24.87 samples on average. Most samples are between 100 and 500; however, certain countries, like Kazakhstan, Turkey, Ukraine, and Poland, have samples above 1,000. Sample sizes are depicted as a graph in Figure 1.

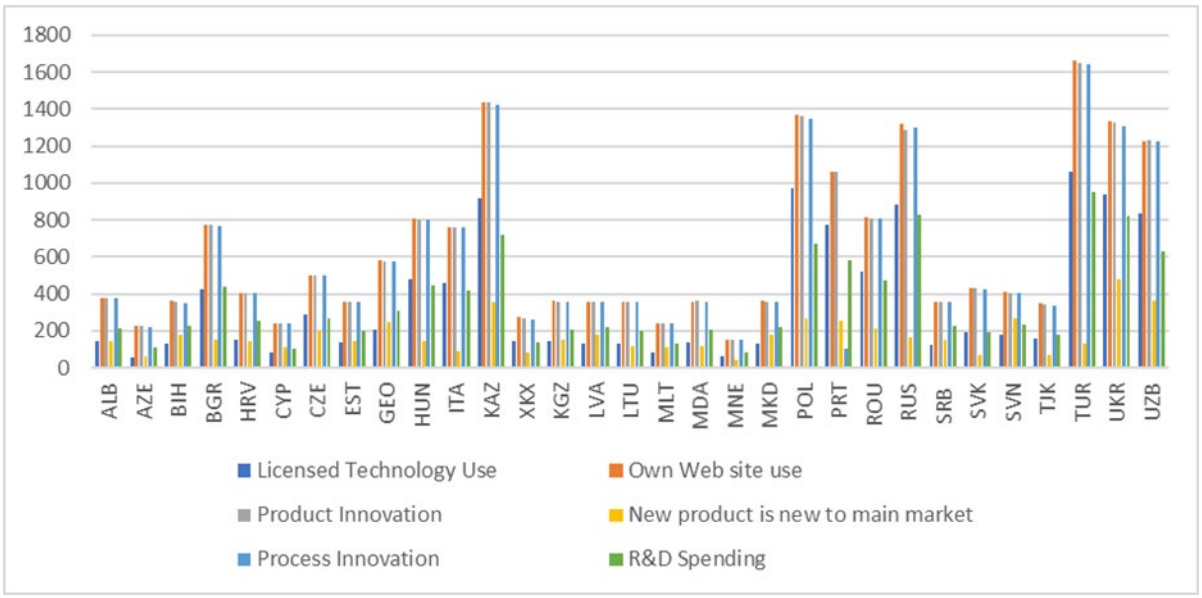

Figure 1. Sample sizes by countries

The innovation and technology module of the Enterprise Survey focuses on seven key variables to measure innovation and technology use in organizations. All variables have attempted to measure the percentages of firms using technology or their innovation behaviors. The indicators used in this study were created from those variables by the World Bank. Also, the computation of regional and global averages for the indicators involves the derivation of a simple mean from the point estimates at the country level. The most recent survey data available for each economy is exclusively utilized in this computation. Moreover, the list of country ISO codes described in ISO 3166 has been referred to for the abbreviation of countries.

The indicators shown in Table 1 with their original codes have been used to compare innovation and technology across different countries in the region. One of the indicators was removed from the analysis since a considerable number of scores had been missing in the dataset.

Table 1. Indicators Used to Compare Innovation and Technology Scores

Codes	Indicators
t4	The percent of firms using technology licensed from foreign companies.
t5	The percent of firms having their own website
t6 (removed)	The percent of firms using E-mail to communicate with clients/suppliers
t7	The percent of firms that introduced a new product/service,
t8	The percent of firms whose new product/service is also new to the main market,
t9	The percent of firms that introduced a process innovation,
t10	The percent of firms that spend on R&D.

3. FINDINGS

3.1. Percent of Firms Using Technology Licensed from Foreign Companies

Based on the data, the countries with the highest percentages of the variable are Azerbaijan, Kosovo, and the Slovak Republic. Azerbaijan had the highest percentage, with an average of 41.7% in 2019, drawing from a sample of 52. Kosovo followed with an average of 31.1%, using a sample consisting of 146. The Slovak Republic had an average of 35.2%, from a sample group of 191. On the other hand, the average percentage across all countries is 15.1%, while the average for Europe and Central Asia is 17.4% (Figure 2). This suggests that these three countries are outliers in terms of their reliance on licensed technology from foreign firms.

The findings might point to a higher reliance on foreign technology in these nations' commercial operations, which might have benefits and drawbacks. On the one hand, the introduction of foreign technology might spur creative thinking and innovation in these nations, resulting in a rise in their economies. On the other hand, relying heavily on foreign technology could result in a lack of domestic innovation and a reliance on foreign businesses, which could potentially harm these countries' long-term competitiveness. Therefore, it is important for these countries to strike a balance between importing foreign technology and strengthening their own in-house innovation capacities. Government policies, access to resources and funding, and the stage of technological development may all have an impact on the lower percentages of businesses using licensed technology from foreign companies.

The countries with the lowest percentages are Croatia, Cyprus, Italy, Lithuania, and Poland. In 2019, the percentage of firms in Croatia was only 8.6%, with a sample population of 149. Similarly, in Cyprus, the percentage was only 2.6%, drawing from a sample of 80, while in Italy, the percentage was 4.5% with a sample population of 458. In Lithuania, the percentage was 8.8% based on a sample size of 128, and in Poland, the percentage was 12% from a sample group of 974. These percentages are

considerably lower than the average for all of Europe and Central Asia, which are 15.1% and 17.4%, respectively.

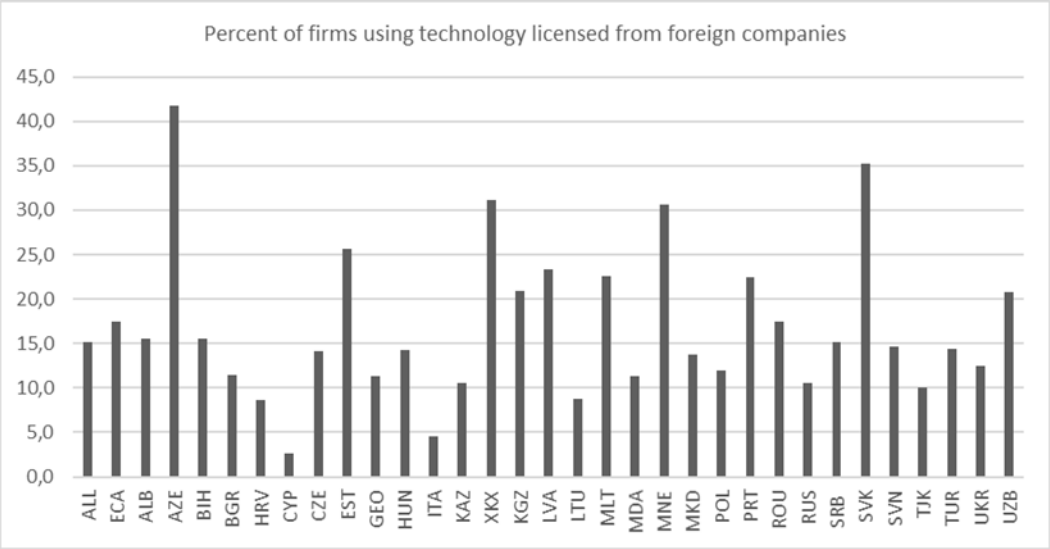

Figure 2. Percent of Firms Using Technology Licensed from Foreign Companies

Türkiye's percentage in 2019 was 14.4%, with a sample consisting of 1,063 companies. This falls just under the average for Europe and Central Asia, which was 17.4%, and slightly lower than the average for all countries in the dataset, which was 15.1%. This result is consistent with the OECD data from 2023, which reports that Türkiye lags behind other OECD countries in terms of innovation and technological development (OECD, 2023:43).

Although some nations have low percentages, it should be noted that the sample sizes are quite small. Therefore, the results should be interpreted cautiously, and further study may be necessary to gain a deeper understanding of how licensed technology from foreign companies is used in these nations.

3.2. Percent of Firms Having Their Own Web Site

The countries where the majority of businesses created their own websites in 2019 were the Czech Republic, with an average of 88.8%, Slovenia, with an average of 86.6%, and Slovakia, with an average of 83.7%. It is significant to notice that the sample sizes for these nations are, respectively, 502, 409, and 429. In comparison to these nations, the average for all nations is 51.8%, while the average for Europe and Central Asia is 68.9%. (Figure 3). As a result, the three aforementioned nations greatly outperform both the global average for all nations and the average for Europe and Central Asia. This suggests that the internet is widely used in these nations and that their digital economies are robust.

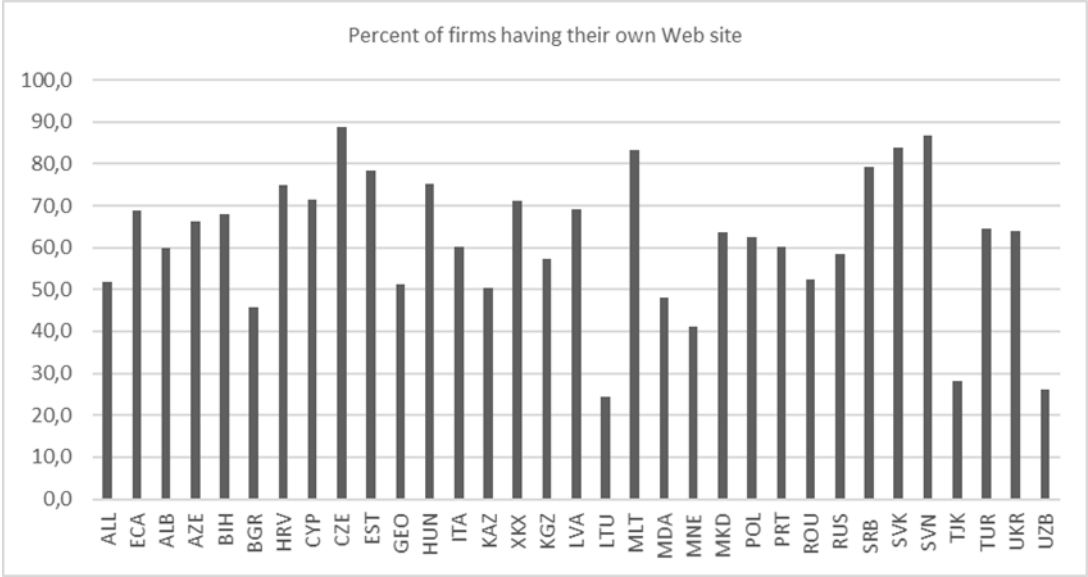

Figure 3. Percent of firms having their own web site

Moldova, Montenegro, Lithuania, and Uzbekistan have the lowest percentages, all of which are below 30%. These nations lag far behind in terms of web presence as compared to the regional average for Europe and Central Asia (68.9%). In fact, Moldova and Montenegro have percentages that are less than half that of the region as a whole, demonstrating a large digital gap between these nations and the rest of the area.

These nations continue to be far below the average, with Moldova and Montenegro once again having less than half the average percentage when compared to the global average of all nations (51.8%). This emphasizes how these nations, even on a global scale, have a low level of web presence among their businesses. It is crucial that these nations concentrate on enhancing their digital infrastructure and promoting internet usage as a means of fostering economic growth and development.

Türkiye has a rather high proportion, averaging 64.6% in 2019. This is greater than the global average of all nations (51.8%) but lower than the European and Central Asian average of 68.9%. With data obtained from 1,662 enterprises, the sample size for Türkiye is pretty substantial. This implies that having a website is becoming increasingly vital for firms in Türkiye, but there is still opportunity for development to catch up with some of the region's best performers.

3.3. Percent of Firms that Introduced a New Product/Service

Slovenia had the largest percentage of organizations that introduced product and service innovation in 2019, with an average of 60.2% and a sample of 404 firms, according to the statistics supplied. North Macedonia and the Kyrgyz Republic are close behind, with 45.6% and 45.3%, respectively (Figure 4). Both nations' sample sizes are 359 businesses. The nations with the highest percentages have much higher rates than the all-European and Central Asian averages of 36.4% and 36.9%, respectively. Interestingly, Slovenia (54.33 billion US dollars) and North Macedonia (12.61 billion US dollars) have higher percentages than Italy (2.01 trillion US dollars) and Russia (1.69 trillion US dollars), both of which have relatively lower overall GDPs in 2019. (The World Bank Group, 2023). This demonstrates that variables other than GDP can have an impact on a country's creativity and productivity.

Countries with the lowest percentages could be said to have a lower percentage than the average of all, as well as Europe and Central Asia. The countries with the lowest percentages are Italy, the Russian Federation, and Turkey, with average percentages of 12.1%, 9.9%, and 6.5%, respectively. Compared to the world's average, Italy and the Russian Federation have rates below a third of the average, while Turkey has less than a fifth of the average. Compared to the average for Europe and Central Asia, Italy has less than a third of the average, the Russian Federation is less than a quarter of the average, and Turkey is less than a sixth of the average.

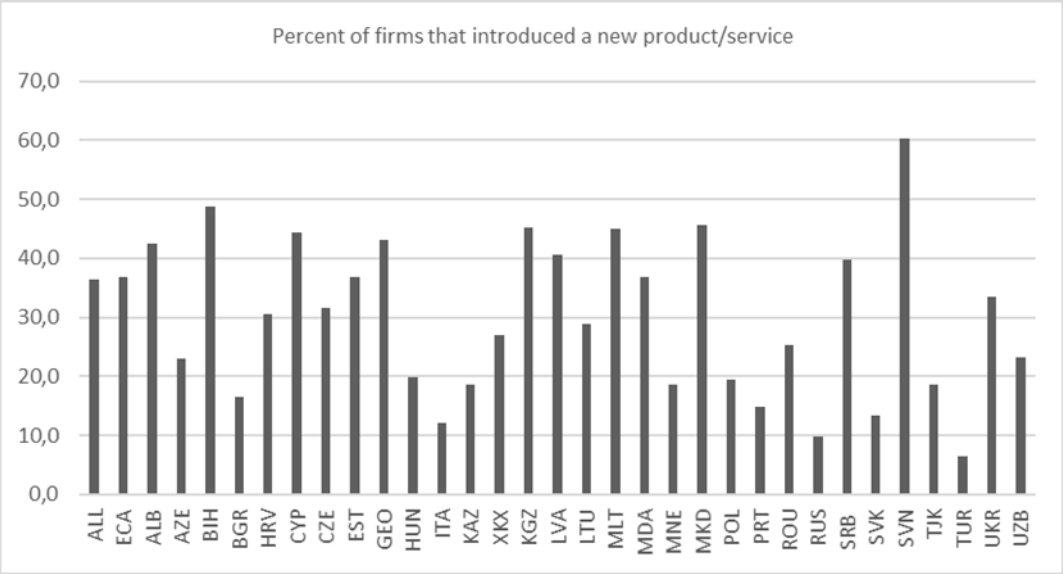

Figure 4. Percent of firms that introduced a new product/service

This suggests that these nations might be confronting difficulties as far as advancement and new item improvement compared with their local and worldwide counterparts. Nonetheless, it ought to be

underscored that there might be different variables adding to these lower rates, like contrasts in financial designs, government strategies, or economic situations, which would require further examination.

3.4. Percent of Firms Whose New Product/Service is Also New to the Main Market

Based on the data, Azerbaijan had the highest percentage, with an average of 90.7% in 2019, based on a sample size of 64. Kosovo had the second-highest percentage, with an average of 82.1% based on a sample size of 81. Other countries with high percentages include Tajikistan (77.8%), Georgia (73.9%), North Macedonia (74.5%), and Albania (71.7%). Comparing these countries with the regional averages, all countries had an average of 68.2%, and Europe and Central Asia had an average of 64.2% (Figure 5). Overall, Azerbaijan and Kosovo stand out as the countries with the highest percentages, with a significant lead over the rest of the countries in the dataset. Even though the sample sizes are relatively small, it is an interesting result that such emerging countries do well when compared to developed countries in the list. There could be several factors that could contribute to emerging countries doing well in terms of having a high percentage.

Figure 5. Percent of firms whose new product/service is also new to the main market

The countries with the lowest percentages are Montenegro, Portugal, and Croatia. Montenegro has the lowest percentage of 26.9% extracted from a limited sample of 45. In Portugal, the percentage was slightly higher at 43%, with a larger sample size of 253. Croatia had the third-lowest percentage at 41.4%, based on a select sample size of 141. When compared to the overall average of 68.2% and the Europe and Central Asia average of 64.2%, it appears that these three countries are struggling more than

others in their region and globally to introduce new products or services to the main market. However, it is worth noting that sample sizes vary greatly between countries, and caution should be taken when drawing broad conclusions from these figures alone.

The average percent in Türkiye is 56.4, with an example size of 129. Hence, Türkiye has a higher rate compared with certain countries in Europe and Central Asia, such as Croatia, Bulgaria, Portugal, Serbia, Lithuania, and Russia, yet it is lower than countries such as Tajikistan, North Macedonia, Kosovo, and Albania. Compared to the average for all, which is 68.2%, Türkiye has a lower rate. On the other hand, compared with the average for Europe and Central Asia, which is 64.2%, Türkiye has a marginally higher level of such.

3.5. Percent of Firms that Introduced a Process Innovation

Based on the provided dataset, the countries with the highest percentages of this variable are Slovenia (49.3%), Latvia (41.2%), Bosnia and Herzegovina (29%), Kyrgyz Republic (26.2%), and Serbia (25.3%). These countries have significantly higher percentages compared to the average for All (27.2%) and Europe and Central Asia (21.5%) (Figure 6). It is worth noting that the sample sizes for some of the countries are relatively small (e.g., Montenegro with N=150), which may affect the representativeness of the results. However, the findings suggest that these countries have a relatively high level of innovation activity among firms, particularly in terms of process innovation, which could be a positive indicator for their economic growth and competitiveness.

According to the dataset, Türkiye has the lowest percentage, with an average of only 2.3% based on a sample size of 1,644 firms. This is in stark contrast to the average for all countries, which was 27.2%, and for Europe and Central Asia, which was 21.5%. The low rate of process innovation in Türkiye could have implications for its economic growth and competitiveness, as Marceau says (2008:136) that process innovation is a key driver of productivity and efficiency improvements in firms. It may be worth exploring the factors behind Türkiye's low rate of process innovation, such as regulatory barriers or a lack of investment in R&D, in order to address this issue and promote economic growth in the country.

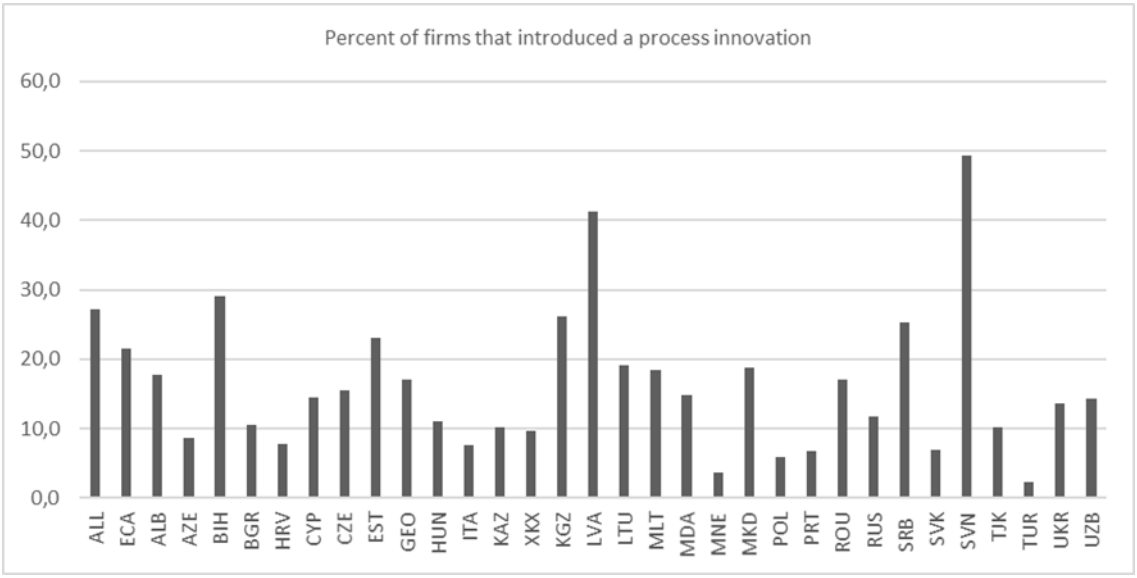

Figure 6. Percent of Firms that Introduced a Process Innovation

After Türkiye, Montenegro has one of the lowest percentages among the nations included in the dataset, with an average of 3.7% and a sample size of 150 enterprises. Poland has one of the lowest results, with an average of only 5.9 percent and a much larger sample size of 1,349. The countries with the lowest percentages have fewer than half of the overall average and less than one-third of the European and Central Asian average. This shows that these countries may have features that make it more difficult for enterprises to develop their processes.

3.6. Percent of Firms that Spend on R&D

The Czech Republic has the highest percentage of R&D spending, with an average of 41.3% and a sample size of 268. Slovenia has the second highest percentage, with an average of 39.4% and a sample size of 234. Estonia is also among the countries with the highest percentages, with an average of 27.3% in 2019 and a sample size of 197. Malta, North Macedonia, and Latvia also have high percentages, with averages of 24.7%, 20.1%, and 19.9%, respectively (Figure 7). When compared to the All and Europe and Central Asian averages, the Czech Republic, Slovenia, and Estonia have much higher percentages. The overall average is 20.3%, and the Europe and Central Asia average is 20%. This indicates that these countries are prioritizing R&D investments in their businesses and may be more innovative compared to the rest of the region.

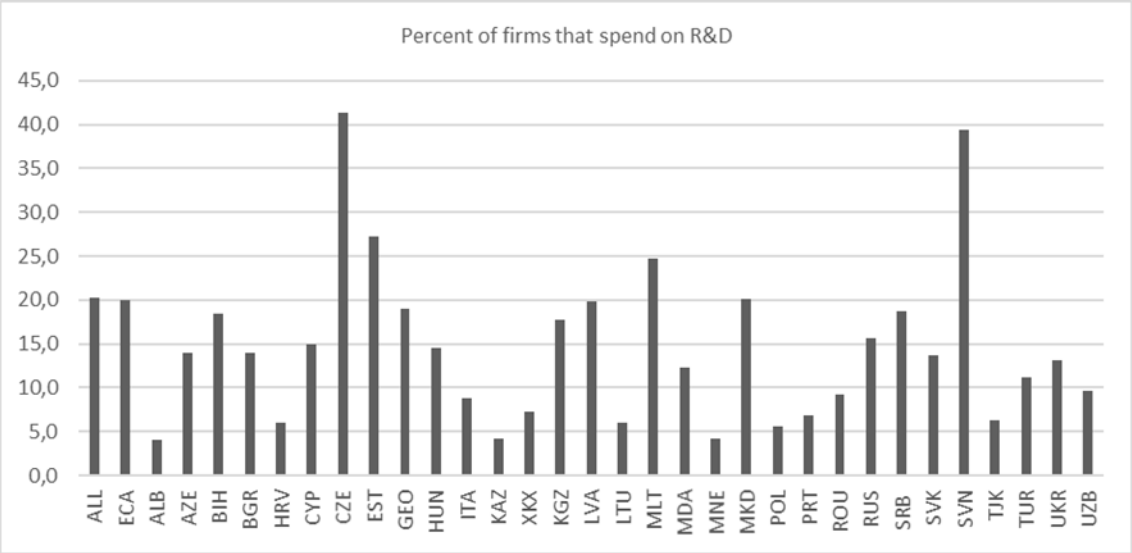

Figure 7. Percent of firms that spend on R&D

Based on the given dataset, the countries with the lowest percentages are Albania, Kazakhstan, and Montenegro. Albania ranks first on the list, with an average of 4% and a sample size of 211 firms. Kazakhstan and Montenegro both rank second lowest with an average of only 4.2% and a sample size of 719 and 81 firms, respectively. When comparing these countries with All (20.3%) and Europe and Central Asia (20%), it could be said that the countries mentioned above have significantly lower percentages of firms spending on R&D compared to the regional and global averages. This suggests that these countries may be lagging behind in terms of innovation and technological advancement, which could hinder their economic growth and competitiveness in the global market.

The average percentage in Türkiye is 11.2%, which is lower than the global average of 20.3%. It is also lower than the average for European and Central Asian nations, which is 20%. This shows that Türkiye lags below its regional peers and the world average in terms of R&D investment. The sample size for Türkiye is rather large (951 businesses), which lends confidence to the conclusions. Overall, the data shows that Türkiye has the capacity to raise corporate R&D investment in order to compete with its regional rivals and perhaps enhance its innovation performance.

3.7. Ranking Countries by Total Score

Lastly, a composite score has been computed by adding the results of each indicator for each country in order to identify the top three nations that scored the highest across all categories. One technique to perform this calculation is to weigh each indication according to its relevance before multiplying the score of each indicator by its weight. Yet, as there wasn't enough information on the

relative weighting of each indicator, it was presumed that they all carried equal weight. In such a situation, each country's composite score is just the sum of its ratings for all indicators (Appx. 1).

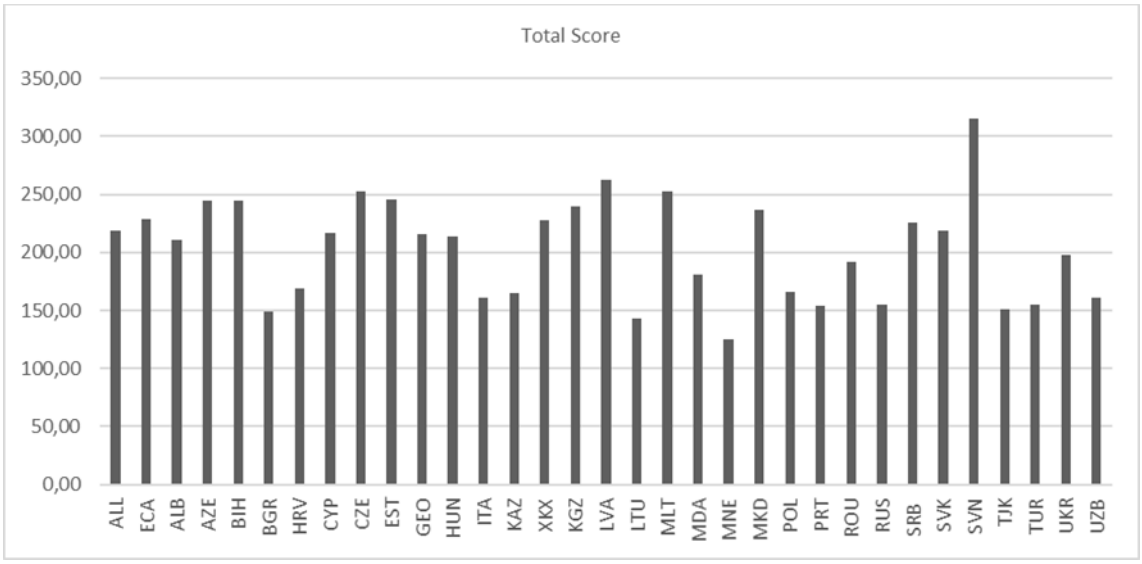

Figure 8. Countries by Total Score

Using this approach, therefore, Slovenia scored the highest among all countries with a total score of 315.70, followed by Latvia with a total score of 262.30 and the Czech Republic with a total score of 253. These top three countries were followed by Malta, Estonia, Bosnia and Herzegovina, and Azerbaijan, with total scores of 252.30, 245.70, 245.00, and 244.20, respectively (Figure 8). It is notable that this ranking is based on the assumption of equal weights for all indicators, and the results may change if different weights are used. On the other side, with the same calculation, the lowest-scoring countries were Montenegro with a score of 124.90, Lithuania with a score of 143.00, and Bulgaria with a score of 149.20.

CONCLUSIONS

Since organizational innovation and technology use are inevitable for organizations (Heidenreich and Talke, 2020:1), outlining the current situation of countries and companies would be very important. From that point of view, this comparative study is aimed at putting forth the current settings of European and Central Asian countries in terms of their companies' innovation behavior and technology use using the data obtained from the 2019 World Bank Enterprise Survey. Since it was the most comprehensive and latest dataset for the region, data from the year 2019 was utilized. Additionally, the study adhered to publication and research ethics.

Slovenia had the highest score among all countries, followed by Latvia and the Czech Republic. Montenegro, Lithuania, and Bulgaria had the lowest scores. It is worth noting that countries with relatively lower overall GDPs in 2019, such as Slovenia (54.33 billion US dollars), Latvia (34.34 billion US dollars), and Bosnia and Herzegovina (20.2 billion US dollars), have higher percentages than some wealthier countries, such as Italy (2.01 trillion US dollars), Portugal (239.99 billion US dollars), and Russia (1.69 trillion US dollars) (The World Bank Group, 2023). This shows that variables other than GDP may have a role in a country's creativity and productivity.

One possible reason for this situation is that emerging countries may have a greater demand for innovative goods and services due to a growing middle class and expanding consumer purchasing power. This might lead to a more competitive corporate environment in which firms are driven to innovate in order to keep up with changing client demands and separate themselves from competitors. Second, emerging markets may have less developed marketplaces and regulatory structures, creating opportunities for unique and ground-breaking goods and services to join the market. This may be especially true in areas such as finance or technology, where emerging nations may be keener to test out fresh ideas in terms of both goods and corporate structures. Finally, emerging nations may have a more risk-taking and entrepreneurial culture. This would foster the formation of more startups and small businesses, perhaps increasing the chance of the market launching novel and cutting-edge goods and services.

To put it briefly, a variety of economic, social, cultural, and political factors may have an impact on these outcomes. The particular causes of the greater percentages of organizational innovation or technology adoption in these nations would require additional investigation. It is advised that policymakers concentrate on initiatives that support innovation and financial investments in R&D. They ought to encourage and simplify access to money, technology, a highly qualified workforce, a welcoming business climate, and a culture that rewards risk-taking and creativity.

Limitations

The study has some limitations. First of all, in some cases, the small sample sizes may limit the estimates' accuracy. However, some nations have larger sample sizes than others, which may indicate that the data is more indicative of the country's general status. Conclusions concerning long-term trends in the variables studied are challenging because the data only extends until 2019, making them. The most closely related date ranges were chosen because research has not been done across all nations in the same time frame. As a result, various events that took place in various nations on various dates could have had an impact on the accuracy of the findings. The collection is based on self-reported data from businesses, which might contain biases and mistakes. Cross-country comparisons can be difficult since

data quality might differ between nations. The dataset may also contain missing data, which, if handled improperly, might result in biased estimations or inaccurate results.

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Appendix.1. Technology Use and Innovation Rates of European and Asian Countries in 2019

Economy	Average/SE/N	Percent of firms using technology licensed from foreign companies	Percent of firms having their own Web site	Percent of firms that introduced a new product/service	Percent of firms whose new product/service is also new to the main market	Percent of firms that introduced a process innovation	Percent of firms that spend on R&D	Total Score
All	Average	15.1	51.8	36.4	68.2	27.2	20.3	219.0
Europe & Central Asia	Average	17.4	68.9	36.9	64.2	21.5	20	228.9
Albania	Average	15.5	59.8	42.4	71.7	17.8	4	211.2
Albania	N	146	377	377	143	374	211	
Azerbaijan	Average	41.7	66.2	22.9	90.7	8.7	14	244.2
Azerbaijan	N	52	225	224	64	221	109	
Bosnia and Herzegovina	Average	15.6	68.1	48.7	65.2	29	18.4	245
Bosnia and Herzegovina	N	133	362	359	178	346	225	
Bulgaria	Average	11.4	45.7	16.6	51	10.5	14	149.2
Bulgaria	N	425	772	772	154	764	435	
Croatia	Average	8.6	74.9	30.5	41.4	7.8	6	169.2
Croatia	N	149	404	404	141	404	256	
Cyprus	Average	2.6	71.5	44.3	68.5	14.5	15	216.4
Cyprus	N	80	240	238	110	237	102	
Czech Republic	Average	14.1	88.8	31.6	61.7	15.5	41.3	253
Czech Republic	N	291	502	501	198	501	268	
Estonia	Average	25.6	78.3	36.8	54.6	23.1	27.3	245.7
Estonia	N	134	359	357	144	356	197	
Georgia	Average	11.3	51.2	43.2	73.9	17	19	215.6
Georgia	N	203	581	578	244	577	310	
Hungary	Average	14.2	75.1	19.8	79	11	14.5	213.6
Hungary	N	480	805	802	145	804	444	
Italy	Average	4.5	60.2	12.1	68.1	7.7	8.8	161.4
Italy	N	458	760	757	87	757	416	
Kazakhstan	Average	10.5	50.4	18.7	71.2	10.2	4.2	165.2
Kazakhstan	N	917	1,438	1,435	359	1,423	719	
Kosovo	Average	31.1	71	26.9	82.1	9.7	7.3	228.1
Kosovo	N	146	271	268	81	261	137	
Kyrgyz Republic	Average	20.9	57.2	45.3	72.6	26.2	17.7	239.9
Kyrgyz Republic	N	146	360	359	152	358	206	
Latvia	Average	23.3	69	40.7	68.2	41.2	19.9	262.3
Latvia	N	130	358	356	178	356	217	
Lithuania	Average	8.8	24.3	28.8	55.9	19.2	6	143
Lithuania	N	128	356	357	117	354	200	
Malta	Average	22.6	83.3	45.1	58.2	18.4	24.7	252.3
Malta	N	82	242	241	113	241	130	
Moldova	Average	11.3	48.1	36.8	57.7	14.8	12.3	181
Moldova	N	136	358	360	114	357	208	
Montenegro	Average	30.6	41	18.5	26.9	3.7	4.2	124.9
Montenegro	N	65	150	150	45	150	81	
North Macedonia	Average	13.7	63.5	45.6	74.5	18.8	20.1	236.2

North Macedonia	N	133	360	359	180	358	220	
Poland	Average	12	62.6	19.5	60.6	5.9	5.6	166.2
Poland	N	974	1,367	1,361	265	1,349	669	
Portugal	Average	22.5	60.1	14.9	43	6.7	6.8	154
Portugal	N	772	1,061	1,059	253	1,060	584	
Romania	Average	17.4	52.3	25.4	70.9	17.1	9.2	192.3
Romania	N	517	812	807	214	806	471	
Russian Federation	Average	10.5	58.5	9.9	48.3	11.8	15.7	154.7
Russian Federation	N	882	1,322	1,289	165	1,299	829	
Serbia	Average	15.2	79.1	39.8	47.2	25.3	18.7	225.3
Serbia	N	127	359	359	152	359	224	
Slovak Republic	Average	35.2	83.7	13.3	66.2	7	13.7	219.1
Slovak Republic	N	191	429	429	71	428	191	
Slovenia	Average	14.7	86.6	60.2	65.5	49.3	39.4	315.7
Slovenia	N	176	409	404	270	402	234	
Tajikistan	Average	10	28.2	18.6	77.8	10.2	6.3	151.1
Tajikistan	N	155	349	342	72	334	176	
Türkiye	Average	14.4	64.6	6.5	56.4	2.3	11.2	155.4
Türkiye	N	1,063	1,662	1,651	129	1,644	951	
Ukraine	Average	12.5	63.9	33.4	61.1	13.7	13.1	197.7
Ukraine	N	940	1,332	1,329	479	1,309	821	
Uzbekistan	Average	20.8	26.2	23.2	67.2	14.4	9.6	161.4
Uzbekistan	N	836	1,227	1,233	361	1,222	628	