

# Similarities of the V4 Countries Characterised by the Business Environment Quality and Megatrends

Mária Dolná<sup>1</sup>, Miroslava Barkóciiová<sup>1</sup>, Lenka Kuhnová<sup>1</sup>

<sup>1</sup> *University of economics in Bratislava, Slovakia*

**Abstract** – Every economy possesses its unique characteristics and forces forming and affecting that particular business environment. Despite the differences in conditions, quality and interventions in the business environment, there are similarities within the specified deviations. Based on these similarities, it is possible to determine the common lines of countries within which their business environments and trends develop over time. The paper focuses on finding that lines through the division of the countries of the V4 into clusters according to indicators of the business environment quality and selected megatrends over time. Using cluster analysis performed in SPSS Statistics 26 for the chosen period from 2011 to 2022, countries are divided into clusters based on indicators of economic environment and megatrends. For the purpose of this study the index of economic freedom, change in economic power, lack of resources, technological breakthrough, social changes, and rapid urbanization. Based on the results of the cluster analysis, the degree of similarity of the economies represented by the quality of the business environment and selected global trends is identified during the monitored period, and vice versa the degree of differences within selected subjects is identified.

**Keywords** – Business environment, cluster analysis, megatrends, V4.

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**Corresponding author:** Mária Dolná,  
University of Economics in Bratislava, Faculty of Business  
Economy with seat in Košice  
**Email:** maria.dolna@euba.sk

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## 1. Introduction

The level and quality of the business environment establishes the basis for the competitiveness of every global market economy. In an ever-changing community of nations formed also by long-scale, transformative processes with significant impact – megatrends – it is inevitable to search for similarities, but as well to formulate differences and distances between economies to foresee and create future opportunities for policy makers and potential investors, furthermore to react to arising challenges.

## 2. Literature Review

In spite of their comparatively close geographical proximity and shared historical and cultural identity among V4 countries, notable distinctions exist in the formation of socio-economic factors within the Visegrad group [1]. The Czech Republic is acknowledged as the most competitive nation and possesses the best business conditions, attributed to a high level of trade, financial freedom, and property rights. Poland benefits from effective corruption management and a favorable market size, coupled with substantial domestic demand and a commendable level of education. The Slovak Republic faces negative impacts due to shortcomings such as a high level of corruption and bureaucracy, government functionality issues, tax burden rates, frequent changes in tax laws, and alterations in business conditions. Despite these challenges, Slovakia holds a notably elevated position in terms of attractiveness for foreign direct investment when compared to other V4 countries. Finally, Hungary lags behind in the transparency of the political system, inadequate tax regulation, education levels, and corruption rates [2]. On a global scale, Slovak entrepreneurs exhibit higher skepticism compared to their Czech counterparts [3].

## 2.1. Global Trends Influencing V4 Countries

V4 nations exhibit a semi-peripheral stance within the world-system. Geopolitically, V4 countries navigated a delicate equilibrium between reliance on Russia for energy and raw materials and economic integration with Western nations. The reliance on raw materials from the East was accompanied by a corresponding dependence on technology and investment from the West, leading to the emergence of what is termed as dependent capitalism in the V4 region [4]. One of the paramount elements exerting a noteworthy influence on the socio-economic advancement of economies is the availability of affordable energy [5]. Furthermore, energy constitutes the foundation of the global economy and a crucial component for both economic expansion and alleviation of poverty. Consequently, guaranteeing energy security is intricately linked with the attainment of sustainable development [6]. It also represents a crucial factor and the origin of interdependence in international relations [7].

Despite sharing common objectives in ensuring energy security, the V4 countries hold divergent perspectives on the implementation of EU energy and climate policy goals. The Czech Republic has attained a high level of energy security, credited to its fuel mix composition and the lowest reliance on imported energy sources among the Visegrad nations. Additionally, the Czech Republic boasts the most favorable net trade balance for energy products. Slovakia has achieved a moderate level, reaching a warning level. Hungary has reached a warning level, demonstrating a higher degree of energy mix diversification compared to other Visegrad countries, coupled with elevated dependence on imported energy sources and low transformation and distribution losses. In contrast, Poland has reached a hazardous level and a warning level [8].

The situation in Poland illustrates a scenario of limited domestic production, a consistent rise in demand, and an increasing share in the national composition of primary energy consumption. Consequently, there is a continuous surge in oil imports to Poland. Given its significance as the most vital imported mineral for the Polish economy, it is understandably the primary objective of Polish energy policy to extensively vary the sources of oil imports [9]. Without such diversification, Poland remains reliant on global oil price trends and factors associated with crude oil sales on the worldwide markets [10]. Among the V4 group, Poland is acknowledged to possess the most challenging and environmentally burdensome energy mix, while Slovakia boasts the most favorable one, primarily dominated by nuclear power [11].

The V4 nations present a notably distinct outlook on population aging, with the trend intensifying across all of them. By 2050, there will be a substantial rise in the old-age dependency ratio across all EU member states, surpassing the average in most V4 countries, except for Hungary, where it will range from 51 to 55 elderly persons per 100 working-age individuals. Consequently, these countries, particularly Slovakia and Poland, are poised to be among those experiencing the most rapid growth in old-age dependency ratio. Projections from EUROPOP2018 confirm that population aging will escalate in the V4 nations in the forthcoming decades. The population of individuals aged 65 and above could surge by 892,000 (a 42% increase) in the Czech Republic, 606,000 (a 67% increase) in Slovakia, 605,000 (a 38% increase) in Hungary, and 3.44 million (almost 50%) in Poland by 2050. The most substantial shifts are expected in Slovakia [12]. Disparities between regions have recently widened in Slovakia, slightly expanded in Poland, and diminished in the Czech Republic and Hungary [13].

Regarding the extent of digital inequality among individual countries, it is apparent that while the V4 nations exhibit relative homogeneity in terms of socioeconomic disparities, their levels of digital inequality vary. Hungary, for instance, displays somewhat greater inequality compared to the more egalitarian Czech Republic [14]. The Czech Republic holds the top position among V4 countries in terms of competitiveness in technological readiness, whereas Poland is identified as the most lagging nation [15]. Examining the Internet usage among the 65+ age group reveals significant differences over time and across countries. For example, in the United States, 58% of this age group were internet users in 2015, while only 28.4% were in the Czech Republic. In 2005, the Internet usage among the elderly was 28% in the United States but merely 2.2% in the Czech Republic [16]. By 2020, Denmark recorded the highest proportion (94%) of individuals aged 65-74 who had used the Internet in the last three months, contrasting starkly with Bulgaria's 25%. Slovakia reached 58%, while Czechia and Hungary were at 53% and Poland at 43% [17].

Three decades post the demise of socialism in Central and Eastern Europe (CEE), the region remains a fertile ground for understanding the evolution of urban spatial structures amidst profound shifts in political and social frameworks [18]. Poland serves as a prime example with its relatively permissive land use policies. In the east, regions exhibit lower population densities, lesser urbanization, greater dispersion, and higher density, wherein cities and city regions display traits of both convergent adaptation and path-dependency.

They showcase typical features of capitalist urbanization while retaining remnants of the socialist era [19]. Economic growth drives energy consumption and urbanization levels, while urbanization, in turn, influences energy consumption and contributes to short-term economic growth. Hence, it is imperative to formulate appropriate urban development policies and sustainable energy consumption strategies for long-term socio-economic stability [20].

### 3. Methodology

The subjects of the study are the V4 member countries within the period from 2011 to 2022. The total sample consisted of 48 individual values due to the business environment evaluation of each country separately for each year. For the analysis, we used selected indicators, and the data for these indicators were primarily obtained from the Eurostat and Heritage Foundation databases – providing relevant data for the V4 countries covering chosen variables for the study.

The cluster analysis was chosen as the analytical tool, which was subsequently implemented in the statistical software SPSS Statistics 26. This method of analysis provides us with a comprehensive overview of countries that share similar characteristics in the business environment. To determine the distance between individual points in our analysis, we used Euclidean distance, which is expressed using the following formula:

$$d = \sqrt{x^2 + y^2}$$

Based on the average linkage (between groups), the distance between individual clusters was calculated, thus the average of all combinations of distances was obtained. The paper focuses on finding that lines through the division of the V4 countries into clusters according to indicators of the business environment quality and selected megatrends over time.

According Malik and Janowska [21] 5 megatrends were generalised representing overall economic and social challenges: M1 – Shifting Economic Power, M2 – Resource Scarcity, M3 – Technological Breakthrough, M4: Social Change, M5 – Rapid Urbanization and variable BE – Business Environment Quality to evaluate the status of business environment of chosen economies. For the purpose of this study the Index of Economic Freedom is used. In the same way, measurable indicators are chosen for individual megatrends: M1 - Change in economic power as Real GDP per Capita, M2 - Lack of resources as Material Import Dependency, M3 - Technological breakthrough as Internet Use and Activities, M4 - Social changes as Old Age Dependency Ratio, M5 - Rapid urbanization as Distribution of Population by Housing Cost Burden and Degree of Urbanization. We obtained all necessary data from the Eurostat and Heritage Foundation databases.

Table 1. Variables representing 5 megatrends and business environment quality

Phenomenon	Indicator	Explanation	
Megatrends	<b>M1: Shifting Economic Power</b>	Real GDP per Capita (euro per capita)	The monetary worth of all finished goods and services produced within a country's borders divided by its population.
	<b>M2: Resource Scarcity</b>	Material Import Dependency (% of imports)	The import-to-material-input ratio, expressed as a percentage, indicates the degree of reliance an economy has on imported goods compared to domestically sourced materials.
	<b>M3: Technological Breakthrough</b>	Internet Use and Activities (% of individuals)	The Internet usage metric encompasses participation in online courses, regardless of the subject matter.
	<b>M4: Social Change</b>	Old Age Dependency Ratio (Ratio 1 <sup>st</sup> variant)	The old-age dependency ratio is calculated as the proportion of individuals aged 65 and above to those aged 15 to 64, expressed per 100 individuals of working age (15-64).
	<b>M5: Rapid Urbanization</b>	Distribution of Population by Housing Cost Burden and Degree of Urbanization (%)	The proportion of the population residing in households where housing expenses account for more than 40% of the total disposable household income, categorized by the level of urbanization.
Business Environment	<b>BE: Business Environment Quality</b>	Index of Economic Freedom (score)	The index evaluates economic freedom through analysis of 12 quantitative and qualitative factors, organized into four main categories, also referred to as pillars, of economic freedom.

Source: Own processing Eurostat 2023 and Heritage Foundation 2022

#### 4. Results and Discussion

In the scope of our research, we used cluster analysis to categorize countries based on their characteristics. Subsequently, four clearly defined

clusters were deduced, which were further visualized in the following dendrogram. These clusters consist of countries with similar characteristics depicting their changes over the observed period from 2011 to 2022.

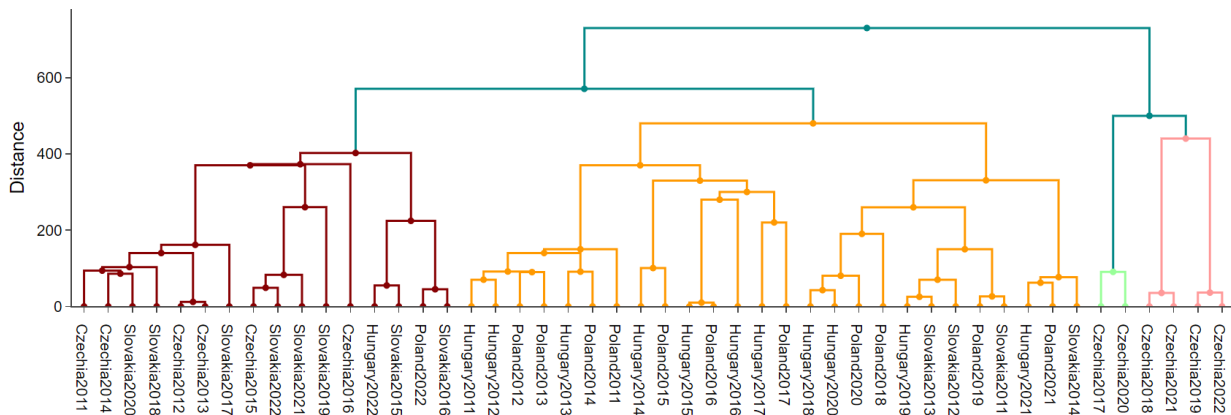


Figure 1. Dendrogram of clusters

On the dendrogram of the cluster analysis, we visually identified four clusters of countries over time to which we assigned colours. The red one for cluster no. 1, orange for cluster no. 2, green for

cluster no. 3, and pink for cluster no. 4. For explanation and better understanding of features and characteristics of the clusters see Table 6

Table 2. Average linkage (between groups)

		IEF	GDP	MID	IUaA	OADR	DoU
1	Mean	68.581	15401.25	30.675	5.3931	24.694	28.906
	Std. Deviation	2.7130	728.998	16.2350	5.08984	3.1792	10.6804
2	Mean	74.033	17971.67	27.333	8.8583	30.650	31.917
	Std. Deviation	0.5391	457.883	13.4101	7.19328	1.4335	3.9620
3	Mean	66.721	10732.86	23.143	2.3193	23.671	32.493
	Std. Deviation	1.4792	724.764	6.4838	1.91133	2.8086	5.0606
4	Mean	67.667	13153.33	30.058	4.9392	24.975	20.375
	Std. Deviation	1.4537	418.858	10.5245	4.86937	5.2697	5.6876
Total	Mean	68.492	13798.96	27.906	4.8163	25.210	28.196
	Std. Deviation	2.9172	2526.205	12.3043	4.93887	4.0882	8.7055

Source: Own processing

One of the key aspects consists in determining the distances between individual clusters. These distances were calculated based on the average linkage method, providing us with information about how the different groups of countries differ from or resemble each other.

When evaluating the results, we took into account all the calculated distances between the cluster groups. The purpose was to compare these distances and to analyse their averages. Wherefore we obtained valuable insights into the relationships and similarities between the different clusters of countries, which allowed us to understand better the results of performed cluster analysis. The findings pertaining to the mean values of different indicators within each cluster are articulated in Table 2, offering in-depth insights regarding the distinctive characteristics and attributes of each cluster

Table 3. Final cluster centers

	Clusters number			
	1	2	3	4
IEF	74.0	68.6	67.6	66.7
GDP	17972	15401	12976	10537
MID	27.3	30.7	29.2	23.0
IUaA	8.86	5.39	4.80	2.05
OADR	30.6	24.7	25.1	23.3
DoU	31.9	28.9	21.1	33.6

Source: Own processing

In Table 3, the average values of various indicators for each cluster are provided. It is evident that the lowest average values for the IEF, GDP, MID, IUaA, and OADR indicators were observed in the case of cluster number 4.

This result is likely related to the diversity among the different clusters, as clusters 1, 2, and 3 include all the V4 group countries, while cluster number 4 consists of only the Czech Republic in the years 2018, 2019, 2021, and 2022. This suggests that, concerning the selected indicators, the business environment in the Czech Republic in these specific years exhibited significant similarities compared to the other countries within the V4 group.

Table 4. Distances between final cluster centers

Cluster	1	2	3	4
1		2570.436	4995.973	7435.012
2	2570.436		2425.549	4864.593
3	4995.973	2425.549		2439.090
4	7435.012	4864.593	2439.090	

Source: Own processing

Table 5. ANOVA results

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
IEF	78.676	4	3.726	48	21.115	0.000
GDP	94248393.353	4	390801.542	48	241.167	0.000
MID	145.965	4	151.766	48	0.962	0.419
IUaA	65.062	4	21.620	48	3.009	0.040
OADR	75.616	4	12.697	48	5.955	0.002
DoU	380.064	4	55.040	48	6.905	0.001

Source: Own processing

A crucial factor that deserves our attention is statistical significance, which indicates whether the differences in the values of individual indicators between clusters are statistically significant if the significance level is less than 0.05. The results tell us that, besides one case, the differences in indicator values are statistically significant.

It should be noted that this analysis is based on ANOVA analysis, and the results of F-tests are for descriptive purpose only. The reason for this is that the clusters were created to maximize the differences between cases in different clusters. The significance levels obtained are not adjusted for this specific situation, and it is therefore not appropriate to interpret them as tests of hypotheses about the equality of means between clusters.

Table 6. Clusters

Cluster	Countries	Years	Count
1	Czechia	2011 – 2016	16
	Slovakia	2015 – 2022	
	Hungary	2022	
	Poland	2022	
2	Hungary	2011 – 2021	26
	Poland	2011 – 2021	
	Slovakia	2011 – 2014	
3	Czechia	2017, 2020	2
4	Czechia	2018, 2019, 2021, 2022	4

Source: Own processing

The analysis of Table 4 allows us to observe that clusters no. 3 and no. 4 show a significant similarity, while a similar situation is observed between clusters no. 1 and no. 2. On the contrary, clusters no. 1 and no. 4 seem to be the least similar. These findings suggest that if we were working with fewer clusters, we would likely observe a gradual merging of clusters no. 2, no. 3, and no. 4 into a larger cluster. Firstly, would merge clusters no 2 and no 3, followed by later accession of cluster no 4.

Based on the table created from the dendrogram of cluster analysis, we can observe that the business environment in the Czech Republic during the period from 2011 to 2016 and in Slovakia during the period from 2015 to 2022 shows significant similarities within selected indicators related to megatrends and the quality of the business environment. Cluster no. 1 also included Hungary and Poland in the year 2022.

Cluster no. 2 included Hungary and Poland during almost the whole period (from 2011 to 2021) and Slovakia during the period from 2011 to 2014. An interesting fact is that the Czech business environment was mostly similar within the years 2017 and 2020, forming cluster no. 3. cluster no. 4, on the other hand, exclusively consisted of the Czech business environment at the end of observed period (in the years 2018, 2019, 2021, and 2022).

Based on these findings, the business environment in the Czech Republic seem to be fluctuating as it over the monitored period was categorized in the three different clusters with quite different centre values relevant to them. In contrast, the business environment in Hungary and Poland report during the monitored period the least fluctuating nature as they were assigned just in one cluster from 2011 to 2021 (with exception of the final year of research – 2022).

The business environment in Slovakia also shows slight changes during the observed period, indicating its transition leading it to cluster no.1 in 2015, bringing it than closer to the Czech business environment. From 2011 to 2014, the business environment in Slovakia reports similarities more towards Hungary and Poland.

## 5. Conclusion

The cluster analysis of the business environments and megatrends in the V4 member countries for the period from 2011 to 2022 has provided valuable insights into the similarities and differences among this grouping. It is evident that the Czech Republic, Slovakia, Hungary, and Poland exhibited varying degrees of resemblance and evolution in their business environments.

The Czech Republic, in particular, showed significant changes over the years, transitioning through three distinct clusters. On the other hand, Hungary and Poland appear to maintain more stable business environments, as they remain in a single cluster from 2011 to 2021.

Slovakia's business environment showed moderate fluctuations, with its transition to cluster no. 1 in 2015 indicating increasing similarities with the Czech Republic. These findings highlight the dynamic nature of the business environments in these countries, which may have implications for policy makers and businesses operating in the V4 region. Further analysis and exploration of the reasons behind these trends would provide deeper insights into the evolving economic landscapes of these nations.

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## References:

- [1]. Hungler, S. (2022). Divergent we fall: The challenges for welfare state - Social integration and unemployment policies in the Visegrad Countries. *Hungarian Journal of Legal Studies*, 62(3), 195-218. Doi: 10.1556/2052.2022.00339
- [2]. Galánková, V. (2020). Competitiveness of V4 Countries Using the Global Competitiveness Index. In *SHS Web of Conferences*, 74, 06007. EDP Sciences.
- [3]. Bélas, J., Gavurová, B., Čepel, M., & Kubák, M. (2020). Evaluation of economic potential of business environment development by comparing sector differences: perspective of SMEs in the Czech Republic and Slovakia. *Oeconomia Copernicana*. 11, 135-159.
- [4]. Žuk, P., Buzogány, A., Mišík, M., Osička, J., & Szulecki, K. (2023). Semi-peripheries in the world-system? The Visegrad group countries in the geopolitical order of energy and raw materials after the war in Ukraine. *Resources Policy*, 85, 104046. Doi: 10.1016/j.resourpol.2023.104046
- [5]. Fuso Nerini, F., Tomei, J., To, L.S. et al. (2018). Mapping synergies and trade-offs between energy and the Sustainable Development Goals. *Nat Energy*, 3, 10–15. Doi: 10.1038/s41560-017-0036-5
- [6]. Proskuryakova L. (2018). Updating energy security and environmental policy: Energy security theories revisited. *Journal of environmental management*, 223, 203–214. Doi: 10.1016/j.jenvman.2018.06.016
- [7]. Le, T., & Nguyen, C.P. (2019). Is energy security a driver for economic growth? Evidence from a global sample. *Energy Policy*, 129, 436-451. Doi: 10.1016/j.enpol.2019.02.038
- [8]. Brodny, J., & Tutak, M. (2021). The comparative assessment of sustainable energy security in the Visegrad countries. A 10-year perspective. *Journal of Cleaner Production*, 317, 128427. Doi: 10.1016/j.jclepro.2021.128427
- [9]. Kamyk, J., Kot-Niewiadomska, A., & Galos, K. (2021). The criticality of crude oil for energy security: A case of Poland. *Energy*, 220.
- [10]. Olkusi, T., Szurlej, A., Tora, B., & Karpiński, M. (2019). Polish energy security in the oil sector. *E3S Web of Conferences*, 108, 02015. Doi: 10.1051/e3sconf/201910802015
- [11]. Brożyna, J., Strielkowski, W., & Zpěvák, A. (2023). Evaluating the Chances of Implementing the “Fit for 55” Green Transition Package in the V4 Countries. *Energies*, 16, 2764. Doi: 10.3390/en16062764
- [12]. Šídlo, Luděk & Šprocha, Branislav & Ďurček, Pavol. (2020). Prospective Dimension of Population Ageing and Potential Use in Pension Security in the V4 Countries. *Ekonomický časopis*, 68, 601-621.
- [13]. Dehnel, G., Gołata, E., & Walesiak, M. (2020). Assessment of changes in population ageing in regions of the V4 countries with application of multidimensional scaling. *Argumenta Oeconomica*, (44). Doi: 10.15611/aoe.2020.1.04
- [14]. Vallušová, A., Kuráková, I., & Lacová, Ž. (2022). Digital Inequality and Usage Gap in the V4 Region. *E&M Economics and Management*, 25(4), 164–179. Doi: 10.15240/tul/001/2022-4-011
- [15]. Kuncová, M., & Doucek, P. (2018). Comparison of ICT Development in V4 Countries. *Konference Hradec Economic Days 2018*, 513-522. Doi: 10.36689/uhk/hed/2018-01-050
- [16]. Svobodová, L., & Černá, M. (2017). Benefits and Pitfalls in Utilization of the Internet by Elderly People. *IFIP International Conference on e-Business, e-Services, and e-Society*, 135-146. Doi: 10.1007/978-3-319-68557-1\_13
- [17]. Eurostat. (2023). *How popular is internet use among older people?* Eurostat. Retrieved from: <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20210517-1#:~:text=In%202020%2C%20Denmark%20recorded%20the%20highest%20share> [accessed: 14 October 2023].

- [18]. Sýkora, L., & Stanilov, K. (2014). The challenge of postsocialist suburbanization. *Confronting suburbanization: Urban decentralization in postsocialist central and eastern Europe*, 1-32. Doi: 10.1002/9781118295861.ch1.
- [19]. Taubenböck, H., Gerten, C., Rusche, K., Siedentop, S., & Wurm, M. (2019). Patterns of Eastern European urbanisation in the mirror of Western trends – Convergent, unique or hybrid? *Environment and Planning B: Urban Analytics and City Science*, 46, 1206 - 1225. Doi: 10.1177/2399808319846902.
- [20]. Myszczyzyn, J., & Suproń, B. (2022). Relationship among Economic Growth, Energy Consumption, CO2 Emission, and Urbanization: An Econometric Perspective Analysis. *Energies*. 15, 9647. Doi: 10.3390/en15249647.
- [21]. Malik, J., & Janowska, A. (2018). Megatrends and their use in economic analyses of contemporary challenges in the world economy. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, (523), 201-220. Doi: 10.15611/pn.2018.523.18.