THE FIELD OF ACTIVITY AND INNOVATION – AN EMPIRICAL ANALYSIS IN EAST EUROPEAN COUNTRIES

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Abstract: *The current business environment is characterized by high competition between companies as well as global challenges and growing technological progress. Businesses must constantly adapt to changes in the business environment, changes in the market environment and the constantly changing requirements of customers. **T**he purpose of this article is to point out the major gaps across eight former communist East-European countries in what regards the innovation: Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia. In order to compare the trends in hat regards innovation in Eastern European countries we have first collected data for four innovation indicators for each East European country, separately for each field of activity. We have computed variation coefficients that revealed the fields of activity with the highest and/or lowest gaps across selected countries. Our conclusion is that Eastern Europe is increasingly becoming a hotspot for innovation, with countries in the region making significant progress in various aspects of innovation-driven development. By leveraging their strengths, addressing challenges, and capitalizing on opportunities, Eastern European countries can further enhance their innovation performance, competitiveness, and sustainable growth in the global innovation landscape.*

Keywords: *innovation, field of activity, OSLO manual, product innovation, Eastern Europe*

JEL Classification: *O30, Q55, O32*

1. Literature review

The concept of innovation is not novel, yet we continue to encounter diversity and challenges in comprehending its essence. This diversity persists even in attempts to define, classify, measure and propose policies as concern both innovation and innovation activities (Bielińska-Dusza & Hamerska, 2021). The field of innovation research predominantly draws upon the overarching theory of entrepreneurship, strategic management principles, and theories of institutional and endogenous growth (Shane, 2003), (Song, 2016), (Costa, et al., 2016), (Mei, et al., 2019). Despite the breadth of theoretical frameworks utilized, there remains a notable gap in empirical studies that delve into microdata analysis within specific business sectors, particularly at the more granular 2–3 digit NACE levels. A study by Vokoun and Dvouletý (Vokoun & Dvouletý, 2022) has shed some light exactly in these specific NACE levels, their results support the idea according to which sectoral variables significantly influence firm innovation.
In order to fully grasp and attain the full benefits of developing a company based or focused on innovation, one starting point would be to understand the notion itself. Numerous definitions have been proposed for the concept of innovation over the years; in order to

provide a unified understanding, we will differentiate between “innovation activities” (referring here to the process), as opposed to simple “innovation” (referring here to the outcomes) (OECD/EUROSTAT, 2018). From an academic perspective, the factors that manage to influence innovation within individual firms are mostly rooted in Schumpeter's influential research, which emphasizes two key hypotheses: (1) larger firms demonstrate a greater propensity for innovation compared to smaller firms, and (2) industries characterized by higher concentration are more likely to exhibit elevated levels of innovative endeavors(Schumpeter, 2003).The major general approaches to innovation within a business ecosystem revolve around the following aspects: product innovation, process innovation, business model innovation, technological innovation, open innovation, disruptive innovation.

Assisted by the framework already established by the 2018 Oslo Manual for measuring scientific, technological and innovation activities, the following definitions shall be used: “An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)” (OECD/EUROSTAT, 2018); “Innovation activities include all developmental, financial and commercial activities undertaken by a firm that are intended to result in an innovation for the firm, whereas a business innovation is a new or improved product or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm”(OECD/EUROSTAT, 2018). As can be taken from the analysis of the 2018 Oslo Manual, in a business setting, we can usually differentiate between product innovation (referring here both to goods and services), business process innovation (included here we enumerate production, distribution, logistics, and IT&C), organizational (referring here both administration and management) and marketing (including sales and after-sales support). We can thus observe that innovation is rooted in the functional areas of businesses.

The major activities that businesses can leverage in their favor in order to attain innovation outputs and results, of relevance to the innovation, are: the development of experimental R&D activities; engineering, design, and other creative work activities; marketing and brand equity activities; IP-related activities; employee training activities; software development and database activities; activities related to the acquisition or lease of tangible assets; innovation management activities (OECD/EUROSTAT, 2018). Apart from these activities that have as a result a specific type of innovative output, an observation that can be made refers precisely to how innovation can be measured throughout various ecosystems, either regional, national, and/or international. As such, there is a need to properly comprehend the spread, the use and the weight of various indicators that are used in order to effectively measure innovation. The existence of a multitude of companies that perform from an innovation perspective implies the existence of a multitude of indicators that have the potential to measure this innovation performance. For this purpose, guidance is provided by the Oslo Manual: “Innovation indicators can be constructed from multiple data sources, including some that were not explicitly designed to support the statistical measurement of innovation. Relevant sources for constructing innovation indicators include innovation and related surveys, administrative data, trade publications, the Internet, etc.” (OECD/EUROSTAT, 2018). Among the sought-after properties of such indicators, we mention relevance, validity, precision, chronology, authenticity, equivalence, and ease of use. In this sense, it is imperative, for business and for researchers as well, to understand the impact that R&D activities have had over the years; R&D bearing activities are included within the innovation activity of businesses, but even so, in order for such endeavors to be deemed as bearing innovation outputs, certain criteria must be met. As according to the Frascati Manual description, R&D undertakings must satisfy five specific criteria: (i) novelty; (ii) creativity; (iii) addressing uncertain outcomes; (iv) methodical approach; and (v) potential for transferability and/or reproducibility(OECD, 2015). Of the previously mentioned criteria,

creativity is the one that is most closely related to the sources "that were not explicitly designed to support the measurement of innovation" as per the Oslo Manual. Such criteria can be thought of as being the sources for company innovation: unforeseen events, disparities, operational requirements, and shifts in industry and market dynamics(Drucker, 2002).

Innovation, even though desired, exists at the intersection of interests manifested by both the business environment and legal authorities (regional or national authorities) (Sehleanu et al, 2021). The primary motives driving companies to engage in research and innovation efforts include the desire to enhance profitability and solidify their strength within the market (Harhoff, 2000). The notion according to which innovation is meant to be seen as the primary driver of global economic advancement during times of crisis has gained widespread acceptance; a noteworthy group of enterprises that manifest such resilience during hardship or economic turmoil are enterprises that manifest innovative performances (Archibugi & Filippetti, 2013), (Wenzel, et al., 2020). Such an example of hardship has been manifested during the recent pandemic; at the same time, this period has also unfolded a particular way in which enterprises have managed to stay above competitors: innovation led through the use of digitalization.

Research indicates a significant relationship between the business sector (categorized by NACE codes - the Statistical Classification of Economic Activities in the European Community) and the extent of business innovation. According to a study conducted by the European Commission, specific sectors, including information and communication technologies (ICT), manufacturing, and healthcare, demonstrate higher levels of innovation compared to others (Hollanders, et al., 2020). This association is ascribed to various factors like competitive intensity, technological progress, and market demand inherent to each sector, all influencing the inclination for innovation among businesses operating within them. Similarly, research carried out by the Organization for Economic Co-operation and Development (OECD) highlightsthat sectors characterized by high-tech manufacturing NACE codes (example here can include the aerospace, pharmaceuticals, and biotechnology sectors), consistently surpass other sectors in innovation activities and performance (OECD, 2019). This underscores the significance of research and development (R&D) endeavors and technological advancements in fostering innovation within these industries(OECD, 2019).

Industries falling under NACE codes associated with information technology and digital services typically showcase heightened levels of innovation when compared to traditional sectors. This phenomenon can be attributed to the innate flexibility, rapid pace of evolution, and intense competition prevalent in these fields. An investigation conducted by the World Intellectual Property Organization (WIPO) has shed light on the correlation between specific NACE codes and patent activity, a pivotal gauge of innovation. Sectors like electronics, automotive, and renewable energy, categorized under distinct NACE codes, have been identified as significant contributors to global patent filings, indicating a robust association between industry sectors and innovative output(World Intellectual Property Organization (WIPO), 2022).While the WIPO report concentrates on innovation trends within technology-driven and research-intensive sectors, it does not imply exclusivity to these industries alone. For instance, Rydvalová and Pittnerová(Rydvalová & Pittnerová, 2013)scrutinized the innovative performances of businesses within the glass and jewelry sector in the Czech Republic. Their analysis disclosed a predominant emphasis on marketing innovation among these entities, with a majority relying on internal resources for innovation initiatives. Nonetheless, the study underscored a generally low level of overall innovative capacity among the surveyed firms. Moreover, it was noted that many companies prioritized tackling immediate challenges over investing in forward-looking development, including innovation endeavors.

Apart from internal business-specific benefits, tailoring the activities of a business through the development of innovation-lead strategies can increase the likelihood of the ability to

adjust to market dynamics, which in turn will favor the existence of satisfied customers (Pazilov, et al., 2020). Another notable research endeavor is the Norwegian Innovation Survey for 2013 levels, an independent inquiry conducted by Statistics Norway as part of the Community Innovation Survey (CIS) during one of its intermediary years. This comprehensive survey provides insights into innovation activities within the Norwegian business sector during 2013, examining the extent to which companies have implemented product or process innovations between 2011 and 2013; apart from aspects pertaining to employment (minimum 5 enterprises) and data that is analyzed for multiple industries and sectors, the study does point to the predominance of innovation within specific industries and fields of activity (NACE codes F41–F43, H49–H53, and I56, and further expanded within the manufacturing sector, specifically, NACE codes C10-C33) (Hashi & Stojčić, 2013).The previous studies highlight an important reality that currently unfolds: not only enterprises/SME's operating within the ICT industry (NACE Code 62 Information technology services) are prone to manifest an innovative activity. Even so, extensive research for the scope of the importance of ICT across various industries has highlighted that resources allocated towards ICT can facilitate a higher productivity and competition, overall reduction 0of costs and customer satisfaction (Añón Higón & Bonvin, 2022). Even though desired, such outcome stemming from the use of ICT for company development showcase the importance of constant investments for ICT related activities, as part of company and industry specific efforts to increase innovation performance and activities.

Another facet regarding innovation refers to types of businesses under analysis; we distinguish here between industrial enterprises and service enterprise. The Polish Central Statistical Office has developed and spread out a number of surveys during 2011-2018 (on a two year basis: 2011-2013, 2014-2016, 2016-2018, andby using NACE divisions); thesehave highlighted the most innovative active industrial enterprises and service SME's within the country. If during 2011-2013 notable activity was observed in divisions such as the manufacture of coke and refined petroleum products, pharmaceutical products, computer, electronic, and optical products, chemicals and chemical products, as well as mining of coal and lignite, during the 2014-2016 time period, mining of coal and lignite, manufacture of pharmaceutical products, computer, electronic, and optical products, chemicals and chemical products, and manufacture of coke and refined petroleum products dominated the industrial landscape. In a similar manner, during the years 2016-2018, compelling industrial activity was present in the manufacturing sector of pharmaceutical products, computer, electronic, and optical products, mining of coal and lignite, manufacture of electrical equipment, and manufacture of coke and refined petroleum products. In respect to service enterprises, during the 2011-2013 period, most innovation was noted in sectors encompassing insurance, reinsurance, and pension funding activities, scientific R&D, computer programming and consultancy activities, financial service activities, and information service activities. In the 2013-2016 period, similar innovation trends have been observed in divisions such as insurance, reinsurance, and pension funding, scientific R&D, computer programming and consultancy activities, financial service activities, and publishing activities. The final analyzed period, 2016-2018, highlights intensified innovation activities within the following areas: scientific R&D, insurance, reinsurance, and pension funding, computer programming and consultancy activities, information service activities, and publishing activities (Bielińska-Dusza & Hamerska, 2021), (GUS, 2014), (GUS, 2018), (GUS, 2020). Activities within specific industries exhibit diversity, showcasing the presence of a certain heterogeneity. This diversity may be based in various factors such as technological advancements, market demands, and regulatory frameworks, contributing to the unique innovation landscapes of each sector.

2. Romanian national and regional context

Countries boasting robust innovation ecosystems often draw greater investment, generate high-quality employment opportunities, and maintain advantageous trade balances (European Commission, 2016) (Wensheng, et al., 2022). As per the 2022 dataset released by the National Institute of Statistics, it is discerned that 10.7% of the active enterprises within Romania exhibit characteristics of innovation (Romanian National Institute of Statistics, 2023). Furthermore, findings from the private entity ROTSA indicate the presence of approximately 500 startups currently operating within the Romanian domain (ROTSA, 2021). Worthy of mentioning is the prominence of the fintech, automation, and marketing sectors within the startup landscape (largely focused on R&D intensity and widespread use of technology), representing 35.2%, 35.2%, and 14.2% of total employees respectively. These following sectors also stand out for developing startups with the highest revenue figures, namely Automation (38.1%), Fintech (31.8%), and Marketing (12.1%). Additionally, Romania's standing in the Global Innovation Index (GII) is noteworthy, positioning itself 49th out of 132 economies surveyed and 31st among the 39 European states evaluated (World Intellectual Property Organization (WIPO), 2022).

Table 1. Share of innovation active enterprises by NACE Rev. 2 activity and size class in 2016, 2018 and 2020

Country\Year	2020	2018	2016
Bulgaria	36.2	30.1	59.8
Czechia	56.9	46.8	72.4
Croatia	54.9	52.5	72.2
Hungary	32.7	28.7	61.5
Poland	34.9	23.7	58.8
Romania	**10.7**	**14.6**	**23.1**
Slovenia	55.2	48.6	66.9
Slovakia	36.6	30.5	66.6

Source: own elaboration by authors based on information from EUROSTAT database for the years 2016, 2018 and 2020 (EUROSTAT, 2023)

Out of 28,776 SME's in 2016-2018, 4,198 of them are focused on innovation. Manufacturing accounted for 94.7%, with relatively small shares in the remaining sectors: water distribution, sanitation, waste management and cleaning services 3.1%, electricity generation and supply and thermal energy, gas, water a it is heating and air conditioning 1.6%, and the mining industry 0.6%. IT&C (39.8%) accounted for the largest share of innovation in service sector activities, followed by general trade (21.4%), transportation and warehousing (16.8%), professional, scientific and technical activities (15.9%), and financial intermediation and insurance (6%). Out of the total of 4,198 innovative enterprises, 1,836 enterprises innovated only products, and 2,843 enterprises innovated products (regardless of other types of innovations). In the industrial sector, 1,222 SME's introduced only new or significantly improved products, and 1,755 SME's innovated introduced innovated product. In the service sector, 614 SME's introduced new or significantly improved products (Romanian National Institute of Statistics, 2020).
Data from the Community Innovation Survey results from the EUROSTAT databaseon innovation activities of enterprises(by NACE Rev. 2 activity and size class)make it possible to observe the imbalances that exist between various European nations concerning innovation activities(EUROSTAT, 2023). The following table highlights the evolution of innovation-active enterprises in three for 2016, 2018 and 2020 levels.

Concerning Romania, a sharp decline in the share of innovative firms can be noticed. From 2016 to 2020, there has been a negative evolution. Between 2016 and 2018, the Bucharest-Ilfov region has had the highest share of innovative enterprises, representing 25.5% of the total, followed closely by the North-West region at 21.1%. Conversely, the South-West Oltenia region and the West region recorded the lowest proportions, each at 4.4% and 4.0% respectively. The North-West region has had the highest percentage of enterprises solely innovating in products, reaching 11.0%, while the West and South-West Oltenia regions had the lowest proportions, both at 2.0%. In terms of combined product and/or business process innovation, the North-West region led with 6.1%, contrasting with the West region's mere 1.3%. At the same time, the North-West region exhibited the highest proportions of innovative SME's introducing new products for internal use (3.7%), while the South-West Oltenia region showcased the highest proportions of innovative SME's introducing new products to the market (1.6%). Innovative activities within the North-West area include R&D (64.1%), IT&C activities (62.1%), beverage manufacturing (52.5%), manufacturing of motor vehicles, trailers, and semi-trailers (41.7%), and computer service activities (41.7%). It is noteworthy that certain regions attract higher levels of innovative activities in SME's, such as the Centre region, where both metallic ore extraction and petroleum product manufacturing score 100%(Romanian National Institute of Statistics, 2020).

3. Methodology

The purpose of this article is to point out the major gaps across eight former communist East-European countries in what regards the innovation: Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia. In our opinion it is relevant to compare countries with similar background before the 90's and that are part of the European Union at the moment. We have used data collected from OECD website and they refer to deviations (differences) of industry-country indicators with respect to the overall country-specific average. The collected indicators are: Innovative firms as percentage of total firms (product/business process - Oslo Manual 2018), Innovation-active firms (innovative enterprises as well as firms with innovation activities that have not necessarily led to an innovation), as a percentage of total firms, Product innovative firms (innovation of services), as a percentage of total firms, Business process innovative firms, as a percentage of total firms. The reference years are presented below:

Table 2. Reference years for the empirical research

BGR	Eurostat Community Innovation Survey 2020 and National Innovation Survey	2018-20	3
HRV	Eurostat Community Innovation Survey 2020 and National Innovation Survey	2018-20	3
HUN	Eurostat Community Innovation Survey 2020 and National Innovation Survey	2018-20	3
POL	Eurostat Community Innovation Survey 2020 and National Innovation Survey	2018-20	3
ROU	Eurostat Community Innovation Survey 2020	2018-20	3
SVK	Eurostat Community Innovation Survey 2020 and National Innovation Survey	2018-20	3
SVN	Eurostat Community Innovation Survey 2020	2018-20	3

All the data collected refer to 2018-2020, as seen above.

4. Results

In order to compare the trends in hat regards innovation in Eastern European countries we have first collected data for four variables: Innovative firms (product/process), as a percentage of total firms (IF), Innovation-active firms (innovative enterprises (INN_OSLO) as well as firms with innovation activities that have not necessarily led to an innovation), as a percentage of total firms (IAF), Product innovative firms (innovation of services), as a percentage of total firms (PIF), Business process innovative firms, as a percentage of total firms (BIF).
Since the data are extremely heterogenous, the only statistical method that could be used as the computation of Pearson's variation coefficient, which is computed as a ratio beteen the standard deviation of the values and the average value.This coefficient indicated if the values are homogenous or not and if the average value is representative for the sample.
In case the values are above 0.4, the indicator is heterogeneous for the selected field of industry. The highest gaps between the selected countries in what regards the Innovative firms (product/process), as a percentage of total firms (IF) is in Warehousing & spt act. for transportation, postal activities whilst the lowest gap is in the manufacturing of transportation equipment.

Table 3. Field of activity-related variation coefficients for Eastern European Countries

Indicators / Field of activity	IF	IAF	PIF	BIF
Warehousing & spt act. for trans., postal act.	0,688	0,53	0,769	0,559
Trans. & storage	0,628	0,607	0,889	0,639
Mining & quarrying	0,627	0,555	0,421	0,671
M. of textiles, leather & related pdts	0,553	0,483	0,506	0,68
Wholesale trade, excl. motor veh. & mtrcl.	0,521	0,496	0,625	0,614
Manufacturing	0,477	0,47	0,542	0,616
Electricity, gas, steam & ac. supply	0,473	0,264	0,482	0,477
M.of food, beverages & tobacco pdts	0,471	0,519	0,508	0,599
Sc. research & dev.	0,471	0,102	0,518	0,466
M. of furniture & other pdts.; eqpt. repair & install	0,458	0,42	0,525	0,559
Land trans. & via pipelines, water, air trans.	0,439	0,415	0,655	0,428
Professional, scientific and technical activities	0,429	0,338	0,48	0,479
M. of computer, electronic & optical pdts.	0,418	0,344	0,463	0,481
Information & communication	0,393	0,364	0,43	0,488
Water coll., treat. & supply	0,369	0,323	0,679	0,384
Advertising & market research	0,352	0,259	0,632	0,382
M. of basic metals	0,34	0,288	0,426	0,392
Architectural, engineering, technical testing act.	0,338	0,285	0,366	0,396
Water supply & waste mgmt	0,332	0,249	0,576	0,343
Sewerage, waste mgmt, remediation act.	0,316	0,215	0,588	0,298
M. of rubber & plastic pdts.	0,315	0,27	0,42	0,337
Financial & insurance act.	0,311	0,264	0,326	0,286
M. of other non-metallic mineral pdts.	0,308	0,287	0,552	0,61
M. of wood, paper, printing & rep.	0,29	0,248	0,405	0,332
M. of fabricated metal pdts., except machinery eqpt.	0,287	0,245	0,431	0,316
M. of basic pharmaceut. pdts. & preparations	0,268	0,188	0,353	0,3
M. of electrical eqpt.	0,259	0,213	0,22	0,295
Publishing & content act.	0,234	0,197	0,204	0,45

M. of machinery & eqpt n.e.c	0,232	0,177	0,253	0,267
ICT Services	0,227	0,386	0,5	0,482
M. of transport eqpt.	0,226	0,167	0,227	0,298

Source: own elaboration by authors based on information from OECD database

In what regards the innovation-active firms (innovative enterprises (INN_OSLO) as well as firms with innovation activities that have not necessarily led to an innovation), the highest gap is in the transportation and storage field of activity. The same field of activity has the highest gap in East European product innovative firms (innovation of services). The business process innovative firms have the highest heterogeneity in the manufacturing of textiles, leather & related products.

Conclusions and discussions

In recent years, Eastern Europe has been making significant strides in innovation, driven by a combination of factors such as economic development, investment in education and research, entrepreneurial spirit, and supportive policies and initiatives. While Eastern European countries vary in their innovation performance and capacity, several countries in the region have emerged as innovation leaders and hubs. Here's an overview of innovation in Eastern Europe:

1. Global Innovation Index (GII): Eastern European countries have been making progress in the Global Innovation Index rankings. Countries like Slovenia, Czech Republic, and Poland have been recognized for their innovation performance and are among the top-ranked countries in the region.
2. Startup Ecosystem: Cities like Prague (Czech Republic), Budapest (Hungary), and Warsaw (Poland) have vibrant and growing startup ecosystems. These cities host numerous startups, incubators, accelerators, and co-working spaces, attracting both local and international entrepreneurs, investors, and talent.
3. Educational and Research Institutions: Eastern European countries have been investing in education, research, and development. Countries like Czech Republic, and Hungary have strong educational systems and universities that produce skilled graduates and researchers in science, technology, engineering, and mathematics (STEM) fields.
4. Technological Infrastructure and Digitalization: Eastern European countries are embracing digitalization and advanced technologies, with increasing internet penetration, ICT infrastructure development, and adoption of digital technologies in various sectors.
5. Government Support and Policies: Governments in Eastern Europe are implementing policies, programs, and initiatives to promote innovation, entrepreneurship, and digital transformation. Supportive regulatory frameworks, tax incentives, grants, and funding opportunities are available to encourage innovation and R&D activities.
6. Collaboration and Partnerships: Eastern European countries are fostering collaborations and partnerships between academia, industry, research institutions, and international organizations to promote knowledge exchange, technology transfer, and innovation-driven growth.
7. Focus on Specific Sectors: Eastern European countries are focusing on specific sectors and industries to drive innovation and economic growth. For example, Hungary and Czech Republic are focusing on automotive, manufacturing, and engineering industries.

8. Challenges and Opportunities: Despite progress, Eastern European countries face challenges such as limited access to finance, talent retention, brain drain, and bureaucratic hurdles. However, these challenges also present opportunities for innovation, collaboration, and growth.

In conclusion, Eastern Europe is increasingly becoming a hotspot for innovation, with countries in the region making significant progress in various aspects of innovation-driven development. By leveraging their strengths, addressing challenges, and capitalizing on opportunities, Eastern European countries can further enhance their innovation performance, competitiveness, and sustainable growth in the global innovation landscape.

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