CHAPTER 1

The impact of internationalization on technological development and innovation of enterprises in Central and Eastern Europe

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Abstract

The process of internationalization has become one of the key drivers of technological development and innovation in enterprises in Central and Eastern Europe (CEE). The integration of the region's economies into global value chains and international markets has enabled companies to gain access to new knowledge, technologies, and financial resources, which has accelerated the development of their innovative capabilities. At the same time, enterprises in the region face challenges related to the adaptation of foreign technologies, limited research and development infrastructure, and the necessity of balancing local and global strategies. This chapter aims to analyze the impact of internationalization on the technological development and innovation performance of enterprises in Central and Eastern Europe, with a particular focus on a specially developed innovation assessment index that evaluates enterprises across both regional and sectoral (SIC/NACE) contexts.

Keywords

Internationalization, CEE, technological development, innovation.

1.1 Introduction

Contemporary economies increasingly rely on innovation, knowledge, and technology, which are key determinants of growth and competitiveness. In particular, in the countries of Central and Eastern Europe, the internationalization of enterprises has become highly significant, acting as a catalyst for technological development and innovation. The accession of most of these countries to the European Union, along with the process of integration into the global economy, has opened new opportunities for market expansion, knowledge and capital transfer, and the development of

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international supply networks. The internationalization of enterprises is an important aspect of international business, as companies operating in foreign markets are often associated with better business performance.

1.2 Internationalization of enterprises – essence and significance

Contemporary enterprises seeking new markets often decide to pursue foreign expansion. Extending operations into new markets allows companies to reach new customers and increase revenues. Firms frequently diversify risk, thereby reducing dependence on domestic market conditions. Moving business activities abroad is not only a necessity to access new markets but also a means to enhance efficiency and optimize costs by locating production and services where it is most profitable. Another important aspect is building a global brand by strengthening the company's competitive position and prestige. Additionally, the transfer of technology and knowledge fosters innovation and enhances organizational competencies. Thus, internationalization is not merely a response to changing economic conditions but increasingly a deliberate strategic decision that supports sustainable growth and strengthens a company's competitive position in both domestic and international markets.

The pioneers of internationalization, such as J. Johanson and J. Vahlne [1], J. Johanson et al. [2], and J. Calof and P. Beamish [3], perceive internationalization as a process of increasing a firm's international engagement and adapting its activities to the specifics of a given environment. In general terms, the internationalization of a company should be understood as any form and scope of its various activities (e.g., production, marketing, sales, and distribution) connected to foreign markets [4]. For comparison, P. Pietrasieński [5] views internationalization as "a process based on exporting products and increasingly on relocating their production to other countries". M. Strzyżewska [6], on the other hand, emphasizes the spatial aspect, arguing that internationalization involves "the geographical expansion of a company's operations, which consequently leads to the globalization of these activities". M. Gorynia [7] asserts that internationalization occurs whenever at least one product or service is linked to a foreign market. According to M. Witek-Hajduk [8], the process of internationalization is synonymous with globalization and involves forming connections between different links of a company's value chain and foreign markets, aimed at acquiring or engaging resources.

The most commonly used criterion for classifying forms of internationalization is the degree and scope of a company's resource commitment abroad, as well as the

level of managerial involvement [9]. According to K. Witczyńska [9], three stages of the internationalization process can be distinguished:

– the domestic stage;
– the stage of passive internationalization;
– the stage of active internationalization.

The domestic stage is the phase in which the enterprise does not engage in any foreign activities; however, it takes steps to gather the necessary resources (capital, knowledge, or experience) that would play a key role in the future internationalization process. The stage of passive internationalization is the phase in which the enterprise engages indirectly in foreign activities, using forms such as licensing or franchise agreements with other companies. Undoubtedly, this type of activity allows the acquisition of appropriate resources, competencies, and experience that may be useful when deciding to move to higher forms of internationalization. The final stage, mentioned by K. Witczyńska, is the stage of active internationalization.

The enterprise begins to directly conduct activities beyond its national borders, utilizing active forms of international expansion, such as foreign investments or establishing subsidiaries. Entities that previously did not engage in passive forms of internationalization often start using them at this stage as well, in order to supplement resources and strengthen their competitive position. A similar classification of internationalization forms is presented by L. Welch and R. Luostarinen [10], who consider the internationalization process as the enterprise's involvement in economic activity, encompassing both internal forms (e.g., import, licensing, franchising) and external forms (e.g., export or foreign direct investment).

The literature on international business highlights several theoretical approaches that help explain why, how, and how frequently firms decide to allocate resources to activities outside their home country. It is therefore worth noting several models in the context of enterprise internationalization.

One of the fundamental models of internationalization in the literature is the Uppsala model, regarded as a key framework for explaining internationalization processes and the mechanisms of foreign direct investment. This model assumes that firms enter foreign markets gradually, progressing through successive stages of expansion as their knowledge and experience increase [11]. This sequential path of internationalization is primarily driven by a low initial level of knowledge about the international environment, risk aversion, and significant uncertainty associated with operating in foreign markets [12].

Another concept explaining the internationalization process is the network approach. Unlike classical theories, it assumes that internationalization does not follow a linear or predictable path, but rather results from the firm's dynamic

responses to stimuli from its environment. As emphasized by M. Gorynia and S. Hollensen [7, 13], contemporary enterprises increasingly engage in foreign markets, bypassing classical, stage-based expansion models. Instead of gradually expanding their international presence – starting with exports or licensing agreements – firms increasingly opt for foreign direct investment as the initial step in the internationalization process.

The pace and manner in which companies engage in foreign markets – whether through passive means (e.g., export, import, licensing) or active means (e.g., foreign direct investment) – result from strategic decisions made by the enterprises. The choice of internationalization path is influenced by numerous external factors, such as the macroeconomic situation, trade policies and legal regulations, cultural and social conditions, international competition, and access to new markets and resources. Equally important are internal conditions, including the adopted development strategy, availability of capital and resources, experience in international trade, staff competencies, level of innovativeness, and the need to diversify operations [14].

In contemporary practice, the desirable model is the *born global* model. *Born global* organizations are defined as enterprises that, within three years of their establishment, have undertaken export activities accounting for at least 25% of their sales and have been operating in the market for no longer than 20 years [15]. These companies typically belong to the small and medium-sized enterprise (SME) sector, most often in the high-tech industry [16]. Modern definitions no longer emphasize quantitative indicators characterizing these enterprises but highlight the conditions and factors influencing their accelerated internationalization process. **Table 1.1** presents the main characteristics of *born global* firms.

Born global enterprises, by definition, undergo rapid globalization of their operations without the need for prolonged prior presence in the domestic or foreign market. These firms are characterized by small size and fast growth. It is also important to note their limited resources, informal and flat organizational structure, and the dominant role of the owner [18]. They challenge classical theories of internationalization, which describe a gradual process of a company becoming international. Therefore, if a firm actively exports to foreign markets shortly after its establishment, it should be classified as a born global. Born global enterprises begin their international activities at the time of their founding or within a few years thereafter. A key feature of this model is a high share of foreign sales relative to total revenue and engagement in large foreign markets. When the activities are more diversified and go beyond exporting, the term "startup" is more appropriate to describe the nature of these operations [19].

Table 1.1 Characteristics of born global firms

Author	Characteristics
G. Baronchelli, G. Cassia (2010)	The development of born global firms depends on five key factors: the dynamism of the company in niche industries, markets, and segments; the knowledge possessed by the founder/managers; innovative products and the company's innovativeness; and access to networks
M. Gabrielson at al. (2008)	SMEs with accelerated internationalization potential and a global market vision are characterized by three development phases: the introductory phase, the growth and resources accumulation phase, and the break-out phase
E. S. Rasmussen, T. K. Madsen, F. Evangelista (2005)	These firms are oriented toward the international market immediately after their establishment and usually possess small, unique resources. They have a high share of foreign sales (almost 70%)
O. Moen, P. Servais (2002)	Firms engage in exporting from the moment of their establishment
R. Wickramasekera, G. Bamberry (2001)	Enterprises classified as SMEs, characterized by an accelerated internationalization process based on the entrepreneur's knowledge and experience in the international market
S. Freeman, R. Edwards, B. Schroder (2006)	Small enterprises, employing fewer than 100 employees and engaging in internationalization within the first two years

Source: [17]

1.3 Technological development and innovation of enterprises

Technological development and business innovation influence competitiveness in today's market. Technological progress primarily involves the introduction of new production technologies, IT systems, process automation, and the development of products or services based on the latest technical solutions. Business innovation, on the other hand, is the ability to design and create new products or services, as well as to develop processes or business models that contribute to increasing added value and gaining a competitive advantage. Companies that invest in research and development (R&D) and in digital technologies (such as artificial intelligence, Big Data, or the Internet of Things – IoT) are more resilient to changing environments and can adapt more quickly to customer needs, while also expanding their operations in international markets.

Technological progress and the ability of enterprises to implement innovations are fundamental determinants of their long-term competitive advantage. In conditions of intense market dynamics and rapid technological development, innovation becomes a strategic factor determining their adaptive capacity and growth [20]. Technological development can be perceived as a continuous process of improving

and implementing innovative technical solutions, encompassing new or significantly enhanced products, processes, management systems, and infrastructure. Its sources include both internal research and development activities within the enterprise, as well as collaboration with the scientific sector, acquisition of external technologies, and participation in technological cooperation networks.

The concept of innovation was introduced into economic sciences by J. A. Schumpeter [21] and, according to him, refers to the introduction of a new product or a new production method, the opening of a new market, the acquisition of a new source of raw materials or semi-finished goods, or the implementation of a new organization in an industry. According to E. Mazur-Wierzbicka [22], the fundamental types of innovation include:

– technological innovations (usually occurring within the product, referred to as product innovations, or within the production process, referred to as process innovations);

– non-technological innovations (typically including organizational and marketing innovations).

Product innovations generally involve introducing new goods or services to the market or significantly improving existing ones, which in turn brings new benefits to customers and substantially enhances existing solutions. Process innovations, on the other hand, concern the introduction of new or the improvement of existing production methods, for example through the use of robots on the production line. Another classification of innovations was presented by M. Dolińska [23], who, in the context of enterprises, categorizes innovations based on their origin, area of application, or the originality of the solutions. Additionally, eco-innovations should be mentioned, which aim to reduce the negative impact on the natural environment [24].

The innovativeness of enterprises constitutes an important element of competitiveness in the context of internationalization, access to global economic networks, and cross-border cooperation, which facilitates the transfer of knowledge and technology. These activities contribute to the acceleration of innovation development. European enterprises, including companies from Central and Eastern Europe, take advantage of these opportunities by investing in human capital and modern technologies, which translates into increased competitiveness and market efficiency.

1.4 Characteristics of the Central and Eastern Europe region

Central and Eastern Europe (CEE) is an economic region that includes countries located east of Germany and north of the Balkans. Most of the countries in this

region underwent political and economic transformation following the collapse of the Eastern Bloc in the late 1980s and early 1990s. The area is diverse in terms of economic development, infrastructure quality, and degree of integration with the European Union [25]. Countries in the region include Poland, the Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Lithuania, Latvia, Estonia, Slovenia, Croatia, other Baltic states, and parts of the Balkans.

Central and Eastern Europe (CEE) plays a key role in the technological and innovative development of the entire European Union. The region is dynamically advancing in terms of technology and innovation, although it still lags behind the more technologically advanced countries of Western Europe. This progress results from increasing investments in research and development, the rapid growth of technology start-ups, and intensified collaboration between companies and scientific institutions.

Enterprises are increasingly engaging in activities abroad within CEE countries, thereby boosting investments in innovation and technological development. Economic growth and GDP growth rates undoubtedly influence the innovation capacity of a country's economy. This is evidenced by the dynamic development of technology and innovation, especially in companies with foreign capital. CEE countries often serve as significant destinations for foreign direct investment. Between 2004 and 2023, economic growth in CEE countries was on average twice as fast as in the EU as a whole.

The economic growth trends in selected EU member states are as follows in **Fig. 1.1**.

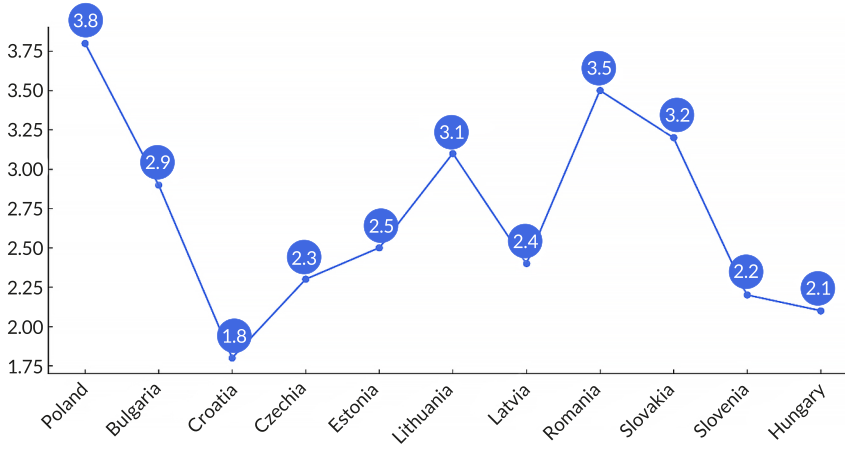

Fig. 1.1 GDP per capita (EU-28 = 100) in the years 2004–2023
Source: based on [26]

Among the 11 Central and Eastern European countries between 2004 and 2023, Poland achieved the fastest growth (3.8%). For the other countries, the growth rates were: Bulgaria (2.9%), Croatia (1.8%), Czech Republic (2.3%), Estonia (2.5%), Lithuania (3.1%), Latvia (2.4%), Romania (3.5%), Slovakia (3.2%), Slovenia (2.2%), and Hungary (2.1%).

The faster development of Central and Eastern European countries was primarily due to the "catch-up effect" and the accumulation of the following factors:

– lower starting point – growth from a lower baseline statistically results in a higher percentage rate, even if absolute increases are smaller;

– integration with the European Union – EU accession opened access to the common market, removed trade barriers, and facilitated the inflow of foreign investments;

– influx of foreign capital – multinational corporations relocated production and services to CEE countries due to lower labor costs, geographical location, and increasing workforce qualifications;

– structural reforms and privatization – economic liberalization, privatization of state-owned enterprises, and the development of the private sector significantly enhanced efficiency and innovation.

It is worth noting the value of foreign direct investment (FDI) in the years 1990–2022 (**Fig 1.2**).

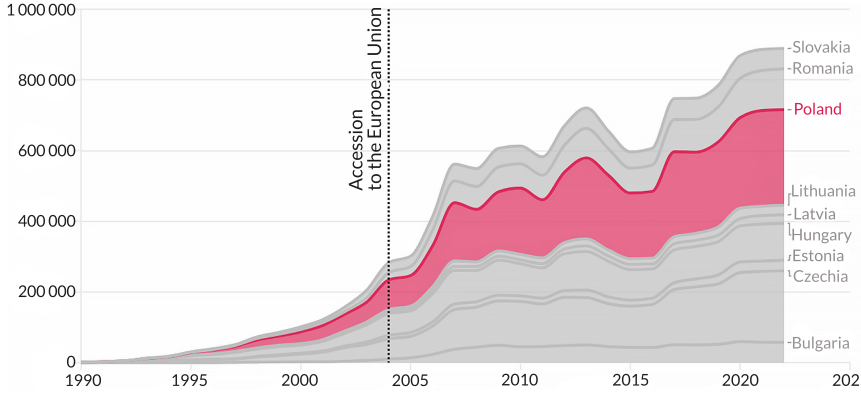

Fig. 1.2 Value of FDI in million USD in the years 1990–2022
Source: [27]

The growth of FDI between 1990 and 2022 was 334-fold. The accession of the above-mentioned countries to the European Union had a significant impact on accelerating this process, as evidenced by the sharp increase in investment after joining

in 2004. These investments contributed to export growth and the modernization of industry. There is no doubt that dynamic economic growth was made possible thanks to numerous reforms and the inflow of foreign direct investment (FDI). It is worth emphasizing that the CEE region has also increased its share in global merchandise trade over the years. Here too, growth is evident – from less than 1.5% in 1993 to over 4.8% in 2023. For comparison, in 1993, exports from all CEE countries accounted for just under 6% of Western Europe's merchandise exports, while in 2023, this share had risen to over 25%.

1.5 The impact of internationalization on technological development and innovation of enterprises in Central and Eastern Europe

Innovation and technological advancement in enterprises in Central and Eastern Europe (CEE) are key factors in their ability to compete and adapt to rapidly changing economic conditions. This region, which includes countries such as Poland, the Czech Republic, Hungary, Slovakia, Bulgaria, and Romania, has undergone a profound transformation – from centrally planned economies to modern, dynamically developing markets.

It is worth highlighting the actively innovative enterprises in the countries of Central and Eastern Europe. According to the Community Innovation Survey (CIS), 51% of all enterprises in the EU declared engaging in some form of innovation activity between 2020 and 2022 (**Fig. 1.3**). The CIS covers reporting on product and process innovations in enterprises operating within the EU. The latest CIS data indicate that the highest share of enterprises undertaking innovation activities was recorded in Belgium (70%), Greece (66%), and Germany (63%). In contrast, the lowest shares were observed in Romania (9%), Bulgaria (26%), and Hungary (30%).

It is also worth considering the findings of studies conducted by the European Investment Bank on the level of investment in enterprises across Europe. The research shows that investment activity has accelerated following the crisis caused by the COVID-19 pandemic and the outbreak of the war in Ukraine. In 2022, the average investment rate among enterprises in the CEE region reached 77%, approaching the average levels in the European Union (80%) and the United States (81%) (**Fig. 1.4**). For 2022, the main investment objective of enterprises in CEE remained the renewal of production capacity – mirroring the EU average (46% of firms in both CEE and the EU). This was followed by increasing production capacity (25% in CEE) and innovation (17%). Manufacturing companies (20%) and large organizations (18%) accounted for relatively higher investment shares. The largest proportion of funds for

innovation was allocated by firms from Poland (22%), Slovenia (19%), and the Czech Republic (17%), focusing on the development of new products or services [29].

It is also necessary to highlight the key areas of investment in the aforementioned countries (**Fig. 1.5**). Innovation is an important investment priority for manufacturing enterprises and large companies.

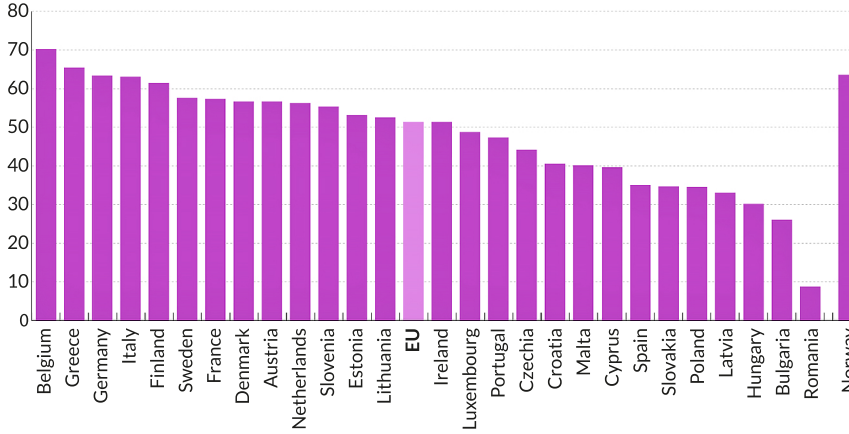

Fig. 1.3 Share of enterprises engaged in innovation activities during the years 2020–2022 in %
Source: [28]

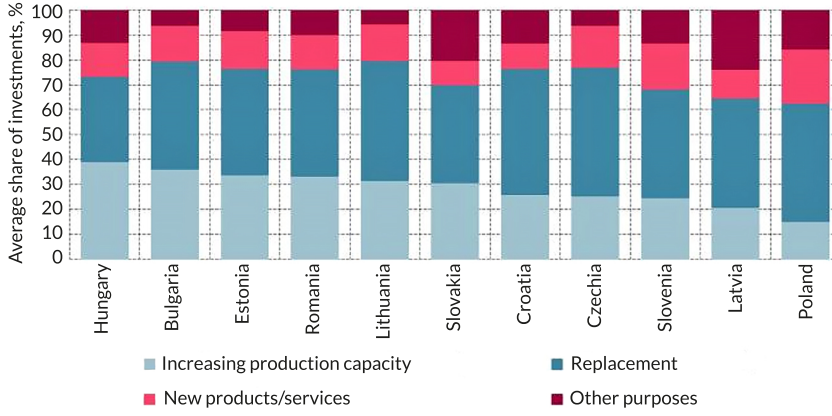

Fig. 1.4 Allocation of investments in 2022 in %
Source: [29]

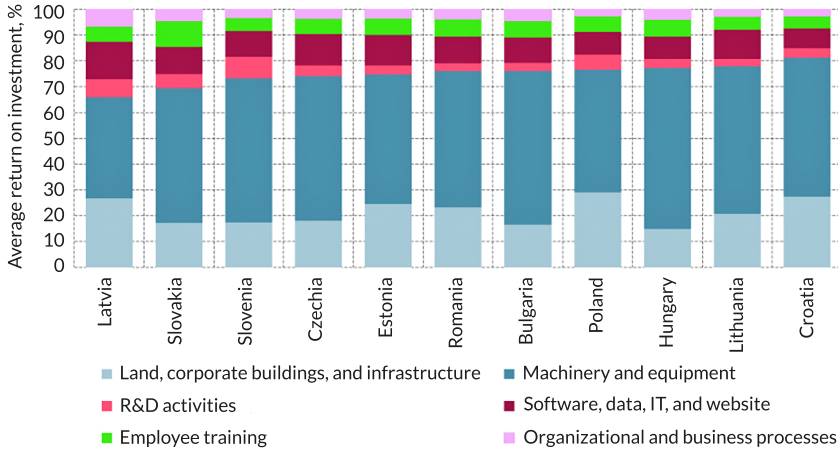

Fig. 1.5 Areas of investment by country in %
Source: [29]

In contrast to companies from the EU and the USA, firms operating in the CEE region allocated a larger share of their investments to machinery and equipment (53% compared to 49% in the EU and 47% in the USA) and a smaller share to intangible assets (24% compared to 37% in the EU and 33% in the USA). The percentage of companies aiming primarily to focus on the innovativeness of new products and services in the CEE (27%) exceeded the figures recorded in the EU (24%) and the USA (21%). Corporate investment spending was directed mainly toward machinery and equipment – particularly in the manufacturing sector (60% of all investments) and the construction sector (59%). In contrast, service companies allocated a relatively larger share of funds to digital technologies (18%). The highest share of investment in intangible assets was recorded in Latvia, Slovakia, Slovenia, and the Czech Republic [29].

One of the tools for assessing the level of innovation in the countries of Central and Eastern Europe is the European Innovation Scoreboard. It primarily refers to the member states of the European Union. The European Innovation Scoreboard provides a comparative assessment of the research and innovation performance of EU member states, other European countries, and global competitors. The EU's innovation performance over time (2018–2025) is presented in **Fig. 1.6**.

The above line chart shows the changes in the EU's innovation performance between 2018 and 2025. The results are presented in relation to the EU's 2018 performance, which was assigned a value of 100 for that year. Overall, a year-on-year

increase in the innovation index can be observed. The slight decline is due to incomplete data for 2025. EU countries, in relation to other global players, occupy a central position (**Fig. 1.7**).

The bar chart presents and compares the EU's innovation performance with that of its main global economic competitors.

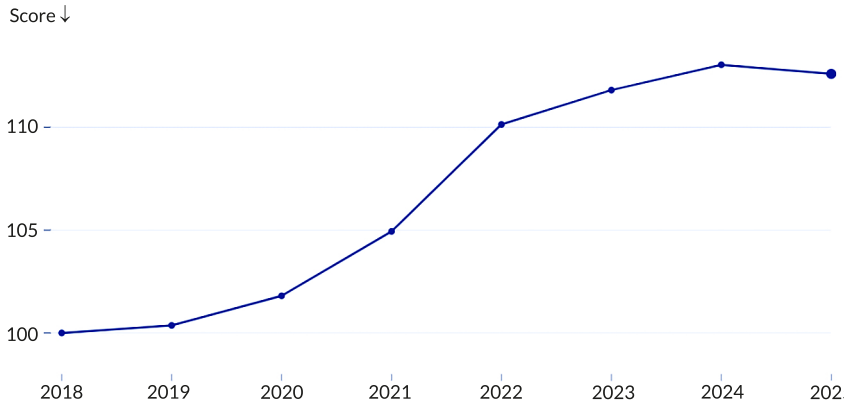

Fig. 1.6 EU innovation performance in 2018–2025
Source: [30]

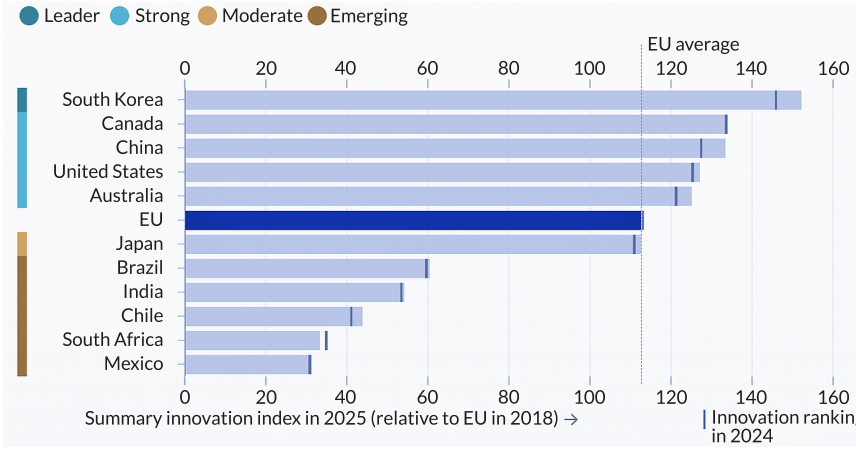

Fig. 1.7 Summary innovation index in 2025 (relative to EU in 2018)
Source: [30]

Poland is classified as an emerging innovator, achieving 65.9% of the EU average in 2025. It ranks 23rd among EU member states and 27th among EU and neighboring countries. For comparison, Bulgaria holds the same status as Poland, reaching 45.8% of the EU average in 2025. It ranks 26th among EU member states and 32nd among EU and neighboring countries. Slovakia ranks higher, achieving 62.6% of the EU average in 2025, placing 24th among EU member states – just behind Poland – and 28th among EU and neighboring countries. Romania holds a lower position, reaching 37.7% of the EU average and ranking 27th among EU member states. Countries such as Lithuania and the Czech Republic are classified as moderate innovators. Lithuania achieves 81% of the EU average in 2025, ranking 18th among EU member states and 22nd among EU and neighboring countries. Meanwhile, the Czech Republic ranks 19th among EU member states, achieving 80.6% of the EU average [30].

Nowadays, digitalization can become a new driver of sustainable economic growth among the aforementioned group of countries. Undoubtedly, this would have positive effects by increasing regional productivity through the digital transformation of both the public and private sectors, as well as through the expansion of e-commerce.

Digital transformation is a long-term and costly process of implementing digital technologies to support business activities. Its primary goal is to increase efficiency, foster innovation, and improve the quality of services provided. On a global scale, digital transformation plays a key role in building competitive advantage. Companies with a higher level of digitalization are better prepared to operate internationally. Digital transformation has a significant impact on economic growth, innovation, and integration with global markets, and it is currently an important element of development strategies – both at the national and international levels [31].

The processes of internationalization of enterprises in Central and Eastern Europe have significantly contributed to the acceleration of technological development and the implementation of innovations. The year 2004, particularly in the context of EU accession, marked the beginning of economic growth and development for these countries. Integration with global markets – resulting, among other factors, from the majority of the region's countries joining the European Union – facilitates access for enterprises to new technologies, know-how, and international cooperation networks. Collaboration with business partners, participation in international supply chains, and foreign direct investments positively impact the transfer of technology, innovative solutions, and the adoption of modern organizational practices. Enterprises undertaking foreign expansion in the Central and Eastern European market are more likely to invest in research and development (R&D), implement

innovative products and services, and enhance the quality of production and logistics processes. These actions contribute to the development and modernization of the national and regional economy, which, in the long term, will help narrow the gap in innovation and productivity levels with Western countries.

In summary, it should be emphasized that the transfer of best practices from developed markets – primarily carried out through foreign direct investments – enhances competitiveness, while foreign direct investments also improve the quality of production processes. Participation in global supply chains enables the implementation of innovative products and services, and access to new technologies and the know-how of other enterprises drives an increase in R&D expenditures.

1.6 Recommendations

When considering issues related to the innovative activities of enterprises in Central and Eastern European countries, it is necessary to propose a tool that allows for their measurement. When assessing the level of innovation of a given group of enterprises – whether by SIC/NACE sector or in the context of a region – three key variables should be highlighted:

– revenue from sales of new or improved products. Sales revenue includes net revenue from the sale of products (goods and services) as well as net revenue from the sale of goods and materials;

– expenditures on innovation activities. Financial expenditures incurred on innovation activities related to product innovations and business processes;

– public support for innovation activities.

Public support for innovation activities is an important component for several reasons. First, it reduces financial risk by lessening the financial burden on enterprises and serving as a motivator to undertake more advanced research and development projects. Second, it stimulates competitiveness and supports the development of strategic sectors. Third, it generates a multiplier effect in the economy, as innovations can encourage private investment and create additional jobs. Actions by public administration and government institutions aimed at stimulating R&D activity and the implementation of new solutions in enterprises include, among others, grants, tax incentives, funding for research infrastructure, and public procurement for innovations. Together, these measures create a favorable environment for the development of innovation in the economy [32].

The index for assessing the level of innovation of enterprises in the context of a given region or SIC/NACE section should be structured as follows

$$EIL = \frac{\frac{RSP}{TSR} + \frac{EIA}{EBA} + \frac{PSIA}{TPS}}{3},$$

where EIL – enterprise innovation level; TSR – total sales revenue; RSP – revenue from sales of new or improved products; EBA – total expenditures on business activities; EIA – expenditures on innovation activities; TPS – total public support; PSIA – public support for innovation activities.

It should be emphasized that the closer the enterprise innovation level is to a value of one, the higher the innovation of the entity. The following scale can therefore be adopted:

- EIL = 0.00 (no innovation);
- 0.00 < EIL ≤ 0.10 (very low innovation);
- 0.10 < EIL ≤ 0.30 (low innovation);
- 0.30 < EIL ≤ 0.50 (average innovation);
- 0.50 < EIL ≤ 0.70 (high innovation);
- 0.70 < EIL ≤ 0.90 (very high innovation);
- EIL = 1.00 (full innovation).

It is worth considering the difficulties and potential critical remarks regarding the proposed index. One should note, for instance, the challenges in measuring intangible innovations and the diversity of industries and enterprise sizes, emphasizing that the proposed index is based on quantitative data. To provide a comprehensive picture of enterprise innovation, qualitative data – such as expert opinions – should also be taken into account. Enterprises may also face issues with data availability and quality, which can affect the reliability of the index.

It is also worth highlighting several positive aspects of the proposed enterprise innovation assessment index. The index allows for the consideration of multiple dimensions of innovation, from expenditures on innovation to revenues generated from introducing new or improved products/services. Undoubtedly, this tool provides valuable support for strategic decision-making. The index offers managers and policymakers critical data that aid in planning development strategies and efficiently allocating resources. Assessing the level of enterprise innovation can also facilitate easier access to financing, as companies with higher innovation levels may gain better access to funds or grants.

The innovation index is a valuable tool supporting management processes within an enterprise, enabling well-informed strategic decision-making. It provides detailed data that allow for the assessment of strengths and areas requiring improvement, as well as the efficient allocation of resources, which in turn enhances the organization's competitiveness and overall effectiveness.

1.7 Conclusion

Currently, the countries of Central and Eastern Europe play an important role in the technological development and innovation of enterprises. Transnational corporations, in particular, have a significant role in this process. Increasing economic and political integration, as well as the geographical expansion of enterprises, are two key phenomena that are especially characteristic of the current dynamics of the global economy [33]. The internationalization of enterprises significantly influences technological development and business innovation. These factors, in turn, are an integral part of modern enterprises' strategies, aimed at maintaining or achieving a competitive advantage in the context of a global economy and a rapidly changing business environment. The process of internationalization thus constitutes an important mechanism supporting innovation and technological progress, especially in enterprises that integrate with international economic networks and systematically invest in the development of employee competencies and the implementation of advanced technologies.

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