

THE ROLE OF REGIONAL INNOVATION SYSTEMS IN PROMOTING SUSTAINABLE ECONOMIC DEVELOPMENT: THE CASE OF THE REPUBLIC OF MOLDOVA

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Abstract: This article examines the role of regional innovation systems in stimulating sustainable economic development in the Republic of Moldova, highlighting the importance of interactions among local actors—the business community, research institutions, universities, and public administration—in generating a functional innovation ecosystem. Based on a systemic approach, the study highlights that economic innovation manifests itself predominantly at the regional level, where the capacity for adaptation, learning, and knowledge transfer directly influences territorial performance. A statistical analysis of innovative enterprises for the 2019–2024 period reveals a downward trend in innovative activity, particularly pronounced in regions with limited infrastructure and resources. At the same time, the predominance of small enterprises in innovation processes and the low level of collaboration between academia and industry point to the existence of systemic constraints. The article links these realities to national strategic directions, such as the National Regional Development Strategy 2022–2028 and the “SMART Moldova” Program, which promote smart specialization and investments focused on sectors with high innovation potential. The paper confirms that the success of sustainable economic development depends directly on the regions’ ability to generate, absorb, and capitalize on knowledge and innovation, and that a coherent policy in this direction can become the driving force behind a new model of national development.

Keywords: regional innovation system, innovative enterprises, economic development, innovations, strategic directions.

JEL Classification: O31, R11, R58, O38.

1. Introduction

In the context of the contemporary global economy, the ability of states to generate and capitalize on innovation is a fundamental determinant of both competitiveness and sustainable economic growth. In recent decades, economic development models have evolved significantly, highlighting the shift from resource- and production-based economies to knowledge-based economies, in which innovation, digitalization, and technology transfer become essential elements of progress. In this context, regional innovation systems take on particular importance, as they are recognized as structures capable of stimulating economic growth by connecting local actors—the business community, research institutions, universities, public administration, and civil society—into a functional and performance-oriented ecosystem.

For the Republic of Moldova, strengthening the regional innovation system represents a strategic priority, given the need to modernize the economy, reduce territorial disparities, and integrate into international value chains. Regions thus become key spaces for generating innovative initiatives, testing new solutions, and attracting technology- and knowledge-oriented investments. Furthermore, in the context of a small economy, regional innovation potential can significantly contribute to increasing productivity, diversifying the economic structure, and enhancing national competitiveness.

Although the state’s role in the direct management of research and innovation activities has diminished in the context of globalization, the role of the regional level is intensifying, as it is considered an optimal space for implementing policies tailored to local specificities. Consequently, analyzing how the regional innovation system influences economic performance becomes particularly relevant, especially for small, open economies such as that of the Republic of Moldova.

2. Materials and methods

This research was based on the analysis and utilization of a diverse corpus of scientific sources, including works by leading authors, materials presented at various scientific conferences, as well as other publications relevant to the subject under investigation. Furthermore, the study utilizes data selected, processed, and interpreted by the author based on information provided by the National Bureau of Statistics and other documentary sources relevant to the research field.

In conducting the investigation, several methods specific to scientific research were applied, such as analysis and synthesis, comparison, generalization, the formulation of logical reasoning, and the drawing of conclusions. These methods enabled a systematic and coherent approach to the analyzed phenomena, contributing to the attainment of results relevant to the proposed objectives.

2.1. The systemic approach to innovation—the foundation for economic development.

The systemic approach to innovation applied in developed countries assumes that the existence of links between actors and organizations within a favorable social and institutional context gives rise to a positive dynamic of learning, creating, and exploiting new knowledge. The nature of these dynamics is systemic, in the sense that the innovation process is far from being a linear phenomenon; rather, it is the result of complex patterns of interaction among a series of components that act together in accordance with shared norms, practices, and historical legacies.

The transition to the innovation-driven model of economic development—which represents a complex system of goal-setting involving many actors, levels, aspects, and different directions—cannot be effectively achieved by examining and addressing tasks related to a single direction (e.g., focusing on the development of the innovation sector). In regional development theory, as well as in economic theory as a whole, there is no generally accepted and sufficiently universal model of how the innovative economy functions as a complex, multidimensional, multi-level system (Klein, 2019).

Based on the above, it can be concluded that a National Innovation System (NIS) should be understood and analyzed as a complex of subsystems that can be classified by region and sector (Chung, 2001). Therefore, the NIS can be described as a matrix of regional and sectoral innovation systems (Table 1).

Table 1. National Innovation System

	Region A	Region B	Region C	
Sector 1	○ □ ▼ ◇	○ □ ▼ ◇	○ □ ▼ ◇	...	SSI – 1
Sector 2	○ □ ▼ ◇	○ □ ▼ ◇	○ □ ▼ ◇	...	SSI – 2
Sector 3	○ □ ▼ ◇	○ □ ▼ ◇	○ □ ▼ ◇	...	SSI – 3
Sector 4	○ □ ▼ ◇	○ □ ▼ ◇	○ □ ▼ ◇	...	SSI – 4
⋮	⋮	⋮	⋮	⋮	⋮
	SRI – A	SRI – B	SRI – C	...	SNI

Note: ○ - universities; □ - public institutions; ▼ - regional authorities; ◇ - industry

Source: Adapted by the author based on [2]

The ability of regions to adapt and adopt innovations is essential for their economic progress (MacKinnon, Chapman and Cumbers, 2002), as regional economic development depends on their capacity to shift resources from old to new activities (Molle and Cappellin, 1988). Regions are, by necessity, often much more open and have a much greater potential for innovation than nations (McCann and Ortega-Argiles, 2015). Furthermore, innovative regions are more resilient to crisis. And to develop an open innovation ecosystem, it is important for the region to be open and supported by intense economic interactions.

Under current conditions, the innovation component of regions is becoming increasingly important. Innovations are becoming the main driver of the country's and region's socio-economic development (Toffler and Toffler, 2006), as well as the factor driving the territory's competitiveness (Sukhovoy and Golova, 2019), or the so-called "power" of regions (Asheim, Grillitsch and Trippl, 2000).

Innovative economic development takes place, for the most part, at the regional level, where systematic and repeated interactions among relevant local actors, encouraged by a favorable institutional framework, shape the innovation capacity of specific regional contexts and enable the absorption and use of knowledge in an economically productive manner.

Innovation systems can be analyzed at different levels: regional, national, and international (OECD, 1999). The study of the regional innovation system makes it possible to take into account the particularities of each individual territory and thus creates the conditions for more effective management of the innovation system at the national level.

In recent years, the concept of the regional innovation system has evolved and become a widely used analytical framework, providing an empirical basis for the development of innovation policies. The concept itself is a popular theory applied to understand the nuances of regional economic interactions and to inform policies and strategies aimed at fostering regional economic competitiveness. The importance of regions within this system lies in the continuous improvement of innovation performance (Simmie, 2003), which supports both the regional and national economies.

The concept of regional innovation is based on an interactive set of public and private interests, formal institutions, and other entities that operate in accordance with organizational and institutional agreements and establish relationships that lead to the generation and dissemination of knowledge. The concept involves analyzing the existence of various actors (institutions, groups, universities, industries, etc.) and regional competencies, as well as

ongoing inter-network interactions engaged in innovation-related purposes within the overall objective of providing local and state authorities with tools to define policies capable of stimulating competitiveness (Huahai, Xuping and Feng, 2011). Innovation is considered one of the main ways through which both regions and the country as a whole can achieve and maintain competitiveness.

2.2 Regional Innovation Systems in the Republic of Moldova.

National economic performance is closely linked to a nation's regional economic performance. Thus, it becomes clear that an NIS will be easily formed and implemented in terms of effective Regional Innovation Systems (RIS). The concept of RIS is a good tool for generating effective Sectoral Innovation Systems. By generating different but competent sectoral innovation systems in various regions, RISs can build an effective NIS.

Figure 1 illustrates the direct linkage between sectoral, regional, and national innovation systems in the Republic of Moldova.

The regional innovation systems of the Republic of Moldova are based on four development regions and one functional region:

1. Northern Development Region – with an area of approximately 10,014 km², constituting about 30% of the territory of the Republic of Moldova. It comprises three municipalities and 11 districts with a population of 644,574 inhabitants. It is the most industrialized region after Chişinău (the capital of the republic), with a diversified infrastructure and a strategic role in trade and transportation.

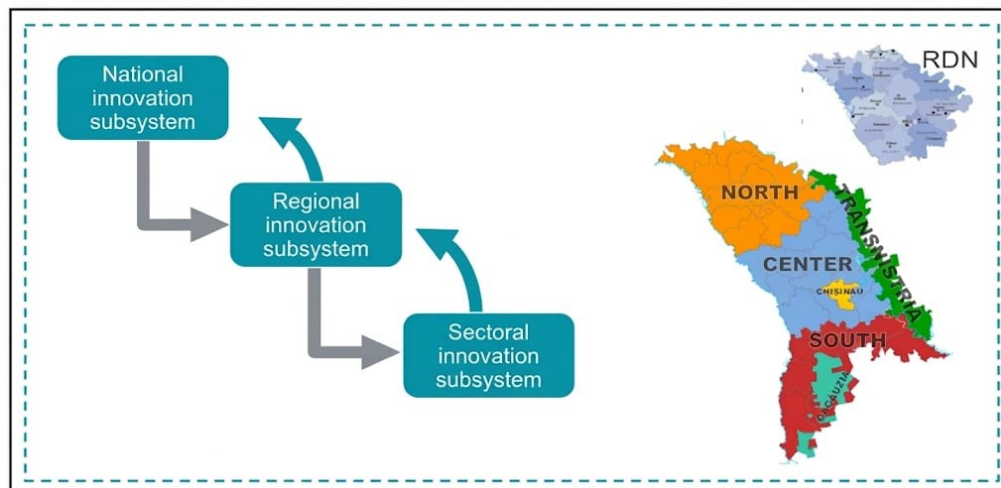


Figure 1. Classification of Innovation Subsystems in the Republic of Moldova

Source: Pripa, S., 2021

2. The Central Development Region comprises 13 districts and includes 14 cities and numerous rural localities, accounting for 31.5% of the country's total area. It has a population of approximately 850,000 people, or nearly one-third (29.8%) of the total population of the Republic of Moldova. It is a mixed-use area with high agricultural potential, food industry, viticulture, and agricultural product processing.

3. The Southern Development Region—comprising 8 districts—covers 24% of the territory of the Republic of Moldova and is home to approximately 15% of the country's total

population. It is a predominantly agricultural region, specializing in cereal crops, viticulture, animal husbandry, and agri-food processing. It is highly vulnerable to drought and climate change.

4. The Gagauzia Territorial Administrative Unit – is a territorial autonomy with its own administrative powers. It includes three cities and the associated rural localities, covering 5.5% of the Republic’s territory. The region’s population is 161,900 inhabitants, or 4.6% of the total population of the Republic of Moldova. It specializes in the food industry, winemaking, clothing manufacturing, and cross-border trade.

5. Chişinău Municipality (Functional Region) – is the capital and the main socio-economic center of the republic. It accounts for over half of the national GDP, most large companies, the IT sector, financial services, education, and research. It attracts the largest share of investments and the workforce with higher education. It is the engine of national innovation and the most important logistical and economic hub.

Regional innovation systems in the Republic of Moldova are in the process of formation and consolidation, reflecting both the potential and the structural constraints of the national economy. The literature emphasizes that the development of innovation at the regional level is influenced by the interdependencies between public policies, the capacity of economic actors, and research infrastructure, as well as limited resources.

3. Results and discussions

3.1 Context and performance of regional innovation in the Republic of Moldova

Technological science and innovation have become recognized as fundamental pillars of sustainable economic development at the national level. Innovative firms are distinguished by the systematic and consistent adoption of innovative practices aimed at achieving a sustainable competitive advantage. Thus, innovation becomes not only a strategic element but also a catalyst for economic performance and long-term competitiveness (Anghel, Grigorescu and Radu, 2020).

To highlight the innovation potential of each region, the number of innovative enterprises was analyzed, given that they form the foundation of both regional development and the national economy.

Table 2 presents the dynamics of innovative enterprises by development region for the years 2019–2024.

Table 2. Trends in innovative enterprises by development regions for the years 2019–2024

Years	2019–2020		2021–2022		2022–2024	
	No. of enterprises	%	No. of enterprises	%	No. of enterprises	%
Chişinău Municipality	272	60.7	230	54.8	248	63.9
Northern Region	69	15.4	69	15.4	53	13.7
Central Region	66	14.7	79	18.8	51	13.1
Southern	25	5.6	28	6.7	28	7.2

Region						
Gagauzia	16	3.6	14	3.3	8	2.1
TOTAL	448	100	420	100	388	100

Source: Author's calculations based on NBS data NBS, 2024.

Following the COVID-19 pandemic, the total number of innovative enterprises nationwide showed a downward trend, falling from 448 enterprises in 2019–2020 to 388 enterprises in 2022–2024, a decrease of over 13%. The data presented in Table 2 show that during the analyzed period, only one region—the southern region—recorded an insignificant increase in the number of innovative enterprises, from 25 to 28 enterprises. The most unfavorable situation is observed in the Autonomous Territorial Unit of Gagauzia, where the number of innovative enterprises has halved (from 16 to just 8 enterprises). Data on the share of innovative enterprises in innovative regions for the period 2019–2024 indicate that the highest share of innovative enterprises is in the municipality of Chişinău (over 60%), followed by the Northern Region and the Central Region with approximately the same share (just over 13% in 2024).

The main causes of the decline in the number of innovative enterprises are cited as weaknesses of the Republic of Moldova's research and innovation system and include: a decline in the number of personnel in the research and innovation system, particularly among young people; low wages, below the national average; outdated infrastructure; very low public funding for research and innovation, at 0.23% of GDP; low levels of collaboration between academia and industry; insufficient investment in technology transfer (ANCD, 2023).

The distribution of innovative enterprises by size class reveals that the majority of innovations occur in small enterprises, both at the national level and across regions (Table 3).

Of the total number of innovative enterprises, small enterprises accounted for the largest share in 2022–2024, over 63% nationwide, and in the South Region, their share exceeded 71%. The share of large innovative enterprises is quite small. Between 2022 and 2024, the share of large innovative enterprises ranged from 3.6% in the Central Region to 15.1% in the Northern Region. In Chişinău, there were 26 large innovative enterprises, accounting for 10.5%. In the Southern Region and the Gagauzian Autonomous Territorial Unit, there was only one large innovative enterprise each.

Table 3. Number of innovative enterprises by size class and development region, 2022–2024

Enterprise size	Total	of which by development region				
		Chişinău Municipality	Northern Region	Central Region	Southern Region	Gagauzia
Small enterprises (10–49 employees)	245	162	27	31	20	5
Share, %	63.2	65.3	50.9	60.8	71.4	62.5
Medium-sized enterprises	104	60	18	17	7	2

(50–249 employees)						
Share, %	26.8	24.2	34.0	33.3	25	25
Large enterprises (250 or more employees)	39	26	8	3	1	1
Share, %	10.0	10.5	15.1	5.9	3.6	12.5
Total enterprises	388	248	53	51	28	8
Share, %	100	100	100	100	100	100

Source: Calculated by the author based on NBS data NBS, 2024.

Enterprises engaged in research specialize in different types of innovations, such as product innovations, business process innovations, or a combination of product and process innovations. The structure of innovative enterprises by type of innovation is presented in Table 4.

Table 4. Structure of innovative enterprises by type of innovation, %

Type of innovation	2019–2020	2021–2022	2022–2024
Total enterprises included in the study	100	100	100
Innovative enterprises, total	12.6	11.4	10.6
of which:			
- product-based innovative enterprises	0.9	0.5	0.6
- enterprises innovative only in business processes	4.9	5.5	6
- enterprises innovating in both products and business processes	4.7	4.9	4
Non-innovative enterprises	87.4	88.6	89.4

Source: Calculated by the author based on NBS data NBS, 2024.

The data presented in Table 4 show that during the period following the Covid-19 pandemic-19, the share of innovative enterprises in the total number of enterprises included in the survey showed a steady downward trend, falling from 12.6% in 2019–2020 to 10.6% in 2022–2024, a decrease of 2 percentage points. Although the share of innovative enterprises specializing in products and business processes is quite small, it is encouraging that during the period analyzed, there is a steady upward trend in the share of these enterprises, rising from 4.9% to 6%, or by 1.1 percentage points.

According to the results of the assessment conducted by the United Nations Economic Commission for Europe—“Innovation for Sustainable Development”—17% of Moldovan enterprises that innovate in products, services, and processes collaborate in the innovation process with equipment suppliers, 24% collaborate with customers and buyers, and only 6% with research institutions and universities (UNECE, 2021).

The main economic sectors where innovation occurs in the Republic of Moldova are industry and services (Figure 2)

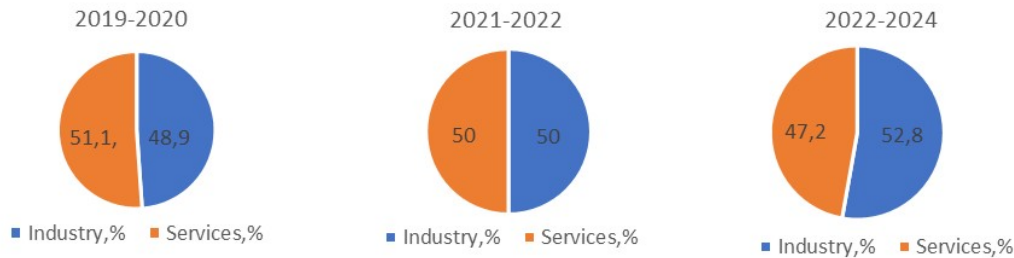


Figure 2. Main economic sectors where innovation takes place in the Republic of Moldova

Source: Calculated by the author based on NBS data NBS, 2024.

Over the past 5 years (2019–2024), the share of innovative enterprises in industry has shown an upward trend, rising from 48.9% to 52.8%, or by 3.9 percentage points. At the same time, the share of innovative service-providing enterprises decreased from 51.1% to 47.2%. Among innovative enterprises in industry, those in the manufacturing sector predominate, accounting for 46.6% during the 2022–2024 period, while among innovative enterprises in the service sector, 16.2% were in wholesale trade, 12.9% in information and communications, and 10.1% in transportation and storage) (UNECE, 2021).

An analysis of innovation activity among enterprises in the Republic of Moldova, both at the national and regional levels, shows that innovation activity is quite insignificant. The share of innovative enterprises in the country is quite low compared to the situation in EU member states (53%) (Eurostat, 2022).

The low level of innovation in the Republic of Moldova is caused by the limited collaboration among representatives of different sectors across the entire innovation value chain. Scientific collaboration between universities and the business community is also quite limited. According to the Global Innovation Index (GII) 2023, which is one of the most important benchmark studies for measuring countries' innovation performance, the Republic of Moldova ranked 60th out of 132 countries and economies, marking a drop of 4 positions compared to the previous year (State Agency For Intellectual Property, 2023).

3.2 Strategic directions for strengthening innovation in the regions.

Innovation in regions is a key factor in stimulating economic growth. The success of a region's innovative development directly influences the territory's competitiveness and the well-being of its residents.

The main strategic directions for strengthening innovation activity at both the national and regional levels are reflected in policy documents that provide for:

- more coherent integration of innovation into regional development strategies;
- intensified cross-sectoral collaboration within the Triple Helix model;
- modernizing research infrastructure and increasing investment in technology transfer;
- stimulating regional cooperation to create innovative clusters and platforms;
- facilitating SME participation in innovation processes;
- strengthening institutional and governance capacity at the regional level.

These recommendations reflect the need for a coordinated and integrated approach to transform the Regional Development System into a functional mechanism for economic and technological development.

The new paradigm of regional development, outlined in the main strategic document dedicated to this field— National Regional Development Strategy (NRDS) 2022–2028 — emphasizes the need for greater involvement of local and central public authorities in local economic development processes. In this context, economic policies prioritize optimizing economic performance and improving the quality of life for the population in the regions. The strategic concept reflects both the conclusions and experiences gained over the past decade of implementing regional development policies and current European guidelines on transforming the approach to regional development (MIDR, 2026).

The document promotes intensified efforts to ensure balanced territorial development by integrating the principles of regional competitiveness and economic cohesion. At the same time, the SNDR 2022–2028 is fully aligned with European regional development policy, complying with the provisions of the Association Agreement between the Republic of Moldova and the European Union, as well as the guidelines established by the 2030 Agenda for Sustainable Development.

Priority directions regarding innovation at the national level are set out in the Republic of Moldova’s National Smart Specialization Program for 2024–2027, titled “SMART Moldova.” It is the first national strategic document aimed at harnessing economic potential through innovation and smart specialization. Its role is to direct public and private investments toward strategic sectors identified as having high potential for knowledge-based development (ANCD, 2023).

The document establishes four priority areas of specialization: agriculture and agricultural product processing, information and communications technology, energy, as well as biomedicine and biopharmaceuticals. The selection of these areas was based on a comprehensive study of research potential, the business environment’s readiness to adopt innovations, and opportunities for collaboration between researchers and the private sector.

The program’s main objectives aim to strengthen the country’s innovation ecosystem by fostering innovative entrepreneurship, increasing the application of research results, stimulating cooperation between academia and the business sector, and promoting smart, sustainable, and inclusive economic growth. The program also emphasizes the training and development of human resources involved in research, innovation, and technology transfer.

Overall, “SMART Moldova” constitutes a central pillar of the modernization of the national economy by strategically directing resources toward sectors with high innovation potential, stimulating collaboration between research and industry, and integrating the Republic of Moldova into European development trends based on smart specialization.

4. Concluding remarks

An analysis of regional innovation systems in the Republic of Moldova highlights the fact that modern economic development cannot be conceived outside of innovative processes, and regions represent the key spaces where these processes manifest, consolidate, and spread at the national level. Although the Republic of Moldova has potential in certain sectors, the performance of regional innovation systems remains modest, being affected by both structural and institutional factors. Interactions between the business community, research institutions, universities, and public administrations are still fragmented, and the level of collaboration

along the innovation value chain is low. This situation limits knowledge transfer, the adoption of new technologies, and the emergence of new economic sectors.

Statistical data on the dynamics of innovative enterprises (2019–2024) indicate a significant decline in innovative activity, both at the national and regional levels. Regional performance is closely dependent on economic infrastructure and the concentration of skilled human resources. The municipality of Chişinău remains the main driver of innovation, accounting for over 60% of all innovative enterprises, which confirms the structural polarization of the national economy. The South, Center, North, and Gagauzia regions face challenges associated with resource constraints, depopulation, weak economic diversification, and climate vulnerabilities. The predominance of small enterprises in the innovation sector suggests untapped potential among medium and large companies, which could typically generate innovation on a larger scale and with a stronger economic impact. Compared to EU member states, where over 50% of companies are innovative, Moldova's share of just 10.6% confirms the significant gaps compared to developed European economies.

For the Republic of Moldova to strengthen its economic performance and move closer to European standards, a profound transformation of regional innovation systems is necessary. Recently adopted strategic documents create a favorable framework for restructuring the national and regional innovation system. These documents emphasize priority areas such as innovative agriculture, information technologies, energy, and biomedicine, thereby aligning national priorities with European knowledge-based development models. Regional transformation and innovation are not merely strategic objectives, but essential conditions for increasing competitiveness, economic resilience, and the quality of life for the population of the Republic of Moldova.

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