INNOVATIONS' ROLE AND IMPACT IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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Abstract
This article aims to argue the importance of innovations and their impact on ensuring the sustainable development of the economy. The article addresses the openness of economies to innovation and involves complex multidimensional research of different sources in the literature that studies the openness to the innovation of different countries and the expenditures allocated to support innovation, addressing innovation management issues specific to small businesses. The scientific novelty of the article consists in researching the correlation between research and development expenditure expressed in the form of their share in gross domestic product and adjusted net national income per capita. A separate line of research is to examine the opening up of emerging countries, which often face the problem of insufficient financial resources to allocate them to innovation. This problem becomes even more pressing if we take account of the specific structure of the economy in which small business enterprises dominate, with a significant share of the family business, for which the financing of innovation activities becomes even more problematic. The basic ideas in this article are managed in this way, as to argue the need for cooperation of the business environment with higher education institutions involved in research-development-innovation activities based on technology transfer.This article was made within the project of National Agency for Research and Development, Government of Republic of Moldova, no. 20.80009.0807.22, "Development of the mechanism for forming the circular economy in the Republic of Moldova".

Keywords: *innovative economy; innovation management; economic growth; research and development; degree of innovation*

JEL Classification: *O32; O36*

I. INTRODUCTION

Innovation performs an indispensable role in ensuring economic growth and improving the quality of life. Currently, in highly developed countries the predominant part of the growth of the gross domestic product is due to innovative products.

Nowadays, innovative activity is to some extent inherent in any enterprise. Even if the company is not the market leader in innovation, sooner or later it will certainly face the need to replace morally used technologies and products. Thus, the problems of managing innovation-related activities are extremely relevant. All the more so as such an activity is very complex, combining in itself a variety of scientific, technical, economic, social, and psychological problems.

To manage innovation-related activities, it is necessary to involve managers with complex studies, who know well the field of innovation, can solve technical and production problems, taking into account economic feasibility and commercial benefits.

In the conditions of high uncertainty of a very fierce competitive environment, innovative management becomes that indispensable lever that at the level of economic entities will directly contribute to the development of the range and the improvement of the quality of the products and services provided; ensuring new competitive advantages in the internal and external markets, strengthening the company's position in existing markets and successfully promoting it in new markets and streamlining the company's activity, all of which ultimately contribute to the economic development of the country as a whole.

II. METHODOLOGY

The article provides for the application of such research methods, such as analysis and synthesis, applied in terms of studying the approaches presented by different scientists and specialists in the field of innovative

economics and innovation management.

In order to study the link between research and development expenditure expressed in the form of their share in the gross domestic product and adjusted net national income per capita, the tools specific to the correlation analysis are applied. Namely, the equation of the correlation dependence with special emphasis on the regression coefficient and the correlation coefficient allows formulating justified conclusions regarding the intensity of the connection between the indicators analyzed in this paper.

In the paper, there are applied the elements of comparative analysis to identify the most open economies in terms of innovation which as a result register economic growth and a high level of economic development.

To analyze the degree enterprises' innovation by registered types of innovation, their structural analysis is applied, which allows identifying the types of innovations that are applied in the most intense within the domestic enterprises.

The statistical data analyzed in the paper are current and objective, they are obtained from the official pages of the institutions or their reports.

III. LITERATURE REVIEW

The intensity of innovation development is characterized by a number of factors that affect the quality of institutions, as well as the role of innovation in certain areas of the country's economic activity.

In the literature, "innovation" is explained as the transposition of a scientific-technical process into a real one, expressed in new products and technologies. The innovation process is a set of actions carried out consistently for the implementation and application of scientific research, inventions, projects, and others in the production process, which form new goods and services, new technologies, new skills, and organizational-managerial techniques.

Strengthening competition in the markets, the dynamism of market relations, the appearance of new innovation-oriented analogs offering a wide range of goods and services, the growing uncertainty of the company's external environment create the conditions for the formation of new approaches to the management of innovation development (Savchenko, Rogov, Shadov & Verhozina, 2015).

In the literature are presented various algorithms for implementing innovation management in the enterprises, but each time this activity is characterized by a higher or lower level of risks, so that the probability success will be mainly influenced by the following factors (Omelchenko, Lyakhovich & Dobryakova, 2019): environmental factors, the stage of the life cycle of innovation, the level of depth of innovative changes.

The innovation process is the consequence of the actions necessary to initiate innovations, which lead to the creation of new products and operations, as well as their successful marketing on the market. Subsequently, measures will be taken for the wider dissemination of the results obtained.

The use of open innovations by enterprises influences the activity of the innovation system and its innovative attractiveness, having a direct impact on the cost of innovative products. An increase in the use of open innovation and an increase in the level of innovation attractiveness contribute to a decrease in the cost of innovative products, ultimately contributing to increased profitability, improving the company's image, and attracting new customers and investors (Kopishinskaia, 2017).

Research conducted by various scientists in the field of innovation management focuses mainly on the approach of innovation management in terms of inputs and outputs, i.e. without addressing innovation management in terms of the project, measuring its performance, and economic and social impact (Chen, 2014: p. 212-231).

The main feature of the modern economy is the speed of implementation of the innovation process. An innovation strategy in a modern economy forces market entry with innovations as technological opportunities arise. Sources of ideas are often outside the enterprise. Hence the interest in developing relationships and interaction with different structures. For this reason, the product life cycle becomes shorter, and the competition is fiercer. Today, with the increase in scientific and technical competition, innovation has become the main condition for survival. Therefore, declining profits are often an incentive for major investment in innovation.

It should be noted, that the allocation of research and development expenditure's trends at the country level are determined by global trends in research and development. Nowadays, the circular economy has already become an irreversible global trend, so most countries support and promote a green economy, promoting the implementation of efficient business to ensure more sustainable use of resources (Ganea & Birca, 2020).

Research and development expenditure refers to the main indicators that characterize investments in science and innovation globally. The most important tasks of the state science and technology policy are the following:

- assistance in increasing the innovation activity, ensuring the increase of the competitiveness of the local products, by implementing the scientific-technical achievements of the production and its renewal;
- creating the optimal conditions for the efficient functioning of the market innovation mechanism.

The state regulates innovation activities, using various methods: organizational, economic, financial, and legal. The main legal innovation activity's form by the state is the legal acts. These are numerous normative acts

that regulate the procedure for creating and implementing innovations, as well as other acts that aim at creating a market innovation infrastructure. State regulation of innovation can be direct or indirect, using leverage and economic incentives.

The innovative development of the economy of a country as a whole requires the continued adoption of its strategies and policies aimed at stimulating innovation, with priority given to increasing research funding for higher education institutions, especially in the field of engineering and natural sciences to be involved in various research projects with an increased interest in the business environment (Szabo, Oltes & Herman, 2013).

The fundamental factors that determine the degree of innovative activity of companies include the scale of the business, financial position, industry affiliation, and the level of competition in product markets, the export structure by countries.

The stable development of products for a longer period depends not only on resources but also on the nature, size of innovative activities related to the innovations' development, implementation, and application. They aim at implementing the results of research and development in a practical technological process, i.e. combining production, exchange, consumption, and including many areas of activity. Their main purpose is the creation, accumulation, and development of the scientific-technical capacities of the enterprise, which ensures its competitiveness, economic security, and further development.

In connection with the growing importance of innovation for the economy and society as a whole, there is also a growing need for state regulation of innovation. Under the influence of innovation, the very structure of the economy changes. Only, due to the increased efficiency of resource use, some of them become free and are redistributed to other areas of activity. Likewise, there is a change in the economic organization of society as a whole. New social institutions and enterprises appear, the content of the interrelationships between them also changes. The launch of innovative processes in the scientific-technical sphere becomes the most important condition for creating an extremely efficient economy on a modern technological basis.

One of the distinct categories of business that is characterized by a high level of innovation is startups. Startups attract increasing interest both in science and in business, providing various economic and social benefits at the country level and in the latter contributing to the growth of gross domestic product per capita and stimulating economic growth (Szarek & Piecuch, 2018: p. 389-397).

The performance of enterprises, especially of multinational enterprises, is largely influenced by the impact of globalization, causing them to develop an international business strategy, in addition to the fact that they depend to a large extent on the level of innovations (Kyove, Streltsova, Odibo & Cirella, 2021: p. 216-230). In turn, the process of globalization contributes to addressing global innovation processes, stimulating the development of international research and innovation projects involving participants from digested countries of the world who jointly research the same important issue.

In a market economy, innovation is the main means of increasing the profits of economic entities, due to the higher satisfaction of market demand, with lower production costs compared to competitors.

The fact that the innovative approach and the innovations themselves are very important is not a current finding. In the market economy, the need for an innovative approach has already proved to be important several decades ago, which highlights the statement of the scientist Christofor Freeman "Not to innovate is to die" (Freeman, 1974: p. 256), so innovation is considered a basic tool for survival and successful development of companies.

As multiple research shows, innovation is the key tool for ensuring economic growth, underpinning the development of different economic models of sustainable development, and thus participating in the development and development of effective policies for modelling sustainable growth. (Yesilay & Halac, 2019).

The main directions of state regulation of innovation activity can be considered the following: (Trott, 2017: p. 50-54):

- Creating special structures that will implement the policy in this field.
- Allocation of funds from the state budget for financing innovation activities.
- Inventory, evaluation, accounting, and introduction in the economic circulation of the rights on the results of the scientific-technical activities, obtained following the accomplishment of the research, development, and technological activities.
- Implementation of amortization and taxation policies aimed at stimulating innovation.
- Informational support of the innovation activity.

The relationship between innovation and performance, at first sight, would be very close, but research by experts in the field has argued the impact of a group of factors on the economy of emerging countries, such as international trade, foreign direct investment, and research and development spending that do not always have positive consequences (Wang & Kafouros, 2009).

The approach and implementation of innovations differ considerably from one economic unit to another depending on the size of the enterprises. If large enterprises can afford research and development expenditure, then micro and small enterprises, which mainly keep the economies of developing countries in this category of expenditure, cannot afford it. In this case, for micro-enterprises that often represent family businesses, it is

proposed to focus their performance on developing new products, promoting available marketing tools, exchanging knowledge, and taking over best practices, instead of improving and developing technological aspects (Alberti & Pizzurno, 2013).

IV. RESEARCH RESULTS AND ANALYSIS

Today, the competitiveness of any country in the world depends on science and innovation, which are key factors in the progressive development of the economy. It is obvious that larger countries can allocate larger amounts in research and innovation activities from the state budget, at the same time in these countries the number of active economic agents that can also finance and carry out research and innovation activities is much higher compared to similar indicators of small countries. In this context, in order to ensure comparability, it is necessary to use in the comparative analysis the relative indicators, so that one of the indicators that characterizes the development possibilities of a country's economy is the share of research and development of the country in the value of gross domestic product.

Today, the competitiveness of any country in the world depends on science and innovation, which are key factors in the progressive development of the economy. More extensive countries can allocate larger amounts in research and innovation activities from the state budget. At the same time in these countries, the number of active economic agents that can also finance and carry out research and innovation activities is much higher compared to similar indicators of small countries. In this context, to ensure comparability, it is necessary to use in the comparative analysis the relative indicators. So that one of the indicators that characterize the development possibilities of a country's economy is the share of research and development of the country in the value of the gross domestic product.

In order to identify the role and effect of oh the research and development expenditure on the level of development of the country, it is proposed to study the correlation between research and development expenditure expressed in the form of their weight in GBP and adjusted net national income per capita which is presented in Figure 1.
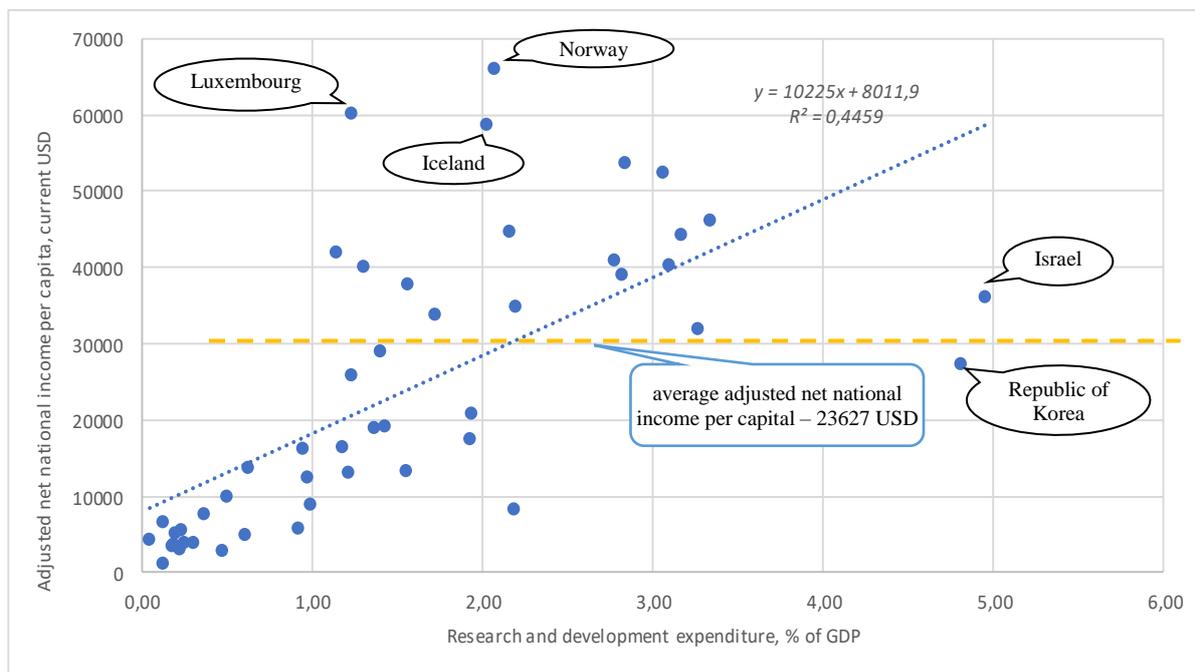
Figure 1 – Adjusted net national income per capita dependence of the research and development expenditure in 2018, based on the 48 countries
Source: Elaborated by the authors based on the statistical data presented on
https://datacatalog.worldbank.org/search/dataset/0037712/World-Development-Indicators

Based on the equation that expresses the correlation link between research and development expenditure reflected in the form of their share in gross domestic product and adjusted net national income per capita, a rather pronounced correlation link is observed. Based on the equation that expresses the correlation between these two indicators we can conclude:

- With the increase of the share of research and development expenditure in GBP by 1%, adjusted net national income per capita increases by about 10225 USD, this increase being quite impressive.
- Of the variation of the adjusted net national income per capita about 44.6% is due to the influence of research and development expenditure expressed in the form of their share in GDP.
- The intensity of the correlation link is moderate so that the correlation coefficient is about 66.78%.

On the other hand, Figure 1 well highlighted some points that deviate considerably from the drawn line, indicating the names of the represented countries.

On the right side of the chart line, a considerable deviation is recorded by such countries as Israel and the Republic of Korea. These countries open the world top of countries in terms of the share of research and development expenditure expressed in the form of their share in gross domestic product. Thus, the leader is Israel, which allocates 4.95% of gross domestic product for research and development activities, followed by the Republic of Korea, which allocates 4.81% of gross domestic product for this purpose It should be noted that these two countries, being leaders in terms of the share of research and development expenditure in a gross domestic product, deviate considerably from the rest of the world, as the third position in this rating is occupied by Sweden, which allocates only 3.34% from the gross domestic product. The explanation for the deviation of these countries can focus on their modest size and the more modest level of gross domestic product per country, but if we analyze the level of gross domestic product, we notice a significant difference between their levels. Thus, in 2020 the Republic of Korea occupies the fourteenth position in the world after gross domestic product which amounted to USD 2233 billion, while Israel occupies in this rating the 49th position with a gross domestic product of 385.78 billion USD, which is about 5.8 times slower than the Republic of Korea. These exceptions are explained by the influence of another group of factors related to the size of the country, the population, etc. which is actually due to the size of the economies of these countries..

On the left side of the chart, a larger deviation is recorded by the following countries: Norway, Luxembourg, and Iceland. These countries are the top 3 countries in the top based on the indicator that reflects adjusted net national income per capita. These countries, based on several indicators attesting to the level of development of the country, occupy top positions, although they invest in research and development activities much less in relation to Israel and the Republic of Korea. Thus, in Luxembourg, the research and development expenditure constitutes only 1.24% of the gross domestic product, while in the other two countries this expenditure is 2.07 and 2.03% respectively. These countries can be approached as exceptions, investing relatively little in research and development they manage to record among the highest levels of adjusted net national income per capita in the world. If we compare the gross domestic product of these countries in absolute value, we notice that in 2020 Norway's GDP is 339.97 billion USD, placing this country in 52nd place in the world rating of countries. Luxembourg's GDP is $ 74.83 billion, ranking it 97th in the world, while Iceland's GDP is only $ 20.23 billion, ranking it 144th. In this way, it can be concluded that the respective countries, registering such a high level of development, and investing relatively little in research and development activities are very different from each other in terms of the size of their economies.

- Following the analysis of the share of research and development expenditure in GDP for the 48 countries whose results are available for analysis, the following conclusions can be drawn:
- Half of the countries allocate for research and development expenditure up to 1.27% of GDP, while half allocate more than 1.27% of GDP (1.27% is the value of the median of the series);
- Countries analyzed on average allocate about 1.57% of GDP for research and development expenditure;
- Poorly developed and developing countries mainly allocate up to 1% of GDP for research and development expenditure;
- Only two countries in the world allocate over 4% of GDP for research and development expenditure.

As a result of different approaches at the country level in terms of innovation activity, as well as a result of more or less direct influence of multiple factors, the level of development of countries is very different, obtaining the next distribution of top of three innovation economies by income group (see Figure 2).

The "Global Innovation Index 2021" report focuses on the innovation ecosystem performance of 132 economies and highlights the most recent global innovation trends. In this context, the report ensures a division of countries into regions, so that in each geographical region are identified 3 countries that have the most innovative economies, the exception represent North America in which geographically are located only two countries.

In the top three innovation economies by income group, shown in the figure above, the countries are located by geographical regions, so that their level differs considerably from one group to another. Certainly, most European countries that are far from the top countries in the European region are much ahead of the top countries in Sub-Saharan Africa or Latin America and the Carribiane region.

Although 2020 was already a year with a pronounced impact of the pandemic caused by the SARS Covid-19 virus, the five most important areas of scientific publication in 2020 remained the same as in 2019, as can be seen in Figure 2, namely (Global Innovation Index 2021):

- science of multidisciplinary materials,
- environmental sciences,
- electrical and electronic engineering,
- multidisciplinary chemistry;
- applied physics.

Figure 2 – Top three innovation economies by income group

Source: Global Innovation Index 2021, Available at: https://www.wipo.int/global_innovation_index/en/

Based on the statements presented above, the dependence between research and development expenditure expressed in the form of their share in GBP and adjusted net national income per capita becomes strongly argued.

Examining the distribution on the graph of the points that express the dependence between research and development expenditure expressed in the form of their weight in GBP and adjusted net national income per capita we find a concentration of points at the bottom left of the graph. This concentration of points allows us to conclude that most countries invest modestly in research and development expenditure and result in a modest level of adjusted net national income per capita

Regarding the role of innovation activity in the Republic of Moldova, it is becoming increasingly important, being a key priority in various state development strategies and programs. The statistical reports submitted by the enterprises do not reflect their execution of the research-innovation activities. In Figure 1 which shows the adjusted net national income per capita dependence of research and development expenditure in 2018, the Republic of Moldova is located in the lower left of the quadrant, investing in research and development expenditure about 0.25% of GDP and obtaining an adjusted net national income per capita of USD 3876. The results are quite modest, the Republic of Moldova investing an extremely small part of GDP in research and development expenditure and having a proper standard of living.

Logically, regardless of the directions of distribution of research and development expenditure, in the end, their results must be implemented within the enterprises, ensuring an additional competitive advantage, a development of them, and economic growth of the country.

The information regarding the accomplishment by the enterprises of the research-innovation activity can be collected only based on specially organized surveys. In this context, The National Bureau of Statistics conducted

a study on the types of activities carried out in the field of research and innovation on a sample of 3326 enterprises. The results of the study are reflected in Table 1.

Table 1. Degree of enterprises' innovation in the Republic of Moldova by types of innovation in 2018

Categories of enterprises	Number of enterprises, units	Structure of innovative enterprises, %
Total enterprises included in the research	3326	x
Innovative enterprises - total, of which:	605	100,0
Enterprises that have made several types of innovations (product, process, methods of organization and marketing)	244	40,3
Innovative product and / or process companies	119	19,7
from which:		
innovative product-only enterprises	51	8,4
innovative process-only enterprises	37	6,1
innovative product and process enterprises	31	5,1
Innovative enterprises of organization and / or marketing methods	242	40,0
from which:		
innovative enterprises only of organizational methods	81	13,4
methods innovative enterprises only of marketing methods	91	15,0
innovative enterprises of organizational methods and marketing methods	70	11,6

Source: Press releases of the National Bureau of Statistics at 20.12.2019, Available at:
https://statistica.gov.md/newsview.php?l=ro&id=6541&idc=168

According to data from The National Bureau of Statistics in 2018 in the Republic of Moldova were active 56463 enterprises. The study organized by The National Bureau of Statistics to find out the main directions of innovation applied by domestic enterprises is focused on a sample of 3326 enterprises, which is about 5.89% of the number of active enterprises in that year, is considered representative. Of the 3326 enterprises surveyed, only 605 enterprises (18.19%) confirmed the existence of certain innovative activities, either related to the product or process or related to organizational or marketing methods.

Circa 40% of the enterprises considered as innovative in the Republic of Moldova, apply innovative methods of organization and/or marketing and only 19.7% of innovative enterprises are focused on product and/or process. At the same time, 40.3% of enterprises that are considered innovative combine the application of innovative methods of organization and/or marketing with innovations focused on product and/or process. If we compare these results with the total number of enterprises operating in the Republic of Moldova, based on the analyzed sample, we obtain that:

- 7.33% of enterprises combine the application of innovative methods of organization and/or marketing with product and/or process-focused innovations;
- 7.28% of enterprises use innovative elements in the organization and/or marketing;
- 3.58% of enterprises introduce innovative elements in products and/or processes.

From the found data, it can be concluded that the Republic of Moldova has great reservations regarding the implementation of innovations at the enterprise level.

Most developing countries face the inability of business representatives to assume their responsibilities and research and development expenditure. In this context, it becomes strictly necessary for the business environment to collaborate with educational institutions and other research institutions that benefit from multiple sources of funding for research activities, especially based on projects. The universities' research results or other research institutions will be translated and implemented in practice in the business environment.

Investments in research and development activities do not ensure high results if they are not correlated with investments in education at the country level which include expenditures related to the acquisition and modernization of the material and technical base of educational institutions, infrastructure financing, modernization educational institutions, the formation of salary funds for employees, the financing of education for students, the financial support of the development of study programs at different stages, as well as other expenses.

V. CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Research shows that there is a fairly strong correlation between research and development expenditure expressed in the form of their share in gross domestic product and adjusted net national income per capita. Although there is a rather strong dispersion in the share of research and development expenditure in gross domestic

product between countries. Research has shown that the countries that allocate the most for research and development are considerably more developed than the countries that allocate much less in this objective.

Developing countries, to which the Republic of Moldova also refers, have large reservations regarding the allocation of resources from the state budget in the form of research and development expenditure, as well as regarding the implementation of innovations at the enterprise level. Given the dominance of small business enterprises in the structure of the economy, the necessary financing of research and development activities from enterprise sources cannot be ensured.

Small business enterprises are often unable to take responsibility and carry out the necessary volume of research and development expenditure, focusing their innovations on the marketing tools used or taking over good practices from economic units in other regions. In this context, it is required to identify effective tools to ensure a direct link between the results of research and development activities carried out by universities and other research institutions and to transform those results into good business practices.

The reporting system applied in most countries does not provide for the mandatory reporting by economic agents of indicators related to innovation processes to determine the trend and measure the impact of innovations on the economic development of the country. In this context, it would be of particular interest to apply a survey focused on representative samples from different countries to carry out a comparative analysis of the results obtained and their correlation with the indicators attesting to the sustainable development of those countries.

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