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IMPACT OF GOVERNMENT OPEN DATA INITIATIVES ON INNOVATION, ENTREPRENEURSHIP, AND ECONOMIC GROWTH

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Abstract

Purpose: The study aims to assess the benefits of using econometric methods to analyse the impact of government initiatives on innovation development, entrepreneurship

and economic growth. The study analysed the impact of government support on innovation strategies, start-ups, entrepreneurship and economic growth in countries such as the United States, the European Union (Switzerland, the Netherlands, Germany, Denmark and France), Japan, South Korea, India and China, accounting for regional and cultural specifics.

Methodology: The methodological approach was based on the analysis of data from official sources, in particular, government websites, as well as reports and analytical materials of international publications. Econometric methods, such as regression and correlation analysis, were used to determine that an increase in gross domestic product per capita is accompanied by an increase in the innovation index, while research and development (R&D) expenditure has an insignificant relationship with the innovation index, demonstrating the benefits of using econometrics.

Findings: The study demonstrated that the Small Business Innovation Research and Small Business Technology Transfer programmes in the US, Horizon Europe in the European Union, and the Creative Economy Initiative in South Korea are highly effective. The study determined that the Startup India Programmes in India and Made in China 2025 in China contributed to the creation of a favourable regulatory environment and provided tax incentives, which has a positive impact on the development of entrepreneurship and innovation. Recommendations on the use of econometric methods to assess the impact of government support on innovation and entrepreneurship improving financial support for start-ups, enhancing educational programmes for entrepreneurs, promoting cross-sectoral cooperation and optimising the regulatory environment, were made.

Originality: This study breaks new ground by rigorously analyzing how government open data initiatives impact innovation, entrepreneurship, and economic growth through advanced econometric methods.

Keywords: international markets, financial incentives, economic growth, competitiveness, government initiatives

JEL classification: O3, L26, O4

1. Introduction

In the context of economic development, where competition and innovation are key, econometric methods are essential for assessing the effectiveness of government initiatives supporting innovation and entrepreneurship. These methods help identify key aspects of policies that can be optimized to maximize their impact. Econometric analysis not only evaluates current policies but also uncovers opportunities for improvement, particularly in the face of rapid global economic changes. The study examines how government support, particularly through open data initiatives, influences innovation, entrepreneurship,

and economic growth. The main challenge is assessing the effectiveness of these methods in evaluating policies and their outcomes, aiming to enhance economic activity through better government initiatives.

The relevance of this study lies in the examination of the impact of government initiatives related to open data on innovation, entrepreneurship, and economic growth, particularly in the context of an increasingly competitive global economy. As the global landscape rapidly evolves, governments are increasingly leveraging open data to foster innovation and support entrepreneurial activities that contribute to economic growth. However, there remains a gap in understanding how these initiatives influence economic development, and what adjustments may be needed to optimize their impact. The study focuses on how government support, particularly through open data initiatives, can drive innovation and entrepreneurship, ultimately enhancing economic growth. This issue is crucial as governments seek to create sustainable, innovation-driven economies. The main challenge addressed by this research is determining the effectiveness of government open data initiatives in promoting these areas, and evaluating how such policies can be optimized to maximize their impact on innovation, entrepreneurship, and economic development.

Wang et al. (2024) aimed to explore the impact of digital entrepreneurship on economic growth, particularly in Organisation for Economic Co-operation and Development (OECD) countries, and examine how various factors such as the Internet, economic growth, and well-known companies influence digital entrepreneurship. The research found that digital entrepreneurship in OECD countries is positively influenced by economic growth, the availability of the Internet, and the presence of successful companies. However, it also showed that information and communication technologies, financial risks, and government spending on research and development negatively impact digital entrepreneurship.

Gomes and Ferreira (2022) conducted a study to investigate the relationship between entrepreneurial activity and economic growth in European countries through dynamic data panel analysis. They discovered that entrepreneurial activity has a significant positive impact on economic growth in European countries, with higher levels of entrepreneurship driving faster economic development. The study emphasized the importance of fostering entrepreneurship to achieve sustained economic growth in the region.

Gomes et al. (2022) focused on examining how the interplay between entrepreneurship and innovation impacts economic growth, especially in the digital age. They highlighted the critical role of innovation in stimulating entrepreneurial activity. Their findings suggest that innovation accelerates entrepreneurship, which in turn contributes to economic growth. The study stresses that innovation is a key driver of entrepreneurial success in the digital economy. Bradley et al. (2021) aimed to examine the role of institutions, policy interventions, and societal challenges in shaping innovative entrepreneurship. They found that policy interventions, including institutional support and societal challenges, significantly affect the landscape of innovative entrepreneurship. The study suggests that effective institutional frameworks and targeted policy interventions are crucial for fostering entrepreneurship, particularly in addressing societal challenges and promoting innovation.

Gomes and Ferreira (2022) also explored the connection between entrepreneurial activity and economic growth in European countries, finding that entrepreneurship positively influences economic development, highlighting the importance of creating an environment that supports entrepreneurial ventures to foster economic growth. Huang et al. (2022) investigated the role of home-country government support and the Belt and Road Initiative in the foreign performance of Chinese state-owned subsidiaries. They found that home-country government support, along with China's participation in the Belt and Road Initiative, positively influences the foreign performance of Chinese state-owned subsidiaries. The study emphasized that these factors provide crucial support for the international expansion and success of Chinese firms, particularly in emerging markets.

In addition, the importance of opportunities to stimulate economic growth in Europe was highlighted. The fact that opportunity-oriented entrepreneurship has a positive impact on gross domestic product (GDP) per capita, while early-stage entrepreneurship and knowledge for starting a new business have a negative impact, was emphasised. Even though econometric methods are actively used to study the impact of government initiatives on innovation and economic growth, many aspects of this process remain insufficiently investigated. This concerns the insufficient integration of econometric analysis with open data, which makes it difficult to understand the effectiveness of policies and prevents the identification of key relationships between government initiatives and outcomes in innovation and economic growth.

Despite a large body of work examining the role of entrepreneurship in overall economic development, there is limited understanding of the specific impact of digital technologies and innovation on entrepreneurial activity, particularly in OECD countries. Most previous studies have focused on general factors such as financing or institutional support, but the impact of specific macroeconomic conditions such as information and communication technologies and financial risks has not yet been sufficiently explored. This study attempts to analyze these aspects in more depth, as well as to examine how economic growth, internet accessibility, and successful companies interact with digital entrepreneurship, thus identifying new ways to develop economies through the support of innovative entrepreneurship.

The purpose of the study is to examine the impact of government initiatives on the progress of innovation and economic growth in different countries in order to improve methods for assessing policy effectiveness. To achieve the aim, the following objectives were set: to assess the impact of government initiatives in the US, EU, Japan, South Korea, India and China on the innovation strategies of companies, start-ups and small enterprises; to analyse the effectiveness of econometric methods in measuring the impact of government initiatives on innovation and economic growth; to assess how regional and cultural factors affect the success of innovation and entrepreneurial strategies; to provide specific recommendations for improving government programmes for innovation, entrepreneurship and economic growth based on the identified.

2. Literature Review

Understanding the relationship between government initiatives, innovation, entrepreneurship, and economic growth has been a focal point of scholarly interest across multiple disciplines. The growing role of open data, digitalisation, and government support programmes has prompted researchers to examine both macroeconomic and sector-specific impacts of these initiatives. The following review synthesises key contributions from recent literature, highlighting conceptual foundations and empirical insights relevant to the present study.

Popescu and Diaconu (2021) employed a cointegration analysis to examine the long-term relationship between government spending and economic growth in Romania, demonstrating that targeted government expenditures can stimulate economic development when effectively aligned with institutional frameworks. Their findings underline the importance of fiscal policy in fostering innovation-driven growth. Similarly, Pradhan et al. (2020) investigated the dynamic interplay between entrepreneurship, innovation, and economic growth across Eurozone countries, employing panel data techniques. Their study confirmed that innovation serves as a crucial mediating variable through which entrepreneurial activity affects economic performance, providing strong empirical support for the endogenous growth theory.

Omri (2020) drew attention to the differentiation between formal and informal entrepreneurship in emerging economies, revealing that the effectiveness of entrepreneurship in promoting growth largely depends on governance quality and financial sector development. This perspective offers critical insight into how institutional variables shape innovation trajectories in different socio-economic environments. The role of digitalisation in shaping innovation and risk management is explored by Potryvaieva et al. (2024), who analysed the digital transformation of control and accounting systems in agricultural enterprises. Their work illustrates how digital tools not only enhance efficiency but also enable more informed decision-making processes, aligning with broader government initiatives aimed at modernising industry standards.

In a study on small and medium-sized enterprises (SMEs) in Ghana, Osei et al. (2024) found that innovation capabilities and marketing intelligence significantly enhance firm performance, particularly when supported by strategic government initiatives. This regional perspective confirms the relevance of innovation policy for business competitiveness, even in resource-constrained environments.

Mulyaman (2023) provided an in-depth review of South Korea's Creative Economy Initiative, a government-led strategy aimed at revitalising economic growth through start-up support, digital innovation, and cross-sectoral collaboration. While the initiative has fostered notable technological advancements, the study also noted challenges such as regional disparities and a stagnating broader economy, which may limit its overall impact. In the Indian context, Moslehpour et al. (2023) analysed how sustainability practices in the automobile industry align with government policy and environmental objectives. Their

findings suggest that corporate responses to government initiatives can create synergies between economic and environmental performance, thus reinforcing the multi-dimensional nature of innovation-driven growth. Nakku et al. (2020) examined the effectiveness of SME government support programmes in developing economies, emphasising that such programmes enhance entrepreneurial orientation and overall business performance when effectively designed and implemented. Their study stresses the need for contextual adaptation of policy tools to local business realities.

The reviewed literature highlights that government initiatives whether through fiscal policy, institutional reform, digitalisation, or targeted support programmes can play a pivotal role in fostering innovation and entrepreneurship. However, the effectiveness of such interventions is contingent upon factors such as governance quality, sector-specific needs, and the integration of open data strategies. This study aims to build on these insights by applying econometric methods to assess how government open data initiatives influence innovation dynamics and economic growth across diverse national contexts.

3. Materials and Methods

3.1. Research Design

To assess how government programmes affect start-ups and innovation strategies, information on innovation support programmes in the US, EU, Japan, South Korea, India and China was initially collected. As part of this process, the data collected covered the main objectives of the programmes, sources of funding and mechanisms for their implementation, which was used to create a detailed picture of their impact on innovation and entrepreneurship. The analysis compares the approaches to innovation development, entrepreneurship support and economic growth in the USA, Switzerland, the Netherlands, Germany, Denmark, France, Japan, South Korea, India and China by systematically examining innovation financing, start-up support and overall economic growth in these countries. The analysis examined the main programmes and initiatives of each country, such as government grants, tax incentives, infrastructure investments and specialised incubators.

3.2. Econometric Methods Used and Justification

The analysis of the effectiveness of econometric methods in measuring the impact of government initiatives on innovation and economic growth was carried out through a comprehensive study of quantitative data. Methods such as regression analysis and correlation analysis were selected and used to assess the relationship between research and development (R&D) expenditures, GDP per capita and the innovation index in the US, Japan and South Korea. The collected data on government initiatives and innovation indicators were analysed using these methods, which was used to identify key trends and assess the

effectiveness of government programmes to stimulate innovation and economic development. The analysis was conducted by examining open data such as the Global Innovation Index, GDP growth in percentage terms and GDP in current US dollars to assess the effectiveness of initiatives and the impact of regional and cultural factors on the success of innovation strategies. This provided a comprehensive assessment of how different government programmes promote innovation processes and their impact on economic development. Based on the identified practices, specific recommendations were formulated to improve government initiatives to adapt programmes to real needs and opportunities.

3.3. Data Sources

Key sources of information were employed to provide a detailed analysis and study of the impact of government open data initiatives on innovation, entrepreneurship and economic growth using econometric methods. Statistical information from the National Centre for Science and Engineering Statistics (2024), Statistics Bureau of Japan (2023), Invest Seoul (2023), World Bank Group (2023a, 2023b) was used to study and compare the effectiveness of government initiatives in the United States, the European Union, Japan, South Korea, China and India, which were used to support the analysis with empirical data and provide a more accurate assessment of the impact of government support on innovation processes and economic growth using econometric methods. In addition to statistical information, descriptions of government initiatives from the Office of Electricity (2024), European Commission (2024a, 2024b), Government of Japan (2022, 2024), Stratsea (Mulyaman, 2023), Government of India (2024a, 2024b) and the official U.S. report were used. General Services Administration (2024), which demonstrated the effectiveness and relevance of econometric methods in assessing the impact of government support on innovation and economic growth.

4. Results

Innovation is key to economic growth and competitiveness. In a modern environment of rapid technological change, governments around the world are actively implementing initiatives to support innovation, start-ups and entrepreneurship. Creating a favourable environment for innovative strategies is important for the success of companies in international markets. Therefore, the impact of government programmes in the US, EU, Japan, South Korea, India and China on innovation strategies and start-ups was addressed (Table 1).

Table 1. The Impact of government initiatives on innovation strategies and start-ups.

Country	Name of the initiative	Result
USA	Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) were created to support the innovation activities of small businesses and start-ups.	As a result of these initiatives, many start-ups can commercialise their innovations, which increases their competitiveness in the market.
European Union	Horizon Europe is the EU's main instrument for supporting research and innovation.	Innovative companies and start-ups in the EU have access to significant financial resources, allowing them to expand R&D capabilities and enter international markets.
Japan	The Japanese government actively supports innovative start-ups through programmes aimed at developing advanced technologies such as artificial intelligence and robotics. The country also has tax incentives for companies engaged in research and development.	Government support promotes the creation of high-tech start-ups specialising in innovative solutions, increasing their competitiveness in both domestic and foreign markets.
South Korea	The South Korean government has introduced the Creative Economy Initiative programme to develop the creative economy, including support for start-ups in the IT and biotechnology sectors.	Thanks to this initiative, the country has become a global leader in technological innovation. Start-ups have access to government funding and incubation programmes, which help them grow rapidly and enter global markets.
India	The Startup India programme aims to create a favourable environment for start-ups by simplifying the regulatory framework, providing tax incentives and creating a venture capital fund to support them.	The initiative has contributed to a boom in start-ups in the country, especially in the financial technology, e-commerce and healthcare sectors. This stimulates the growth of innovative solutions and their application in the domestic and international markets.
China	The Made in China 2025 strategy is aimed at transforming China into a global leader in the production of high-tech products. It provides support for start-ups and innovative enterprises in areas such as robotics, biotechnology and artificial intelligence.	Government support helps to create innovative companies specialising in advanced technologies that play an important role in strengthening China's position in the global market.

Source: compiled by the authors based on European Commission (2024a), Government of Japan (2022), Government of India (2024b).

Government initiatives have a significant impact on the development of innovation strategies and start-ups in different countries. Programmes such as SBIR and STTR in the US, Horizon Europe in the EU, and the Creative Economy Initiative in South Korea show that government support is critical to securing funding, stimulating research and development, and commercialising innovations. These initiatives provide start-ups and small businesses with access to the resources they need to grow rapidly and enter international markets. This, in turn, strengthens the economic position of countries in the global economy.

In addition, the results of the analysis of government initiatives in Japan, India and China highlight the importance of creating a favourable regulatory environment and tax incentives to stimulate innovation. Programmes such as Startup India and Made in China 2025 demonstrate that government policies that support technology startups and innovative enterprises not only enhance their competitiveness at the national level but also improve their role in global markets, contributing to economic growth and strengthening the national position in the global economy. To compare the effectiveness of government initiatives in the US, EU, Japan, South Korea, India and China, their approaches to fostering innovation, supporting entrepreneurship and stimulating economic growth were examined (Table 2).

Table 2. Comparison of approaches to innovation, entrepreneurship support and economic growth in the US, EU, Japan, South Korea, India and China.

Country	Financing innovation	Support for entrepreneurship	Economic growth	Efficiency
USA	A large number of government grants and tax incentives for research and development through programmes such as SBIR and STTR.	Accelerator and incubator programmes such as Y Combinator and Techstars, along with initiatives that support start-ups through venture capital.	Policies to stimulate investment in infrastructure and innovative sectors, including corporate tax cuts and investment tax credits.	The US leads the way in global innovation thanks to a strong venture capital ecosystem and a large number of high-tech start-ups.

European Union	The Horizon Europe programme supports research and innovation across the continent.	The Erasmus for Young Entrepreneurs and EU Startup Nations Alliance programmes support start-ups and entrepreneurs.	Social and regional development policy through EU funds, in particular the European Social Fund and the European Regional Development Fund.	The EU demonstrates a high level of support for innovation through large-scale funding and cross-border initiatives, although there are challenges in harmonising policies across member states.
Japan	Programmes such as the Innovation Network Corporation of Japan to support technological innovation.	Initiatives for the development of small and medium-sized enterprises, as well as government programmes to promote start-ups.	Investments in the latest technologies and environmentally friendly solutions, as well as programmes to stimulate economic growth in the context of an ageing population.	Japan has a good innovation ecosystem, particularly in the areas of robotics and high technology, but faces challenges due to demographic issues and the need to further stimulate domestic consumer demand.
South Korea	Support programmes through the Creative Economy Initiative and national innovation funds	Initiatives such as Startup Campus and the K-Startup Grand Challenge, promote startups and entrepreneurship through various platforms and events.	Investments in new technologies, including 5G and artificial intelligence, as well as incentives to develop an export-oriented economy.	South Korea has made significant strides in technological innovation through active government support but needs to improve access to resources for small and medium-sized enterprises in different regions.

India	Programmes such as Startup India and Make in India provide support for innovation and entrepreneurship.	Investing in start-ups through funds and supporting small and medium-sized enterprises.	Economic reforms and infrastructure development policies, including digital innovations, expand access to financial services.	India has a high potential for start-ups and innovation but faces challenges such as unequal access to investment and infrastructure in different regions.
China	Programmes to support innovation through public investment and programmes such as Made in China 2025.	A policy of promoting start-ups through tax rebates, soft loans and incubators.	Aggressive investment in infrastructure and new technologies, such as artificial intelligence and green technologies.	China has made significant strides in innovation and technology thanks to active government support and large-scale investment but faces challenges in transparency and equal access to resources.

Source: compiled by the authors based on the Centre for Public Impact (2016), United Nations Development Programme (2024), and Government of Japan (2024).

The US leads the venture capital and startup ecosystem thanks to government programmes, tax incentives and developed infrastructure, but faces the problem of inequality in access to finance. While the EU effectively funds research and innovation through programmes such as Horizon Europe, differences in policies between member states make it difficult to implement coherent strategies. In turn, Japan is focusing on high technology and environmental innovation but is facing demographic challenges and the need to maintain domestic demand. South Korea is making progress in supporting start-ups and technological innovation, but the issue of equal access to resources remains a challenge. While India demonstrates great potential in the development of start-ups thanks to the Startup India and Make in India programmes, infrastructure and access to resources should be improved. China, on the other hand, is investing in the latest technology and infrastructure, leading the way in technological progress, but must address issues of transparency and access to resources for further development and international cooperation.

Next, the study addressed the econometric methods used to analyse the impact of government initiatives on innovation and economic growth. Table 3 presents the advantages and disadvantages of regression and correlation analysis, as well as recommendations for their use depending on the nature of the data and the research objectives.

Table 3. Advantages and disadvantages of econometric methods used to analyse the impact of government initiatives on innovation and economic growth.

Method	Pros	Cons	Usage
Regression analysis	Used to assess the impact of independent variables on the dependent variable, suitable for testing hypotheses and determining the significance of variables, simplicity and clarity of the model	It can be sensitive to multicollinearity between independent variables, does not always address time effects, and may be limited in cases of nonlinear relationships.	When independent and dependent variables are clearly defined when it is necessary to test relationships between variables in the data without complex time effects.
Correlation analysis	Can be used to determine the degree and direction of the relationship between two variables, a simple and quick assessment of the relationship, provides basic information for further analysis.	It does not determine cause-and-effect relationships, does not address the influence of third variables, and is sensitive to extreme values and sample deviations.	Quickly assess the relationship between two variables for preliminary analysis before using more complex models.

Source: compiled by the authors based on Bewick et al. (2003).

The analysis of econometric methods demonstrated that each has its characteristics that affect effectiveness in measuring the impact of government initiatives on innovation and economic growth. Using Microsoft Excel, regression analysis was employed to assess the relationship between R&D expenditure, GDP per capita and innovation index in the US, Japan and South Korea in Table 4. These countries were selected due to their different levels of economic development and innovation activity, which identified variations in the impact of economic and investment factors on innovation progress.

Table 4. Regression analysis to assess the relationship between R&D expenditure, GDP per capita and innovation index in the US, Japan and South Korea.

	Input data		
Country	**R&D expenditure, trillion USD**	**GDP per capita, trillion USD**	**Innovation index**
USA	0.163	27.36	63.5
Japan	0.145	0.4	54.6
South Korea	0.024	1.71	58.6

Conclusions on results						
Regression statistics						
R Multiple	0.996					
R-square	0.992					
Normalized R-square	0.948					
Standard error	2.88					
Observations	3					
Dispersion analysis						
	df	SS	**MS**	**F**	**Variable F**	
Regression	2	131.5	65.75	14.54	0.044	
Remainder	0	0.29	0.29			
Total	2	131.79				
	Coefficients	**Standard error**	**t-statistics**	**P-value**	**Lower 95%**	**Upper 95%**
Y-intersection	58.70461114	12.45	20.47	0.016	44.58	72.82
R&D expenditures	-29.27224917	2.69	10.87	0.038	-58.12	-6.42
GDP per capita, trillion USD	0.349662481	0.07	0.15	0.889	0.24	0.46
Withdrawal of the balance						
Observation	**Predicted Innovation Index**	**Remainder**				
1	63.5	0				
2	54.6	0				
3	58.6	0				

Source: compiled by the authors based on National Center for Science and Engineering Statistics (2024), Statistics Bureau of Japan (2023), Invest Seoul (2023).

A regression graph illustrating the relationship between R&D expenditure, GDP per capita and the innovation index is shown in Figure 1.

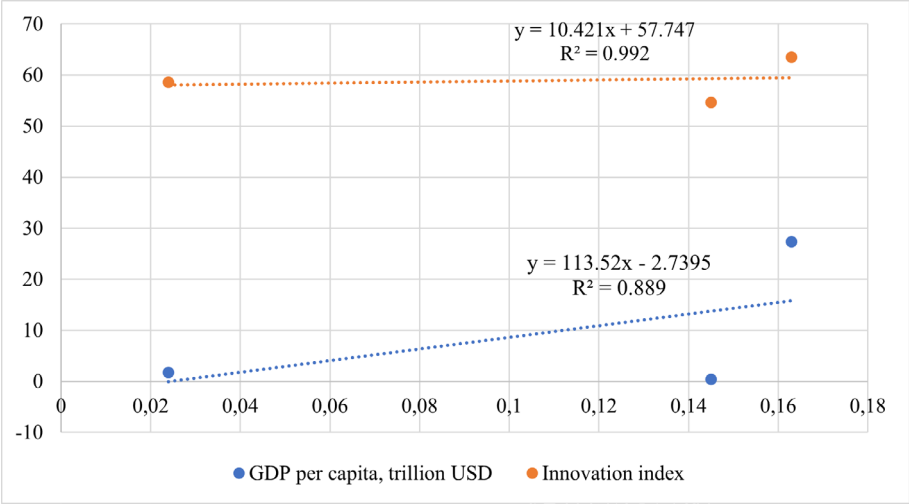

Figure 1. Results of regression analysis to assess the relationship between R&D expenditure, GDP per capita and innovation index in the US, Japan and South Korea.

Source: compiled by the authors based on National Center for Science and Engineering Statistics (2024), Statistics Bureau of Japan (2023), Invest Seoul, (2023).

Regression analysis using Microsoft Excel showed a significant impact of R&D expenditure on the innovation index in the US, Japan and South Korea. The R-squared (0.992) indicates that the model explains well the variation in the innovation index based on R&D expenditure and GDP per capita. The impact of R&D expenditure is significant and negative, with a coefficient of -29.27, indicating that an increase in R&D expenditure is associated with a slight decrease in the innovation index. However, the coefficient for GDP per capita (0.35) is not statistically significant, as its p-value (0.889) exceeds the usual threshold of significance. In the US, R&D expenditures have the greatest impact on the innovation index, while in Japan and South Korea, the relationship between R&D expenditures and innovation is less pronounced. These findings suggest that R&D spending strategies need to be reviewed to ensure that they are more effective in stimulating innovation. At the same time, the weak significance of GDP per capita in this model may indicate that this indicator has less influence on the level of innovation in the sample under study.

To analyse the relationship between the variables of R&D expenditure, GDP per capita and the innovation index for the US, Japan and South Korea, a correlation analysis was conducted using Microsoft Excel in Table 5.

Table 5. Correlation analysis in the assessment of the relationship between R&D expenditure, GDP per capita and innovation index in the US, Japan and South Korea.

Input data			
Country	**R&D expenditure, trillion USD**	**GDP per capita, trillion USD**	**Innovation index**
USA	0.163	27.36	63.5
Japan	0.145	0.4	54.6
South Korea	0.024	1.71	58.6
Results of correlation analysis			
GDP per capita, trillion USD		**Innovation index**	
GDP per capita, trillion USD	1		
Innovation index	0.912198048	1	
R&D expenditure, trillion USD		**Innovation index**	
R&D expenditure, trillion USD	1		
Innovation index	0.176725837	1	

Source: compiled by the authors based on National Center for Science and Engineering Statistics (2024), Statistics Bureau of Japan (2023), Invest Seoul, (2023).

A correlation analysis graph illustrating the relationship between R&D expenditure, GDP per capita and the innovation index is shown in Figure 2.

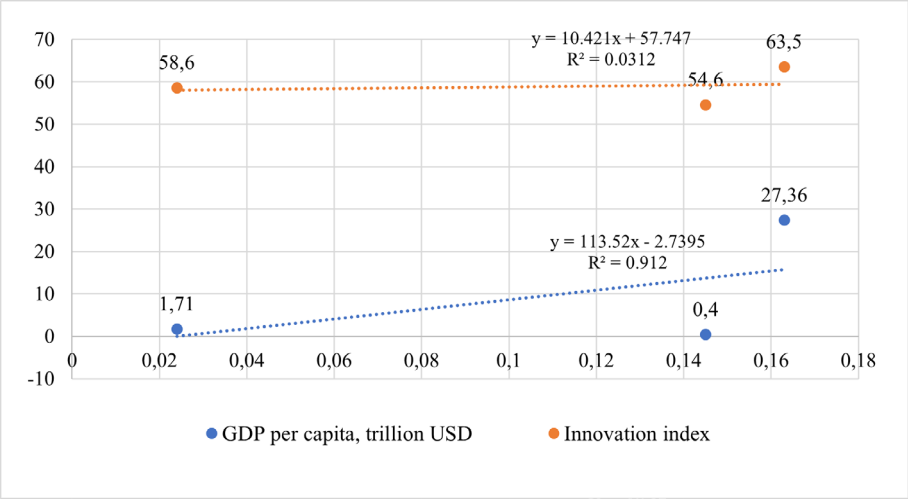

Figure 2. Correlation analysis results to assess the relationship between R&D expenditure, GDP per capita and innovation index in the US, Japan and South Korea.

Source: compiled by the authors based on National Center for Science and Engineering Statistics (2024), Statistics Bureau of Japan (2023), Invest Seoul, (2023).

The high value of the correlation coefficient between GDP per capita and the innovation index (0.912) indicates a denotes a positive relationship. Therefore, the growth of GDP per capita is accompanied by an increase in the innovation index, which demonstrates the importance of economic prosperity in the development of innovation. The correlation between R&D expenditure and the innovation index was weak (0.177). This indicates that the increase in R&D expenditure is only marginally related to the increase in the innovation index. This result indicates that R&D expenditure is not the main factor determining the level of innovation in a country.

Comparison of the effectiveness of regression and correlation analysis for studying the relationships between R&D expenditures, GDP per capita and the innovation index concluded on the demand for and practicality of using econometric methods. In turn, the correlation analysis confirmed the significance of the relationship between GDP per capita and the innovation index, indicating a high correlation between these indicators. At the same time, the weak correlation between R&D expenditures and the innovation index suggests the need for additional analysis of other factors that may affect innovation development. Correlation analysis is easier to perform and interpret, providing a quick overview of the relationships between variables. Thus, both econometric methods are effective and in demand for data analysis, as regression analysis describes in detail the impact of individual factors on the results, while correlation analysis allows for quick identification of general trends. The use of both methods in combination provides a more complete picture and enables informed decisions to support innovation development.

The Global Innovation Index, which measures the ability of countries to innovate and use innovation to drive economic growth, is an important indicator of understanding the dynamics of economic development. The study of GDP growth (annual %) and GDP (current US dollars) combined with these rankings revealed how innovation strategies affect economic productivity and development. Therefore, the rankings of the countries under study were reviewed and some countries from the European Union were also selected, namely Switzerland, the Netherlands, Germany, Denmark and France (Table 6).

Table 6. Global Innovation Index 2023.

No.	Country	Mark
1	Switzerland	67.6
3	United States of America	63.5
7	Netherlands	60.4
8	Germany	58.8
9	Denmark	58.7
10	Republic of Korea	58.6
11	France	56.0
12	China	55.3
13	Japan	54.6
40	India	38.1

Source: compiled by the authors based on World Intellectual Property Organization (2023).

The high ranking of countries such as Switzerland, the United States and the Netherlands in the index reflects their ability to innovate and use innovation to drive economic development. In particular, Switzerland and the United States demonstrate leadership in innovation and a high level of economic productivity, which is confirmed by their high positions in the global ranking. At the same time, countries with high innovation scores also show significant GDP and income growth results, indicating a close link between innovation strategies and economic development. At the same time, countries such as India, although ranked lower in the global innovation index, show significant potential for further growth through active innovation initiatives. High scores for innovation in countries such as China and South Korea also confirm their contribution to the global economy through the development of new technologies and infrastructure. Thus, the index data confirms that innovation is a key driver of economic growth, and countries with high innovation scores can ensure sustainable development and competitiveness at the global level.

The analysis of GDP growth dynamics for the period from 2019 to 2023 is relevant for the determination of economic trends at the global level. An analysis of annual GDP growth in such key economies as the United States, EU countries (Switzerland, the Netherlands, Germany, Denmark, France), South Korea, China, Japan and India assessed the

impact of global events and domestic economic policies on economic development. This analysis identified key trends in economic growth, including the impact of the COVID-19 pandemic, global trade conflicts and other significant factors, and defined how different economies are responding to changes in the global economic environment (Figure 3).

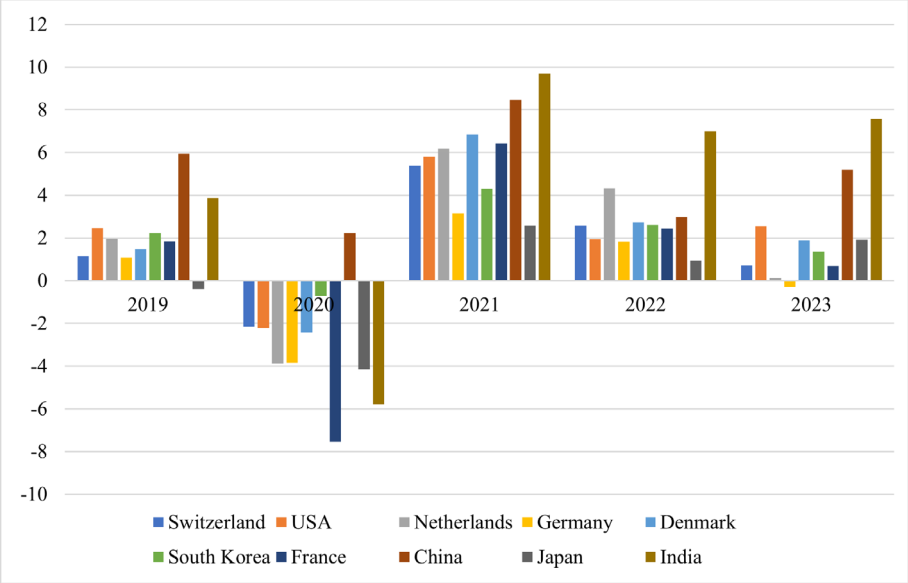

Figure 3. GDP growth dynamics from 2019 to 2023 in the USA, EU countries (Switzerland, Netherlands, Germany, Denmark, France), South Korea, China, Japan, and India, annual %.

Source: compiled by the authors based on World Bank Group (2023a).

During 2019-2023, GDP growth in different countries demonstrated significant variability. China and India demonstrated a steady recovery from initial negative performance in 2020, with a particular focus on strong growth in 2021-2023, reflecting strong economic recovery and high growth rates in both countries. This is related to the effective implementation of government initiatives, such as investment incentives, support for innovation and infrastructure development, which contributed to the rapid recovery. By contrast, developed economies such as the US, the Netherlands, France and Germany were more volatile, with periods of negative growth. However, overall, their dynamics were more stable compared to 2020, which could indicate a successful adaptation to economic difficulties and the implementation of government initiatives aimed at stabilising the economy and supporting business. Switzerland and Japan, on the other hand, showed moderate growth, with Switzerland showing a slight decline in growth in 2023. This could be the result of a more conservative approach to economic policy or the limited impact of government

initiatives on economic growth.

In general, the data showed that effective government initiatives can significantly contribute to economic growth, especially in times of economic crisis. Countries that adapted more quickly and implemented supportive programmes, such as China and India, experienced stronger growth, while advanced economies experienced a gradual and irregular recovery. Analysis of the dynamics of GDP growth is key to the determination of economic trends and comparison of the economic performance of different countries (Ismayilov et al., 2024). The period from 2019 to 2023 was marked by significant economic changes driven by both global crises and domestic political and economic transformations. In this context, the analysis of GDP growth of such economic centres as the USA, EU countries (Switzerland, the Netherlands, Germany, Denmark, France), South Korea, China, Japan and India assessed the impact of global and local factors on economic development (Figure 4).

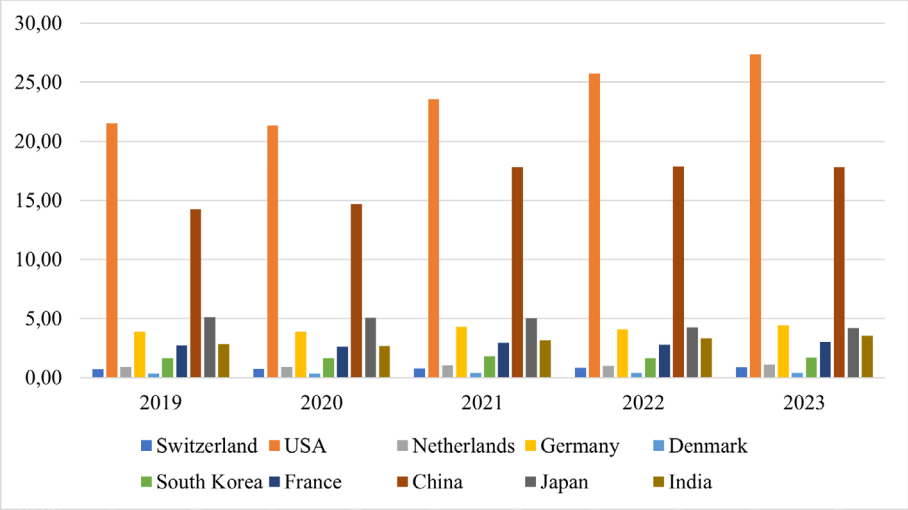

Figure 4. GDP growth dynamics from 2019-2023 in the USA, EU countries (Switzerland, Netherlands, Germany, Denmark, France), South Korea, China, Japan, and India, trillion USD.

Source: compiled by the authors based on World Bank Group (2023b).

The analysis of GDP growth from 2019 to 2023 revealed significant differences between countries. The US is set to achieve steady growth in 2023, reflecting its strong economic development, supported by innovation and infrastructure. Despite a slight slowdown in growth in 2023, China remains one of the global leading economic players. European countries, such as Switzerland, the Netherlands, Germany and France, show different levels of economic development, with Switzerland and the Netherlands showing stable growth, while Germany and France have experienced some fluctuations in growth rates.

South Korea and Japan are facing difficulties in maintaining their growth rates, especially Japan, where GDP has declined in recent years. India is showing positive dynamics, which underscores its economic potential and growing role on the global stage. Thus, the data shows that economic growth varies by region and country, including between developed and emerging economies.

The main theories explaining the processes of innovation and economic growth provide valuable tools for understanding the mechanisms of development in the modern economy. The theory of innovation systems focuses on the importance of interaction between different actors in the innovation process: governments, research institutions, enterprises, and financial organizations (Panchenko et al., 2022). It emphasizes that innovations are not the result of the actions of individual innovators, but are the product of collective activity, in which an important role is played by the institution of supporting innovation processes. This can be either a national or local innovation system, within which there are stable interconnections that contribute to the development of new technologies and markets (Roshchyk et al., 2024). The systems approach allows us to consider innovation as a complex process in which not only technology but also social, cultural and economic factors interact.

The theory of endogenous growth, in turn, emphasizes the importance of internal factors for economic growth, such as knowledge accumulation, investment in human capital, and technology development (Petersone et al., 2016; Petersone and Ketners, 2017). According to this theory, economic growth is not the result of external factors, such as resource endowments, but depends on investments in scientific and technological progress and innovation. The key idea is that economic growth can be self-sustaining if a country or region invests in the development of infrastructure to support innovation, including research and development institutions, educational institutions, and other elements of innovation infrastructure (Samoichuk et al., 2016).

Institutional economics adds an important aspect to these theories, in particular by emphasizing the role of institutions in the development of economic systems. Institutions, according to this theory, are the rules of the game in the economy that shape the behavior of economic actors, including businesses and governments. They include both formal (legislation, government programs) and informal institutions (social norms, culture). According to the institutional approach, the success of innovation depends to a large extent on the effectiveness of these institutions, as well as on the country's ability to adapt to changing economic conditions (Liadskyi and Diadyk, 2023). These theories provide an important conceptual framework for understanding the complex processes that take place in an economy on the way to innovative development. They help to explain not only the mechanisms of growth, but also the factors that determine different approaches to development at the level of government policies, institutions, and enterprises.

The formulation of specific recommendations for improving government programmes aimed at innovation, entrepreneurship and economic growth is critical to ensure the effective development and adaptation of government initiatives. In a rapidly changing global

environment and diverse regional and cultural contexts, analysis of the most successful practices and models that have proven effective in different countries is relevant. Effective government initiatives are important to stimulate innovation, support entrepreneurship and promote economic growth (Xhafka et al., 2024). Modern conditions require governments to be dynamic and adaptive, responding to rapid changes in the global economy and technological development. Key aspects to consider when improving government initiatives include strengthening support for innovative start-ups, improving educational programmes for entrepreneurs, promoting cross-sectoral cooperation, optimising the regulatory environment, R&D and attracting private investment.

Supporting innovative start-ups is an important component of the development of the knowledge and technology economy. Start-ups are often a source of new ideas and technologies that can have a significant impact on the market and the economy (Kharchenko et al., 2017). One of the key aspects of strengthening support for innovative start-ups is the provision of financial assistance. To implement these initiatives, the state can create specialised agencies or platforms focused on supporting start-ups. It is also necessary to ensure close cooperation between government agencies, educational institutions, business incubators and investors. Strengthening support for innovative start-ups will create a favourable environment for their development, increase their chances of success and help bring new technologies and business ideas to the market, which in turn will have a positive impact on the national economic development.

The effectiveness of government initiatives in the areas of innovation, entrepreneurship and economic growth is enhanced by active cooperation between government agencies, the private sector and academic institutions. Integrating the efforts of different sectors creates synergies that contribute to the development of innovative solutions, efficient business models and scientific achievements (Shahini et al., 2023). To implement this recommendation, interagency working groups and consortia should be formed, bringing together representatives of government, business and academia. Such groups should have clearly defined goals and objectives, as well as mechanisms for coordinating their activities. Moreover, these working groups should meet regularly and report back on efforts, so that progress can be effectively monitored, and strategies can be adjusted if necessary.

Creating an effective regulatory environment is a key factor in stimulating entrepreneurship and innovation (Khoda et al., 2024). To implement this recommendation, it is necessary to start by reviewing and simplifying existing regulatory requirements. This includes optimising business registration processes, and obtaining licences and permits, which are often lengthy and bureaucratic. Reducing the number and complexity of requirements will reduce administrative costs for entrepreneurs, which in turn will help to launch new businesses faster and reduce barriers to innovation. In a modern competitive environment, where technological development is a driving force for economic growth, government support for R&D can significantly accelerate innovation processes and create favourable conditions for the development of new technologies (Kudrenko and Hall, 2024). For this recommendation to be implemented effectively, it is necessary to provide

financial incentives for companies to invest in research and development. Providing tax incentives to such companies can significantly reduce expenditures on innovative projects, which will lead to an increase in R&D investments. This may include reduced income tax rates, deductions from research and development taxes or tax credits for expenditures on innovative projects. Such benefits will reduce the financial burden on companies and make investments in innovation more attractive.

The creation of funds to finance research and technical innovation is another important area of R&D support. Public funds can provide funding for research projects that cannot be financed by the private sector, for basic research and early-stage projects. These funds can be used to support research in strategic areas, such as artificial intelligence, renewable energy or biotechnology, which have significant potential for economic development. To achieve maximum results in supporting R&D, it is necessary to ensure transparent and efficient management of financial resources and grants. This may include the establishment of specialised agencies or committees to oversee the allocation of funds and the evaluation of research results, as well as regular monitoring and reporting on the use of public funds.

To ensure sustainable economic growth, it is important to intensify the attraction of private investment in key sectors. The private sector can significantly contribute to economic development by providing the necessary capital, innovation and management expertise required to implement ambitious projects and initiatives (Alqsass et al., 2023). Implementation of this recommendation could include the development of investment incentives, such as tax breaks and guarantees for private investors. Tax incentives may include reduced income tax rates, tax credits or deductions for investments in strategic industries. Investor guarantees may protect against certain risks, such as currency fluctuations or political instability.

These recommendations can help improve government initiatives, stimulating innovation, entrepreneurship and economic growth by creating a favourable environment for investment and development.

5. Discussion

The results of this study confirm that public initiatives have a significant impact on stimulating innovation and entrepreneurial activity, which in turn has a positive impact on economic growth. The application of econometric techniques, including regression and correlation analyses, was used to assess the links between these factors, providing accurate evidence for policymaking and emphasising the importance of a systematic approach to analysing the impact of public expenditure on innovation performance. Thus, coinciding with the results of Pradhan et al. (2020), Kim et al. (2022), and Urbano et al. (2020), emphasise the importance of supporting innovative entrepreneurship for economic development, especially in countries with different levels of economic development, as well as the importance of institutional conditions for stimulating entrepreneurial activity.

In developed countries, no clear positive relationship between the overall level of entrepreneurship and economic growth is evident, but entrepreneurship was found to have a positive impact on growth in developing countries, especially in the manufacturing sector (Ketners et al., 2024). In developing countries, institutional factors such as the number of procedures for starting a business, access to credit and communication resources play an important role in the development of opportunity-oriented entrepreneurship, which highlights the need to improve the institutional environment to increase economic efficiency (Karki et al., 2024; Osei et al., 2024). Econometric methods have made it possible to accurately assess these relationships, providing reliable evidence for policy development. Their application contributes to a deeper understanding of the role of institutional conditions and government support in innovation development.

The study results highlight the importance of integrating innovation strategies into government initiatives to stimulate economic growth and increase the productivity of small and medium-sized enterprises. The results correlate with those of Surya et al. (2021) and Nakku et al. (2020) in that technological innovation and public policy, including support for business capital and human resource capacity building, have a positive impact on the development of small and medium-sized enterprises. Research confirms that the strategic integration of innovation into government support programmes can significantly increase the productivity of small and medium-sized enterprises while contributing to overall economic growth. While Bradley et al. (2021) and Omri (2020) analysed the impact of macroeconomic and institutional factors on innovative entrepreneurship and found that while some institutional conditions and government initiatives could support innovation, the effectiveness of these measures varied across policy contexts. They also noted that, in the case of poor governance or inappropriate policies, the positive impact of institutional conditions could be reduced or even negated. However, these results do not coincide with the conclusions of the study, which focused on the use of regression and correlation analysis. This was used to assess the relationship between government spending on R&D and innovation performance. The use of econometric approaches revealed the mechanisms of interaction between inputs and innovation outputs, which is lacking in more general studies focused on macroeconomic or institutional factors.

The results are consistent with those of Huang et al. (2022), Moro et al. (2020), and Popescu and Diaconu (2021), which confirm the importance of government support and technological innovation for entrepreneurship and economic growth. State support has a positive impact on entrepreneurial initiatives, by increasing access to credit, while good governance helps to maximise the positive effects of financial development on formal entrepreneurship (Ketners et al., 2025). Studies show that government support makes it much easier for multinational companies to conduct international operations. However, its effectiveness is declining in countries participating in the Belt and Road Initiative (Jakubik et al., 2017; Kerimkulov et al., 2015). This is related to the specific economic and political conditions in these countries, which reduce the positive impact of government support on the success of international projects. It also reveals that in the short term, government

spending has a double impact on GDP, while in the long term, its impact is limited, which confirms the existence of inflationary macroeconomic bottlenecks (Tleubayev et al., 2024).

The results of the study confirm that the integration of technology into sustainable economic development has a positive impact on economic growth. The use of econometric methods in this context provides an accurate analysis and verification of the relationship between the introduction of new technologies and economic growth. These results are consistent with the results of Maneejuk and Yamaka (2020), Ahmad et al. (2020) and Dabbous et al. (2023), which found that the integration of technology into sustainable economic development has a positive impact on economic growth. These results are particularly evident in countries where technology and innovation drive economic progress. However, in contrast to the overall positive impact, studies confirm the existence of a non-linear relationship between technology development and economic growth and highlight the long-term role of technological innovation in reducing the ecological footprint and increasing competitiveness. This demonstrates the critical importance of digitalisation for sustainable economic, environmental and social development. The authors confirm the existence of a non-linear relationship between technology development and economic growth.

However, Ponce Rodriguez (2019), Panzera and Postiglione (2022), Ruijer and Meijer (2020) emphasised that open government data has a significant impact on entrepreneurship and economic growth, especially in high-income countries, where there is a positive correlation with the entrepreneurship index, which does not coincide with the results of this study, as they indicate different impacts depending on specific government programmes and contextual factors in each country. This factor underlines the importance of considering local conditions and the specifics of state support. In addition, data analysis using regression and correlation methods showed that the effectiveness of government initiatives depends on several economic and social factors, which were not accounted for in previous studies.

The results of the study demonstrate the importance of assessing the effectiveness of government initiatives in the context of innovation development and economic growth. In particular, the study determined that econometric methods such as regression and correlation analysis provide a deeper understanding of the impact of government programmes on innovation and economic development. In turn, these results are consistent with the results of Ahmed et al. (2022), Ma et al. (2023) and Moslehpour et al. (2023). Studies on the green revolution movement in Japan show that public investment in clean energy, particularly nuclear energy, contributes to significant reductions in CO_2 emissions, while economic growth, conversely, increases emissions.

An analysis of the effectiveness of government measures against COVID-19 shows that tough government actions at the beginning of the pandemic, despite possible short-term economic shocks, subsequently had a positive impact on the economy and contributed to its recovery (Potryvaieva et al., 2024; Rao and Kumar, 2024; Chykurkova et al., 2025). Corporate sustainability practices in the Indian automotive industry highlight the importance of government initiatives, business social consciousness, technological innovation, and

sustainable organisational culture to achieve sustainability goals. Studies on environmental technologies indicate that environmental innovations significantly reduce energy intensity and that capital investment in information and communication technologies also has a significant impact on energy intensity reduction (Ismayilov et al., 2023; Murtezaj et al., 2024).

The results obtained in comparison with other studies have confirmed that econometric methods are significant in determining the impact of innovation on stimulating economic growth, especially in developing countries. These methods provided a more detailed understanding of the relationship between government initiatives and innovation processes, highlighting their importance for economic development.

6. Conclusions

The conducted study provides empirical evidence of the significant role government initiatives play in stimulating innovation, entrepreneurship, and economic growth across a range of developed and emerging economies. The comparative analysis of programmes such as the Small Business Innovation Research, Horizon Europe, Startup India, and Made in China 2025 demonstrates that public policy measures, including financial incentives, regulatory simplification, and targeted investment in high-tech sectors, positively influence the formation and international competitiveness of start-ups. Countries that actively supported innovation ecosystems—particularly South Korea, China, and the United States—achieved demonstrable success in integrating innovation into their broader economic growth strategies.

Econometric analysis using regression and correlation models confirmed the significance of certain macroeconomic variables in innovation outcomes. Notably, R&D expenditure showed a high explanatory power ($R^2 = 0.992$) in relation to the innovation index, although its coefficient was negative and its interpretation requires further investigation into the efficiency of spending. In contrast, gross domestic product per capita displayed a strong positive correlation ($r = 0.91$) with the innovation index, highlighting the reinforcing role of economic prosperity in innovation dynamics. Cross-country comparisons of gross domestic product growth from 2019 to 2023 revealed that nations with coherent innovation strategies and robust government support especially China and India rebounded more effectively from global crises. The Global Innovation Index data further support the conclusion that countries investing in research infrastructure and fostering favourable conditions for entrepreneurial activity maintain stronger positions in the global economy.

Regression and correlation analyses of R&D expenditure, gross domestic product per capita, and the innovation index in the US, Japan, and South Korea revealed a strong link between gross domestic product per capita and innovation, while the correlation with R&D spending was weak, indicating the influence of other factors. The analysis of global innovation index rankings and gross domestic product growth from 2019 to 2023 confirmed that innovation is a key driver of economic development. Stable growth in countries like

the US and Germany reflects effective innovation strategies, while high post-2020 growth in China and India underscores innovation's role in recovery. Switzerland and South Korea's high innovation scores highlight their global economic impact through technological advancement.

Based on the analysis, recommendations for improving government initiatives in the field of innovation and entrepreneurship were developed. The study recommended focusing on improving financial support for start-ups, enhancing educational programmes for entrepreneurs, promoting cross-sectoral cooperation and optimising the regulatory environment.

The study was limited by the availability and quality of open data, which will affect the accuracy of econometric models. To improve the results of the study, it is recommended to expand the use of econometric models. It is also necessary to study the effectiveness of specific government initiatives in different countries and assess their long-term impact on innovation and economic growth.

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