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THE CZECH REPUBLIC WITHIN THE CONTEXT OF MEETING THE R&D&I TARGETS SET OUT IN THE EUROPE 2020 STRATEGY

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Abstract

This article aims to assess the development and structure of gross domestic expenditure on research and development (GERD) concerning the Europe 2020 strategy (Strategy) and the Czech government's targets. Four research tasks are outlined: 1. Assessing if the EU met the 3% GDP R&D investment target set by the Strategy. 2. Determining if the Czech Republic met its national R&D expenditure target. 3. Verifying the statistical relationship between GERD and the Summary Innovation Index (SII). 4. Examining the statistical relationship between GERD components and SII. Findings reveal that neither the Strategy nor the Czech Republic's targets were achieved. Correlation analysis indicates a significant relationship between total GERD and SII. Further analysis shows a strong correlation between the pairs of business enterprise expenditure on R&D and SII, as well as between government expenditure on R&D and SII.

Keywords

R&D&I; Gross expenditure on research and development; GERD; R&D intensity; SII; Europe 2020.

Introduction

Over the last few decades, theoretical and empirical research has paid considerable attention to the issues of economic growth, productivity growth, and increasing competitiveness. Since the very beginning of economics as a science, all major theoretical trends have been devoted to the issue of economic growth. Economists have tried to find answers to such questions as the source of growth, why some countries are rich and others are poor, etc. Each of these theoretical approaches offered different answers. In the late 1980s, endogenous growth models dominated economic theory and influenced the direction of economic thinking in subsequent years. These models identified research, development and innovation, or R&D&I spending, as one of the main sources of growth. Their importance and relevance are reinforced by the fact that R&D&I is one of the most important priorities in the strategic development documents of all developed countries.

This article aims to assess the development and structure of gross domestic expenditure on research and development (GERD) with respect to the achievement of R&D&I targets set by the Europe 2020 strategy (Strategy) and the Czech government.

It proceeds from the general to the specific. The introductory part of the article is devoted to the theoretical background of economic growth or the importance of R&D&I for economic

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growth, especially in the framework of endogenous models. Attention is also paid to science, research and innovation in the strategic documents of the European Union and the government of the Czech Republic. In the main analytical part of the article, four research tasks are formulated with regard to the fulfilment of the above aim. The data were obtained from publicly available sources. They were first analyzed using descriptive statistics, and then comparative and correlation analysis methods were used to verify the relationship between the selected variables. The conclusion summarizes the findings and formulates answers to the individual research questions.

1 Literature Review and Theoretical Background of the Issue under Investigation

Investments in science, research, development and innovation, together with investments in education, are considered the main sources of economic growth, productivity growth, and increasing competitiveness in modern economies. Mainly in the last twenty years, the awareness of this fact has become more important, and the area of research, development and innovation (hereinafter R&D&I or R&D) has been at the top of the priorities of regional, national and supranational policies. Macroeconomic growth theories are the theoretical basis for this thesis of economic development based on knowledge and innovation, and for the emergence of new policies that intensively support R&D. According to modern macroeconomic theory, the main factors affecting economic growth include labor efficiency, which is the result of technological progress, qualitative changes in economic, institutional and social organization, and capital intensity. Two main approaches can be identified as the most important of the growth theories, namely the neoclassical models, the most famous of which is the growth model of R. M. Solow, and the later constructed endogenous growth models.

It is useful to recall the most important conclusions of Solow's model (Solow, 1956, 1957). Solow argues that mere capital accumulation increases output per worker only up to the steady-state level; when capital accumulation is supported by an equally large increase in labor, the result is an increase in output, but not in output per worker, and that the only factor in long-run growth is technological progress, which determines the growth of labor productivity. In this model, however, technological progress is an exogenous quantity, i.e. unexplained by the model. Technological progress and innovation are only random events in the model and can only be expressed as the residual growth after the effect of the factors on which the model is based has been subtracted. It can, therefore, be argued that the Solow model does not adequately explain economic growth and does not capture the factors that are key to the development of today's knowledge-based economies.

In response to the shortcomings of neoclassical models and their inability to explain empirically the differences in wealth between countries, endogenous growth theories emerged in the late 1980s and early 1990s. One of the main exponents is R. Romer (Romer, 1986, 1990). Endogenous growth theories are characterized primarily by the extension of the concept of capital to include so-called knowledge capital, which arises as a result of investments in R&D of new technologies, process and product innovations, as well as investments in human capital. They attribute increasing returns to investments in R&D and human capital due to the existence of so-called positive externalities of these investments in knowledge capital, which bring social benefits that can exceed the initial investment costs several times over. As a result, aggregate returns on total capital may be at least constant, possibly even increasing, but certainly not decreasing as predicted by the neoclassical model. Thanks to rising returns, capital, and dependence on it, the output can thus grow essentially indefinitely. (Romer, 1986). Technological change is endogenized in these models, identified

with the growth of knowledge capital, which is a function of the growth of investment in new technology and human capital.

Some empirical studies conducted in the 1990s refute the assumption of increasing returns. For example, Jones (1995a, 1995b, 1999) argues through US statistics that although the number of scientific researchers has multiplied over the last half century due to a substantial increase in R&D funding, the growth in output per capita has been much lower. On the basis of these arguments, the assumption of increasing returns to scale has been removed from the models, and these models tend to be referred to as "second-generation" endogenous models (Dinopoulos and Sener, 2007).

Models that seek to explain the origins of new technology and innovation are referred to as Schumpeterian growth models. Schumpeterian growth theory is based on the idea that economic growth is driven primarily by technological progress generated by the endogenous process of product and process innovation. The word endogenous here means innovation arising from the conscious actions of economic agents to maximize their utility. (Holman, 2000). The theory is based on the well-known assumption of the existence of the so-called process of creative destruction, which was first described by Schumpeter in 1942. This is the idea that economic development is continuously pushed forward by invention and the introduction of new technologies and innovations, from which some economic units benefit and others are harmed. A newly introduced product or technology upsets the previous equilibrium in the markets and thus has a disruptive effect on companies or entire sectors, which are unable to adapt to the new situation and lose competitiveness. The whole process is, however, a recovery process for the economy, as it ensures the survival of the better, more competitive businesses and lets the weaker ones fail. Over time, the economy then reaches a new equilibrium at a higher level. Thus, competition in such an economy is actually a kind of Darwinian struggle for survival, where the ability to produce, adopt and continuously improve new technologies and the ability to adapt to constant change is the guarantee of success and the sustainability of competitiveness.

The Schumpeterian theories of endogenous growth also provide suggestions for economic policy. Romer (1990) and his followers (Aghion and Howitt, 1992) argue that government policies that promote scientific research activities, whether in the private or public sector, together with policies that promote education, can contribute to economic growth in both the short and long run. Technological progress is considered to be the result of a number of factors, such as in particular: the level of investment in physical and knowledge capital (i.e. technology and human capital), openness to international trade, the quality of property rights provision, government consumption, population growth, and the level of government regulation.

The EU has placed increasing emphasis on innovation as the main means of increasing competitiveness since around the mid-1990s. Innovation can be seen as an expression of creativity and the creative process. It is very diverse. It can be the result of science and research, entrepreneurial and managerial skills, or organizational, social, and administrative skills. Innovation means the successful use of new ideas in any environment. It can be the discovery of a new cure for Covid 19, the creation of a new product, or a change in a production process. In March 2000, the European Council announced the objective that the European Union should become the most competitive and dynamic knowledge-based economic area in the world by 2010 - an area capable of sustained economic growth, with more and better jobs and greater social cohesion. (European Commission, 2000)

This was, in effect, a set of interacting reforms whereby it was assumed that measures implemented in one Member State would be much more effective if implemented in other

Member States. The problem was that the Lisbon Strategy was too broad to be seen as a coherent whole. The Lisbon Strategy dealt with everything and, in principle, nothing in particular; everyone was responsible, but no one in particular.

The time horizon for the Lisbon Strategy expired in 2010. It was replaced by a new long-term strategy, Europe 2020. This strategy responded not only to the economic crisis at the time but also to other long-term problems, such as the ageing population in Europe and pressure on resources.

In this strategy, the EU sets out three priorities - smart growth, i.e. to develop an economy based on knowledge and innovation; sustainable growth, i.e. to promote a more competitive, greener and less resource-intensive economy; and inclusive growth, i.e. to promote a high-employment economy characterized by social and territorial cohesion. These priorities are then concretized in the five headline targets that the EU wanted to achieve by 2020, one of which is the target to invest 3% of EU GDP in research and development. (European Commission, 2010)

The Czech Republic has long lacked a systematic and coordinated state policy aimed at creating an overall pro-innovation environment. The only relevant document since the establishment of the independent Czech Republic has been the National Innovation Strategy of 24 March 2004. On its basis, the National Innovation Policy for 2005-2010 (Vláda ČR, 2006) was prepared, which set itself the task of creating conditions for a systematic and coordinated state policy aimed at creating an overall pro-innovative environment, especially for the business sector, which is decisively linked to the innovation process. In the conditions of a globalized world, strategies of the "low-cost economy" type, using low costs (e.g. low wages, a low exchange rate, etc.) as a source of competitive advantage, are proving unsustainable for the Czech Republic in the future. Therefore, the innovative capacity of enterprises, the growing quality of human resources, research and technology, which are considered to be the key to the growth of European competitiveness, must increasingly come to the fore as a source of advantage.

The National Innovation Policy proposed four strategic objectives for the development of innovation and sustainable growth, namely to strengthen research and development as a source of innovation; to create functional cooperation between the public and private sectors; to provide human resources for innovation; and to improve the efficiency of government performance in research, development and innovation.

Czech firms, especially SMEs, generally invest significantly fewer resources in R&D than large firms and their innovation activity is relatively low. Most R&D activities are carried out by foreign multinationals. Therefore, it is necessary to create instruments to support research and development aimed at young dynamic companies.

The Europe 2020 strategy has been the EU's main economic strategy over the past decade. In line with the June 2010 European Council conclusions, Member States were to set national targets in cooperation with the European Commission and taking into account their national economic and social specificities. This is what the Czech government has done. In the following period, these targets were subsequently expanded and adjusted during the course of the strategy's validity. With regard to R&D funding, the target was set to obtain a share of public support for R&D equal to 1% of gross domestic product. (Vláda ČR, 2021)

In 2019, the Czech government presented a new innovation strategy for the Czech Republic - "Innovation Strategy of the Czech Republic 2019-2030". Here it is stated that the share of total R&D and innovation spending in the Czech Republic in 2019 was 1.79% of GDP, of which business sources are 60%, government and EU sources 40%. The R&D funding targets,

measured as a % of GDP, are 2.0% in 2020, 2.5% in 2025 and 3.0% in 2030. This, therefore, assumes an increase of 0.1 p.p. each year, with public sources increasing to 1%, followed by business sources increasing to 1.5% in 2025 and 2% in 2030. (Rada pro výzkum, vývoj a inovace, 2019), (Vláda ČR, 2022)

The way the strategy is managed and monitored is crucial for its future success. This is where most national strategic plans have ended up in the past. Between 2022 and 2026, extra resources of CZK 12.5 billion should be drawn from the European Union for science and research, which should contribute to meeting the 2.5% target in 2025.

Another document adopted by the Government is the National Policy on Research, Development and Innovation of the Czech Republic 2021+. The National Policy represents an overarching strategic document at the national level for the development of all components of research, development and innovation in the Czech Republic. The document contributes to the fulfilment of certain criteria essential for the possibility of drawing funds from the European Union in the programming period 2021-2027. (Rada pro výzkum, vývoj a inovace, 2020)

2 Research Objectives

The aim of this article is to assess the development and structure of gross domestic expenditure on research and development in the Czech Republic in relation to the achievement of the set R&D&I targets. The following research tasks were formulated:

1. To determine whether the European Union met the target set by the Europe 2020 strategy to invest at least 3% of GDP in research and development.
2. To determine whether the Czech Republic met the national target set in the context of the Europe 2020 strategy for public expenditure on research and development to reach at least 1% of GDP.
3. To verify whether there is a statistically significant relationship between GERD and the Summary Innovation Index.
4. To verify whether there is a statistically significant relationship between the individual components of GERD and the Summary Innovation Index.

3 Data and Methodology

Secondary data were obtained from publicly available sources. Data concerning the Czech Republic were obtained from the Czech Statistical Office. Data concerning the EU28 Member States (including the United Kingdom, which is not an EU Member State as of 2020), some candidate countries (Montenegro, the Republic of North Macedonia, Serbia and Turkey), potential candidates (Bosnia and Herzegovina), neighboring countries (Iceland, Norway and Switzerland) and other major economies (Russia, United States, and China (except Hong Kong), as well as Japan and South Korea) were obtained from the Eurostat database. The analysis is extended to include selected non-EU countries for comparison with major economies, whose inclusion in the analysis increases the predictive value of the results.

The period covered is 2000 to 2019. The reason for choosing this time frame is that the data for the following years are impacted by the crisis caused by the Covid-19 pandemic. This ensures that the analysis is unaffected by the exceptional fiscal measures and disruptions associated with the pandemic, thus providing a more accurate assessment of trends in GERD. In addition, the focus on this period allows for a comprehensive assessment of pre-pandemic, pandemic, and post-pandemic patterns in this area.

The data were analyzed using the Statgraphics software program. Table 1 describes all variables used in the analysis.

Tab. 1: *Description of variables examined in the analysis*

Variable	Description	Source
GDP per capita	gross domestic product per capita	(Eurostat, 2022)
GERD	gross domestic expenditure on R&D	
GERD per capita	gross domestic expenditure on R&D per capita	
Business enterprise expenditure on R&D (BERD)	intramural GERD in the business enterprise sector	
Government expenditure on R&D (GOVERD)	intramural GERD in the government sector	
Higher education expenditure on R&D (HERD)	intramural GERD in the higher education sector	
Private non-profit expenditure on R&D (PNPRD)	intramural GERD in the private non-profit sector	
R&D intensity	ratio of GERD to GDP	
Summary Innovation Index (SII)	composite indicator: 32 innovation-related indicators are divided into four main groups: framework conditions, innovation activities, investments, and impacts.	
Public sources of GERD in the Czech Republic	public sources of gross domestic expenditure on R&D in the Czech Republic	(ČSÚ, 2022)

Source: Own

The evolution of the two most commonly used indicators of innovation performance is monitored and analyzed through descriptive statistics, which were employed to describe the variables and illustrate their trends over the observed period. These indicators are GERD and R&D intensity. GERD, the primary indicator for international comparison of R&D activity, "*covers all expenditures for R&D performed in the national territory during a specific reference period.*" (OECD, 2015) It is a crucial indicator for assessing the investment level in research and development activities and determining whether the targets set by the Europe 2020 strategy and the Czech government are met.

According to OECD (2021): "*Gross domestic spending on R&D is defined as the total expenditure (current and capital) on R&D carried out by all resident companies, research institutes, university and government laboratories, etc., in a country. It includes R&D funded from abroad, but excludes domestic funds for R&D performed outside the domestic economy.*"

The structure of GERD can be viewed from two basic perspectives, which are described in more detail in the Frascati Manual (OECD, 2015). According to the first aspect, i.e., funding sector, which can be the business enterprise sector, government sector, higher education sector, private non-profit sector, and the rest of the world. The second aspect, performing sector, again breaks down GERD by the sectors mentioned above, omitting only the rest of the world sector. According to the Frascati Manual, these are business enterprise expenditure on R&D (BERD), government expenditure on R&D (GOVERD), higher education expenditure on R&D (HERD), and private non-profit expenditure on R&D (PNPRD).

GERD as a share of gross domestic product (R&D intensity) measures R&D expenditure as a percentage of GDP. This indicator does not assess the structure of GERD or its absolute amount. It indicates the relative importance of R&D investments compared to the overall economy. Higher R&D intensity is often associated with greater innovation potential and economic growth.

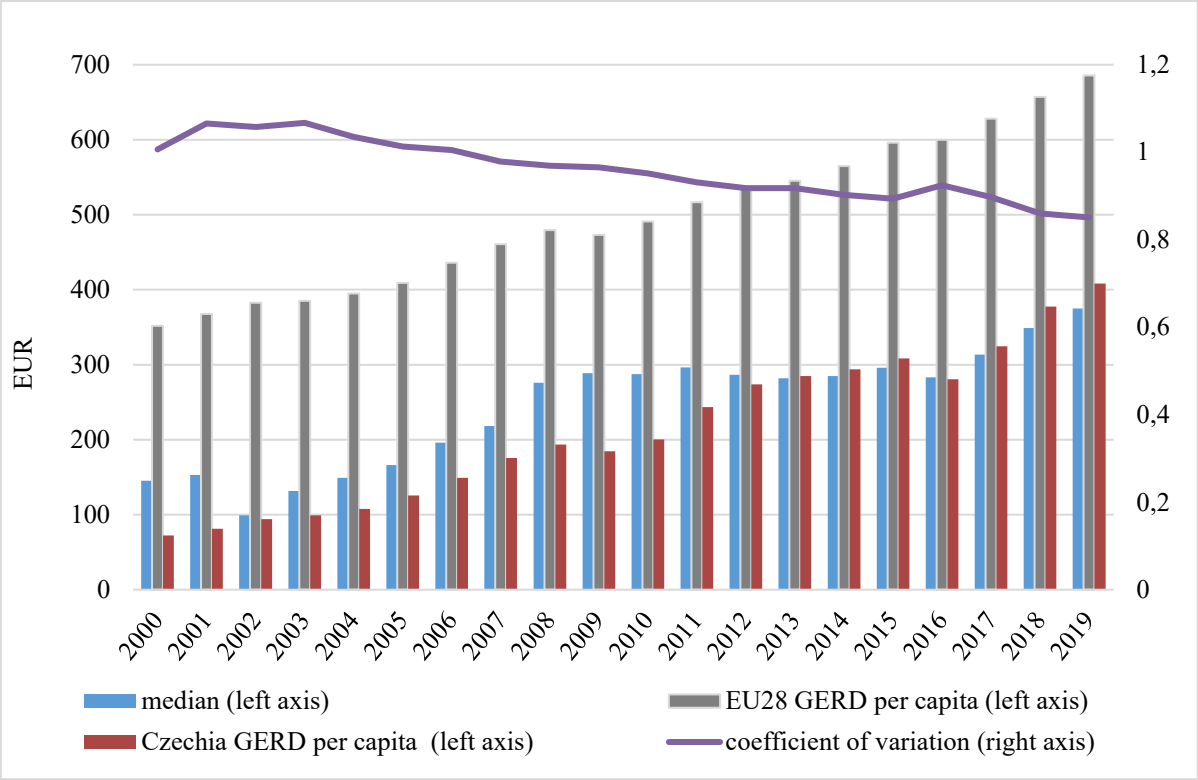
The analysis of these two indicators of innovation performance is further enhanced by the correlation analysis, which was employed to verify the relationship between R&D expenditures and the innovation index. This analysis provides insights into the impact of investments in research and development on overall innovation performance. The Summary Innovation Index (SII), which was first published by the European Commission in 2001, was chosen for this analysis. The SII is a composite indicator that reflects the overall performance of a country's innovation system. It encompasses various dimensions, including human resources, research systems, finance and support, firm investments, and economic impacts. The relevance of SII in the study lies in its ability to provide a comprehensive overview of the innovation landscape and its correlation with R&D expenditure. According to the value of SII, countries are divided into four categories on the European Innovation Scoreboard (innovation leader, strong innovator, moderate innovator, and emerging innovator). Not only EU Member States but also selected third countries are rated by SII. (European Commission, 2020)

The variable of public sources of GERD is important for the comprehension of the impact of government policies on R&D funding, driving innovation, and economic growth. This variable helps to analyze the extent of governmental support for R&D activities, the effectiveness of policy measures in fostering a conducive environment for scientific and technological advancements, and their subsequent impact on the country's economic development.

The methodological limitations of this study include a reliance on secondary data sources, which may be subject to inaccuracies and inconsistencies that affect the reliability of the findings. While the utilization of descriptive statistics and correlation analysis is beneficial for the identification of trends, it does not establish causality. The implementation of more sophisticated models could facilitate a deeper understanding of the subject matter. The focus on specific indicators, such as GERD and the SII, may result in the overlooking of other influential variables, including political stability and the regulatory environment. Furthermore, the findings are based on EU countries, which may limit their generalizability to other regions with disparate economic structures and innovation ecosystems. Addressing these limitations in future research could enhance the robustness and applicability of the findings.

4 Empirical Results and Discussion

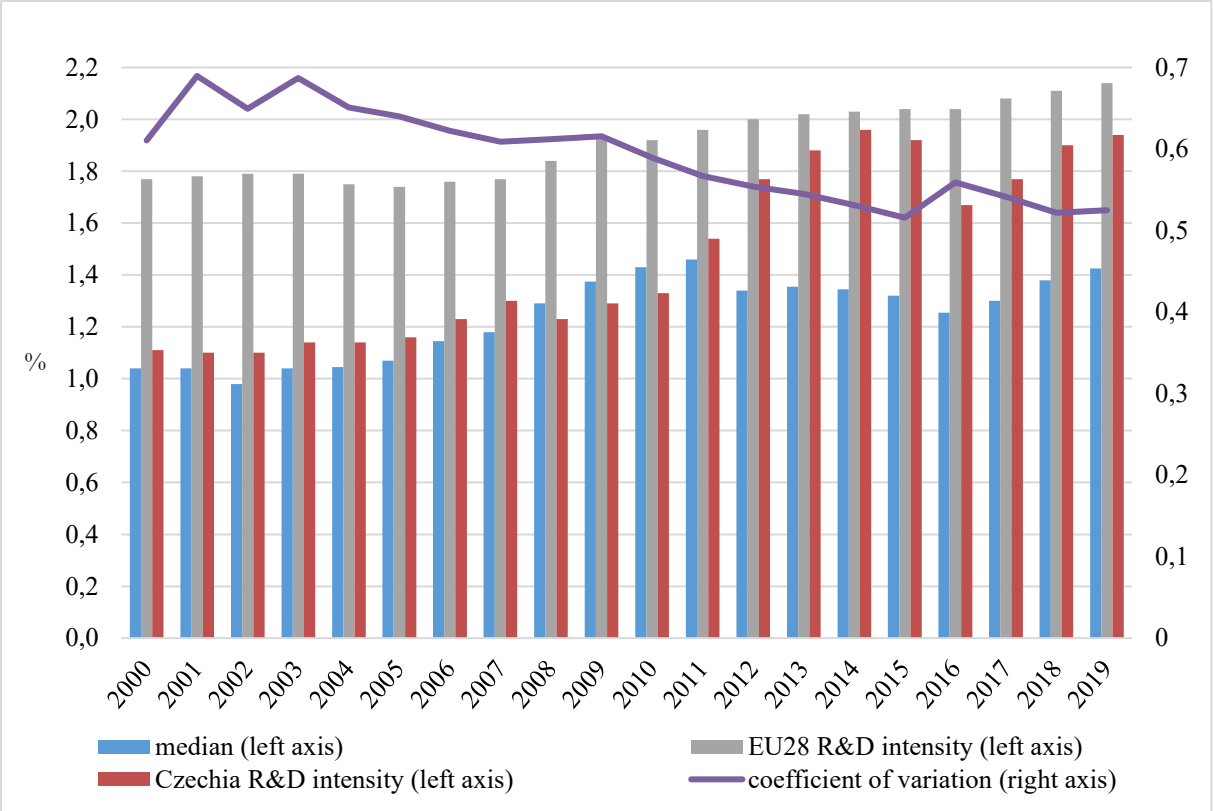
Firstly, the evolution of GERD per capita is assessed. As can be seen from Figure 1, the coefficient of variation calculated for the EU28 as a whole has a decreasing trend over the period under review, which means that the differences between Member States are decreasing. The GERD per capita value for the Czech Republic has been above the median since 2013 (except in 2016, when the median was €283.15, compared to €280.8 in the Czech Republic). Compared to values for the EU28 as a whole, the Czech Republic lags significantly behind.



Source: Own calculation using (Eurostat, 2022)

Fig. 1: *GERD per capita*

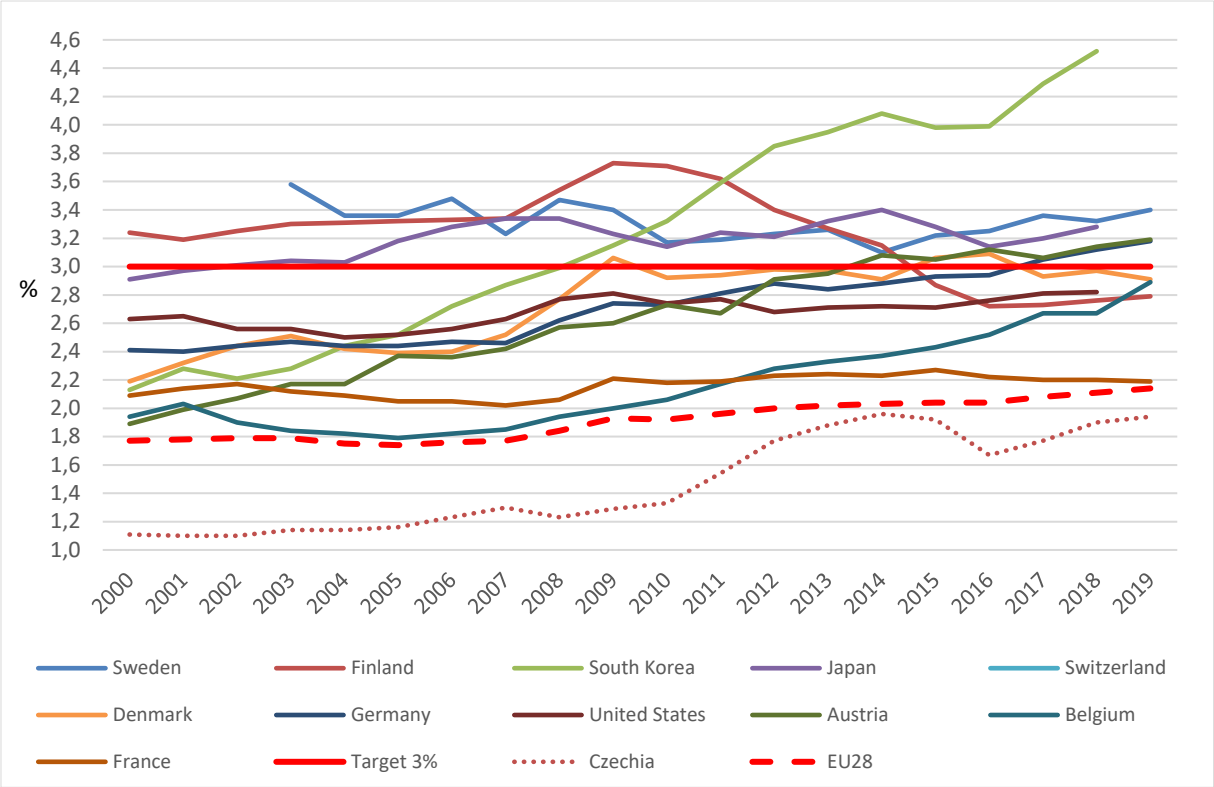
The following Figure 2 shows the evolution of GERD as a percentage of GDP, or R&D intensity. As can be seen from the figure, the coefficient of variation calculated for the EU28 as a whole also has a decreasing trend over the period under review, which means that the differences between Member States are also decreasing in terms of this indicator. The R&D intensity value for the Czech Republic is above the median throughout the whole period, except for the years 2008-2010. Compared to the values for the EU28 as a whole, the Czech Republic is not lagging as far behind as in the case of GERD per capita. Although the trend in R&D intensity for the EU as a whole (i.e., EU28 R&D intensity) is increasing, the 3% target was not met over the period. In 2019, the R&D intensity value was the highest, namely 2.14%. Based on the findings of research task 1, it can be concluded that the EU has not invested at least 3% of its GDP in R&D, as set by the Europe 2020 strategy. Therefore, the target has not been achieved.



Source: Own calculation using (Eurostat, 2022)

Fig. 2: *GERD as a percentage of GDP (R&D intensity)*

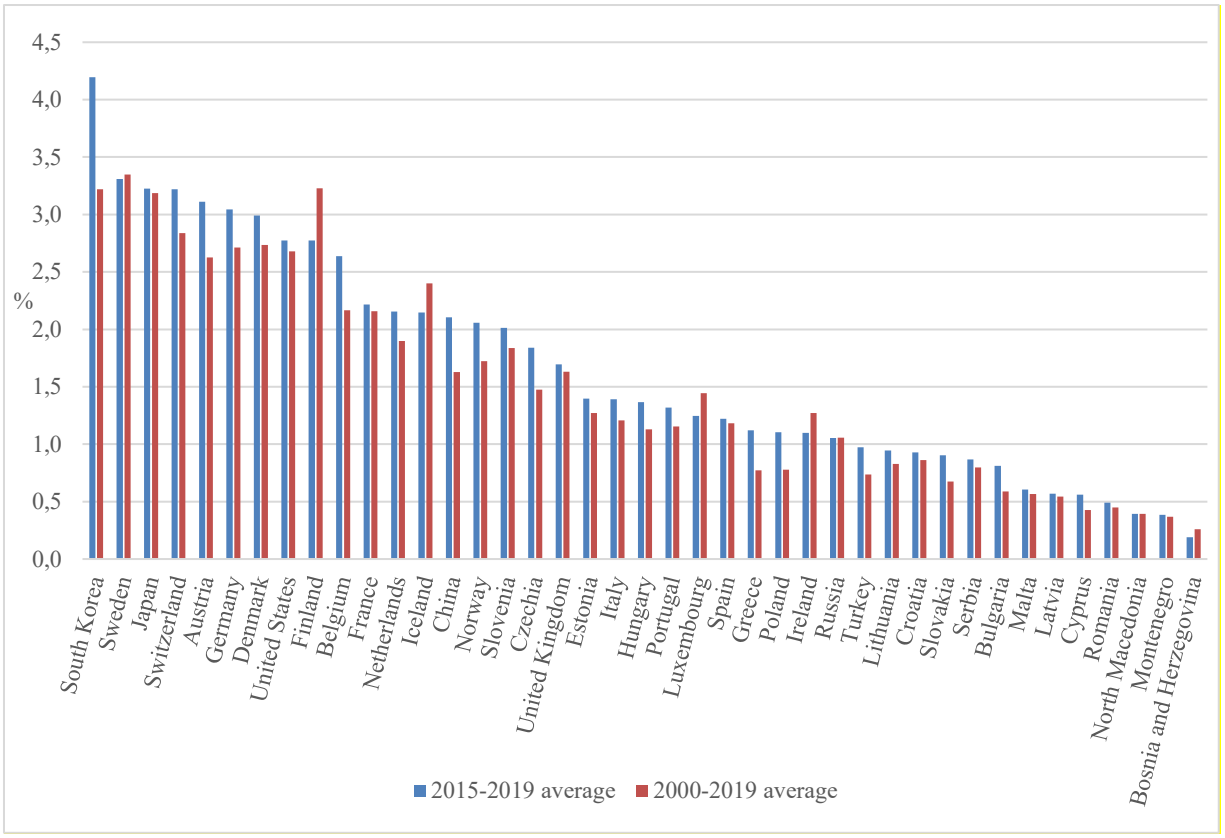
In terms of individual EU Member States, Sweden has the highest R&D intensity. Its average R&D intensity for the period 2000 to 2019 is 3.35%. Figure 3 shows the evolution of R&D intensity for countries that have reached or are close to the Europe 2020 target. Finland is among the EU Member States with a high R&D intensity for most of the period under review. However, there was a downward trend in 2010 and since 2015 R&D intensity has been below the target, partly due to problems with the ICT sector (European Commission, 2016). Despite this, Finland ranks among the countries with the highest R&D intensity. For Denmark, Germany, Austria, and also Belgium, an increasing trend can be seen. As for the Czech Republic, it has not exceeded the 2% threshold throughout the period under review. The significant decrease in 2016 was caused by the transition to the next programming period of the absorption of European structural and investment funds and the related reduction of foreign public sources. Thus, from the long-term development of R&D intensity, it can be concluded that the Czech Republic's accession to the EU had a positive impact and a continued upward trend can be expected in the future.



Source: (Eurostat, 2022)

Fig. 3: *R&D intensity development, selected countries, 2000 – 2019*

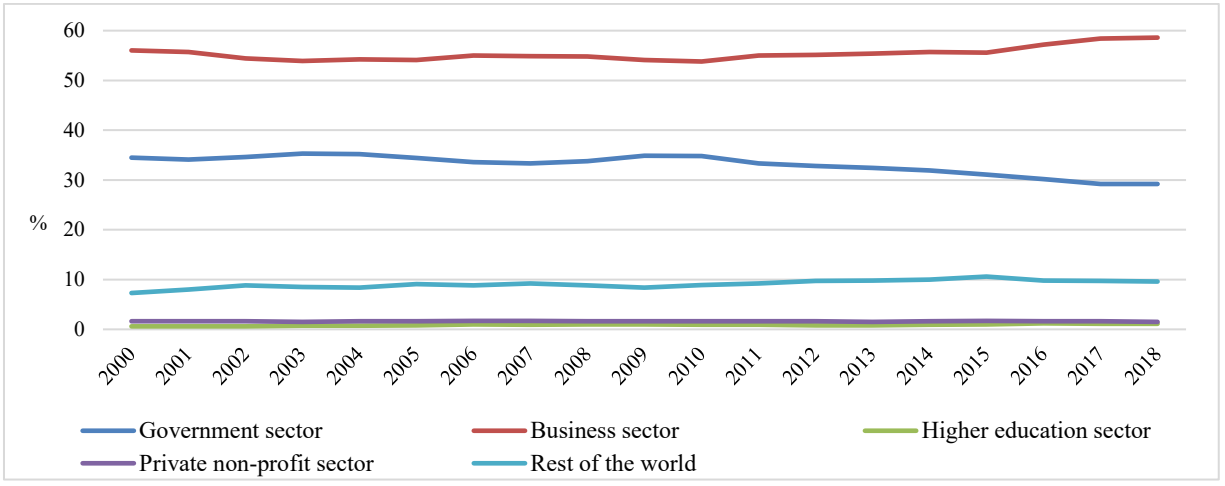
Figure 4 below shows the average R&D intensity over the whole period (2000 to 2019) and over the last five years (2015 to 2019). The latter period was chosen to compare the long-term R&D intensity with that of recent years. In addition to the EU Member States, the table includes data from selected non-EU countries. The countries are ranked in descending order of the average of the last five years, i.e., the 2015-2019 average. For most countries, there has been an increase in average R&D intensity over the last five years, which means that the ratio of GERD to GDP has been increasing in recent years. The most significant change is observed for South Korea, followed by Austria, China and Belgium. On the other hand, the largest decrease has occurred in Finland. Other countries that have reduced R&D intensity over the last five years include Iceland, Luxembourg, Ireland, and Bosnia and Herzegovina.



Source: Own calculation using (Eurostat, 2022)

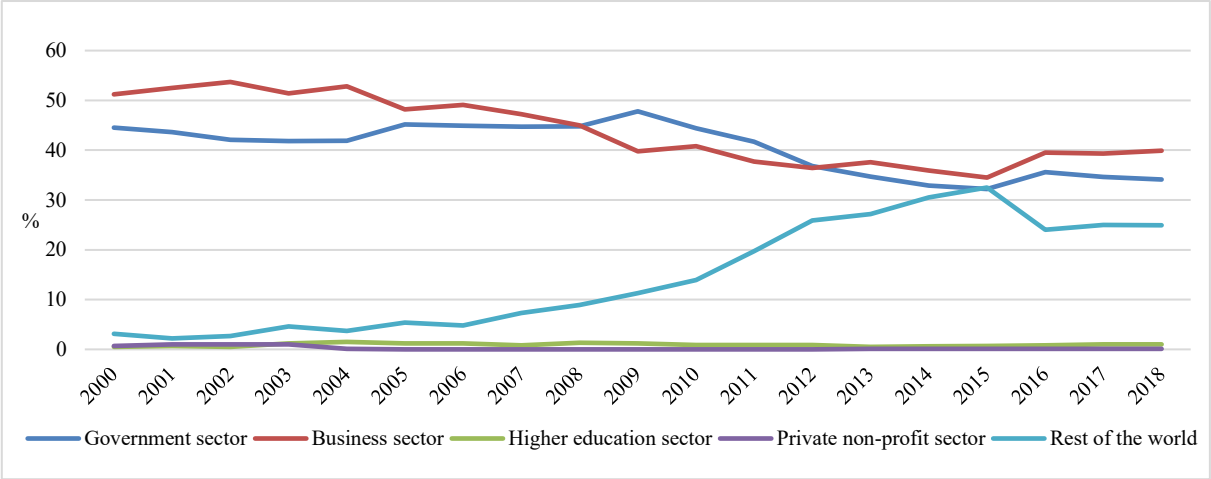
Fig. 4: *R&D intensity, 2000-2019 average versus 2015-2019 average development*

The following Figures 5 and 6 show the structure of GERD by source (funding sector) as a percentage of the total. Across the EU27, sources from the business sector are the most significant (almost 60% of the total). This is followed by the government sector (around 30% of the total). With around 10%, the rest of the world is also quite significant. The private non-profit and higher education sectors account for around 1 to 2 % of the total.



Source: (Eurostat, 2022)

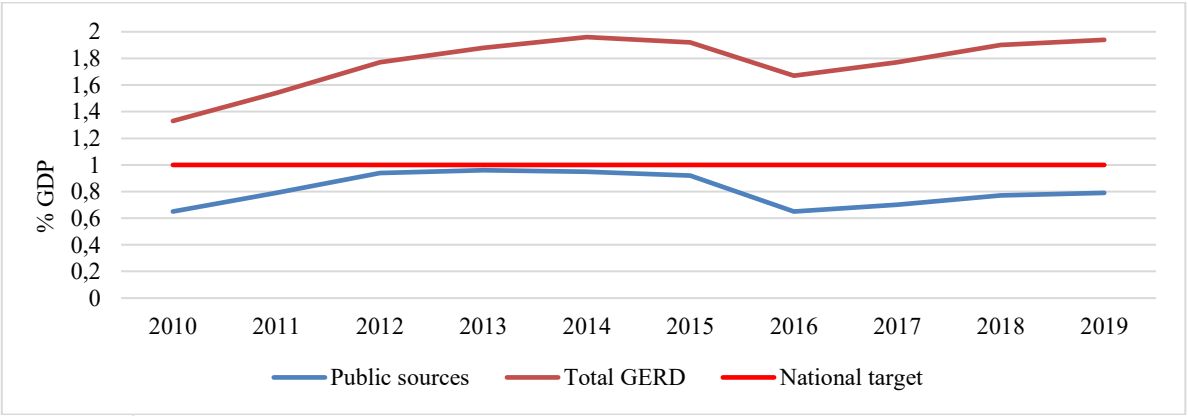
Fig. 5: *Structure of GERD in the EU28 (funding sector)*



Source: (Eurostat, 2022)

Fig. 6: *Structure of GERD in the Czech Republic (funding sector)*

In addition to the aforementioned breakdown of GERD according to the Frascati Manual, it is also important, from the point of view of the national target of the Czech Republic (research task 2), to observe the breakdown of GERD according to the sources of funding into public, business and other. Figure 7 shows the evolution of public sources of GERD in the Czech Republic between 2010 and 2019 as a percentage of GDP. The Czech Republic's national target set under the Europe 2020 strategy for public spending on R&D to reach the 1% of GDP target was not achieved throughout the period under review. The Czech Republic came closest to this target between 2012 and 2015. The significant decrease in 2016 was caused by the transition to the next programming period of the European structural and investment funds and the related reduction of foreign public resources. As mentioned above, the significant decrease in 2016 was caused by the transition to the next programming period of the absorption of European structural and investment funds.



Source: (ČSÚ, 2022)

Fig. 7: *National target of the Czech Republic*

To assess the relationship between GERD and the innovation performance of the Czech Republic as expressed by the Summary Innovation Index (SII), a correlation coefficient test was performed. The relationship was assessed not only between total GERD and SII but also between the individual components of GERD, i.e., business enterprise expenditure on R&D (BERD), government expenditure on R&D (GOVERD), higher education expenditure on R&D (HERD) and private non-profit expenditure on R&D (PNPRD).

Table 2 captures the results of the correlation analysis to test the third and fourth research tasks. The sample correlation r (GERD, SII) = 0.985 with p-value = 0.00. Therefore, we reject

the hypothesis of independence; the variables are positively correlated. Regarding a more detailed analysis and assessment of the relationship between the individual components of GERD and SII, we again report only the values of the sample correlation and the corresponding *p*-value. The results presented in the table show that the first two pairs exhibit a statistically significant relationship and are positively correlated. Based on Evans' correlation strength scale (Evans, 1996), we are talking about a very strong correlation. On the other hand, the second two pairs can be considered as independent variables because the *p*-value for each is greater than the 5% significance level.

Tab. 2: *Correlation matrix of GERD and SII*

Variable	r	p-Value
GERD, SII	0.985	0.00
BERD, SII	0.981	0.00
GOVERD, SII	0.864	0.01
HERD, SII	0.518	0.19
PNPRD, SII	-0.227	0.59

Source: Own calculation

As the correlation analysis showed a strong relationship between the business enterprise expenditure on R&D and the Summary Innovation Index, and also between the government expenditure on R&D and the Summary Innovation Index, it can be concluded that the growth of expenditure in the given sectors will lead to an increase in the position of the Czech Republic in its innovation index ranking.

The findings of our analysis are consistent with those outlined in the European Innovation Scoreboard (European Commission, 2020), particularly regarding the position of the Czech Republic as a moderate innovator. For instance, although R&D intensity in the Czech Republic has been above the median since 2011, it has not yet reached the target of 3% of GDP. Furthermore, the European Innovation Scoreboard 2020 emphasizes the importance of public sector support for R&D, a factor that is also highlighted in our study. The significant correlation between public R&D expenditure and innovation performance highlights the need for continued and enhanced government support to foster innovation and economic growth. In summary, the European Innovation Scoreboard 2020 findings support our conclusions on the crucial role of R&D investment in improving innovation performance.

Although the Europe 2020 Strategy was more focused on concrete, measurable objectives and more reflective of the need for sustainable and inclusive growth than the Lisbon Strategy, it has faced criticism for under-investment, fragmentation of national policies, complex administration and bureaucracy. A lack of coordination and cooperation between Member States has frequently resulted in the duplication of efforts and an inefficient use of research and development resources. Furthermore, there has been criticism of the lack of support for innovative projects in the case of small and medium-sized enterprises (SMEs) and start-ups. Additionally, there has been criticism of the weak cooperation between the public and private sectors and between research institutions and industry. This results in a gradual transfer of technology and knowledge from research institutions to practice, which impedes the commercialization of research results. These limitations were identified in the evaluation report of the Supreme Audit Office of the Czech Republic (NKÚ, 2022), among other sources. In light of these observations, it would be prudent to implement certain corrective measures in the Czech Republic and across the EU. It is of significant importance for the Czech Republic to augment its research and development funding in order to attain a minimum of 3% of its gross domestic product by the year 2030. It is necessary to strengthen

cooperation between research institutions and companies, to support the development of knowledge and skills needed for a knowledge-based economy, and to increase the attractiveness of scientific and technical fields for young people. Furthermore, the process of obtaining grants and subsidies for research and development projects must be simplified in both the Czech Republic and the EU, and project approval deadlines must be shortened. The digitalization of the single market should continue, data sharing should be promoted, and further investment in research and development of key technologies such as robotics, nanotechnology, and artificial intelligence should be strengthened. The role of regions and their involvement in innovation processes must be strengthened.

Conclusion

The article examines the evolution and structure of gross domestic expenditure on research and development in the EU within the context of the target set by the European Union for R&D&I expenditure and the form in which this target has been implemented in the national policy of the Czech Republic.

Based on the analysis carried out, it was found that the target set by the Europe 2020 strategy of 3% of EU GDP has not been achieved. When the 3% threshold was applied to individual EU countries, it was found that only five Member States (Belgium, Sweden, Austria, Germany and Denmark) had reached it. Thirteen EU countries spent less than 1.5% of their GDP on R&D, of which six spent less than 1%.

The Czech Republic spent less than 2% of GDP on R&D throughout the period. It failed to reach the national target of 1% of GDP on R&D through public spending even once during the whole period under review, although it was very close to it between 2012 and 2015. Future research should focus on an analysis of GERD's public resources to provide insights into the funding structure, sectoral priorities and comparative international position. This analysis should also provide policy recommendations for future improvements. Furthermore, comparative studies involving other countries with different funding structures could be conducted in order to identify best practices and potential areas for reform. Such research could lead to more effective policy frameworks and better innovation performance.

Another task of this article was to examine the statistical significance of the relationship between GERD, and the individual components of GERD, and the Summary Innovation Index. For this purpose, a correlation coefficient test was performed. A positive correlation was found between total GERD and SII. A more detailed analysis then showed that there is a strong correlation between the pairs of business enterprise expenditure on R&D and the Summary Innovation Index, and also between government expenditure on R&D and the Summary Innovation Index. On the other hand, the pairs of higher education expenditure on R&D and the Summary Innovation Index, and private non-profit expenditure on R&D and the Summary Innovation Index can be considered independent variables. This analysis has been carried out only with data from the Czech Republic. It would be relevant to extend the analysis with data from selected countries occupying leading positions in the rankings compiled on the basis of the innovation indices to verify the relationships found.

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Česká republika v kontextu plnění cílů v oblasti výzkumu, vývoje a inovací stanovených ve strategii Evropa 2020

Cílem tohoto článku je zhodnotit vývoj a strukturu celkových výdajů na výzkum a vývoj (GERD) v souvislosti se strategií Evropa 2020 (Strategie) a cíli české vlády. Jsou nastíněny čtyři výzkumné úkoly: 1. Posouzení, zda EU splnila cíl 3 % HDP na investice do výzkumu a vývoje stanovený ve Strategii. 2. Zjištění, zda Česká republika splnila svůj národní cíl výdajů na výzkum a vývoj (VaV). 3. Ověření statistického vztahu mezi GERD a souhrnným inovačním indexem (SII). 4. Prověření statistického vztahu mezi složkami GERD a SII. Zjištění ukazují, že ani Strategie, ani cíle České republiky nebyly splněny. Korelační analýza indikuje významný vztah mezi celkovým GERD a SII. Podrobnější analýza potvrzuje silnou korelaci mezi dvojicí výdajů podnikatelských subjektů na VaV a SII, a také mezi vládními výdaji na VaV a SII.

Die Tschechische Republik im Zusammenhang mit der Erfüllung der in der Strategie Europa 2020 festgelegten Ziele in den Bereichen Forschung, Entwicklung und Innovation

Ziel dieses Artikels ist es, die Entwicklung und Struktur der Gesamtausgaben für Forschung und Entwicklung (GERD) im Kontext der Strategie Europa 2020 (Strategie) und der Ziele der tschechischen Regierung zu bewerten. Es werden vier Forschungsaufgaben skizziert: 1. Die Bewertung, ob die EU das in der Strategie festgelegte Ziel von 3 % des BIP für FuE-Investitionen erreicht hat. 2. Die Feststellung, ob die Tschechische Republik ihr Nationalziel der Ausgaben für FuE erfüllt hat. 3. Die Prüfung der statistischen Beziehung zwischen GERD und dem zusammenfassenden Innovationsindex (SII). 4. Die Prüfung der statistischen Beziehung zwischen den GERD-Komponenten und dem SII. Die Ergebnisse zeigen, dass weder die Strategie noch die Ziele der Tschechischen Republik erreicht worden sind. Die Korrelationsanalyse zeigt eine signifikante Beziehung zwischen GERD und SII. Eine detailliertere Analyse bestätigt eine starke Korrelation zwischen den FuE-Ausgaben der Unternehmen und dem SII sowie zwischen den FuE-Ausgaben des Staates und dem SII.

Republika Czeska w kontekście realizacji celów w zakresie badań, rozwoju i innowacji określonych w strategii Europa 2020

Celem niniejszego artykułu jest ocena rozwoju i struktury całkowitych nakładów na badania i rozwój (GERD) w kontekście Strategii Europa 2020 (Strategia) oraz celów czeskiego rządu. Przedstawiono cztery wyzwania badawcze: 1. Ocena, czy UE osiągnęła cel 3% PKB na inwestycje w badania i rozwój określony w Strategii. 2. Sprawdzenie, czy Republika Czeska spełniła swój cel krajowy dotyczący nakładów na badania i rozwój (BiR) 3. Sprawdzenie statystycznego związku między GERD a sumarycznym wskaźnikiem innowacyjności (SII) 4. Sprawdzenie statystycznego związku między składowymi GERD a SII. Wyniki pokazują, że ani strategia, ani cele Republiki Czeskiej nie zostały osiągnięte. Analiza korelacji wskazuje na istotny związek między całkowitym GERD a SII. Bardziej szczegółowa analiza potwierdza silną korelację między parą wydatków przedsiębiorstw na badania i rozwój a SII oraz między rządowymi wydatkami na badania i rozwój a SII.