

SOCIO-ECONOMIC IMPACTS OF THE SCIENCE AND RESEARCH SYSTEMS

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Abstract:

Slovenia has an above-average European scientific results, innovation system is rated just below the European average, while the per-capita shop GDP barely reaches the two thirds of the European average. Slovenian economic competitiveness is low.

Research activity is not intended for itself, therefore scientific as well as the socio-economic effects are important too. Therefore the paper covers the analysis of socio-economic effects of research that can be divided into economic, political/social and educational. In the paper we firstly discuss the schematic and systematic methodology and assessment of the socio-economic effects of the research. The international waymarks of planning and monitoring of the research effects is presents as well. The paper further analyses the strengths and weaknesses of the Slovenian innovation system and isolate the good practices of the successful countries and countries which are progressing rapidly. Therefore, the European Innovation Index and the Global competitiveness index will be studied and the detail that identify the reasons for successes and failures of the United States and provide guidance on how to be more successful with the help of the socio-economic effects of science and/or research and development.

Keywords: science, research, development, innovation, socio-economic impacts, European innovation index, global innovation index

1. INTRODUCTION

For effective management of the Slovenian research and innovation system, in order to achieve as closely as possible the major effects of the survey is a useful knowledge of the entire innovation space: institutions, financial resources and mechanisms of formation and the exchange of knowledge. The relationship between types of surveys, research results and their effects, represents a very complex social process. Characteristic of scientific research methods of work, the public release of the results. Nevertheless, noting that in the research process plays an important role also called silent (private) knowledge (Molas, Tang & Morrow, 2000). Among the public the results of the research results in the form of include knowledge of theoretical explanations, concepts, methodologies and instruments, which are spread through publications and, in particular, the effect on scientific developments. On the other hand private knowledge exists in the form of overcoming learned and acquired information and skills in social life through individuals and affect mainly on social, technological and economic development. The social

impacts of research are numerous and are usually indirect in nature and in terms of size and effectiveness vary depending on the time. Technological and economic effects of the survey, it is easier to determine than the social and cultural effects (Sorčan, Demšar, & Valencia, 2009).

One of the important preconditions for high-quality socio-economic effects of the research is the scientific quality of research (Science Impact, Rethinking the Impact of Basic Research on Society and the Economy, 2007).

2. PURPOSE OF THE RESEARCH

There are a wide range of research and development, which takes place on both the research institutions (universities and research institutes) and in various industries. At universities and research institutes conducted mostly scientific research (short: science), in industries or in the business sector so called development.

The Slovenian Research Agency (Agency) in possession of most of the state funds, which are intended for research at universities and institutes and therefore its significance for the effective exploration of the great. The Mission of the Agency, wrote in the inaugural Act, is a concern for scientific and socio-economic effects. Each evaluation of the effects of the survey must have in mind a balanced treatment of both sides. Research the effects of those contributions, for which you can show that it has an excellent science offered to society and the economy. Successful countries are aware of the positive effects of research activities and therefore in their innovation systems provide ways for their maximization and opportunities for their best possible exploitation.

The Agency has devised a good methodology for measuring and the promotion of scientific research in the socio-economic effects the effects due to the complexity of the issues (diversity, the difficulty of measuring the gap between scientific knowledge and its use) a lot of possibilities for the development of criteria and indicators and to measure the socio-economic effects of the research as well as for the development of additional opportunities to promote these effects.

Therefore, it makes sense an analysis of those national socio-economic valuation of the effects of science and research, which have proved to be effective and it entered in ranking related to innovation and competitiveness. An analysis of good practices in these countries can serve to assist in the analysis and evaluation of the effectiveness of selected instruments and criteria for the evaluation of the Agency in terms of socio-economic effects of science and research. On these grounds it is possible further elaborated proposals for improvements of the management of scientific research system in terms of instruments, criteria and indicators of the Agency.

3. LITERATURE REVIEW

In the literature, which includes transparent articles (Martin & Salter, 1996), monographs (Sorčan, Demšar, & Valencia, 2009), (Husso, Karjalainen, & Parkkari, 2000), manuals for research agencies (Science Impact, Rethinking the Impact of Basic Research on Society and the Economy, 2007) and the individual stakeholders, who are active in the field of research (Emerald Group Publishing, 2016) they worked out a number of more or less detailed division of the effects of the research.

Australian Research Council has developed a signpost research funders allows monitoring of the intermediate steps to better monitor the effects of the survey. We summarize the waypoint, which was supplemented with markers, which effects are most associated with it taking into account inputs, activities, outputs, the results and the benefits. (Australian Research Council, 2016)

The EU Member States want to know the ultimate impact of research activities: better functioning innovative system, richer country. In this regard, they developed two detailed annual monitoring of the final model of the effects of research:

- European innovation index (Innovation Scoreboard, Union of 2015) and

- The global competitiveness index (Global Competitiveness Report, 2015).

European innovation index reading of the EU Member States with each other and compare them with important non-European countries (Adam, 2014). Items that are systematically collected mainly from the different bases (Eurostat, Scopus) are related to: the prerequisites for innovation in the Member States, with the indicators of innovation activities and the economic results that are the result of innovation efforts. The global competitiveness index deals with 140 countries, among them all the EU Member States and compares each other annually after the basic prerequisites for the country's economy's competitiveness, promoters (advocates...), the State of working more efficiently and by innovation and quality business space. Slovenia has better results in the European innovation index as in the global competitiveness index, a detailed analysis of both indexes show which elements we are weak and strong.

Research agencies more or less successfully integrated into the procurement procedures guidelines of projects calls to promote socio-economic effects of the maximization mechanisms research (Economic and Social Research Council, 2016), (Empowering Researchers that Provide Societal Value, 2015). Guidelines describe how to draw up a plan of transferring knowledge acquired at the time of the execution of the project, from the determination of the target publics, which are ranked in order of importance, by the way, how to achieve the most effective (letter/briefing, Conference/seminar, visit, email/you/them). The instructions include how the researcher shall draw up a program of activities provided for the transfer of knowledge resources, timeline, and self-assessment of performance.

For qualitative understanding of the financing instruments of research in the EU is a useful material ERAWATCH Web portal (Research and Innovation Observatory – Horizon 2020 Policy Support Facility, 2016), who promptly gives a detailed overview of each country's research landscape useful publications are websites of ministries and agencies into Science research of the United Europe.

A literature review demonstrates the great importance to the socio-economic impact by paying a successful country. Their efforts are focused in the design and monitoring of the measures for increasing the effects of the surveys and in the measurement of the final effects.

A balanced composition of the index is the reason that European countries are used as the most important tool for monitoring the functioning of their respective innovation systems and as an important indicator of the performance of instruments for establishing the economic impacts of research.

The basic findings related to European innovation index: Slovenia recognizes the importance of innovation for our development and investing in research and development, especially in the last decade brought extensive assets, higher than the European average (total investment in research and development are higher than the European average). The result of the increased investment in research and development and the introduction of some success in the past ten years, there is also a high growth innovation index (third highest among EU Member States). The index value is close to the European average, and if the efforts associated with the innovative activity in Slovenia to continue, then we can expect further growth of the index (Novak 2016).

3.1. Economic Effects

The most important instrument for the financing of the Agency are applied to projects, both for established as well as young researchers. The most important criterion for the promotion of cooperation with industry is the indicator, which tells us that the researcher obtains support from outside the Agency, an important part of the economy.

In Slovenia, the 25% of doctorate holders employed in the private sector economy, which is not bad, but it's still quite a few steps to the United States and Denmark, where it is at 35%. Even more problematic are the salaries of doctors of science in the economy; as is the case with all other developed countries, in particular, where doctorates in the economy significantly better paid than in the academic sphere (Kitasomagun, Miso, & Freeman, 2013) (Arsenjuk, 2015).

3.2. The Political and Social Effects

In 1994, the Ministry responsible for science has developed a system of target research projects (so called CRPs), combining the financial resources of different ministries, who are interested in the expert research into the scientific sphere in particular in the field of agriculture and social sciences. A feature of the instrument is a high CRP relevance attached, because it goes to fund selected topics to be determined exclusively by the Ministry. It also selected the successful proposals.

The Agency, for each application of the project requires a notification containing a separate description of the research and socio-economic results of the earlier work. When you log on, programs, and projects of young researchers in the logs of the content of the project also requires a description of the expected socio-economic effects of the research. This item represents a good basis for upgrading projects with signs of planning and monitoring the effects of the survey.

3.3. Educational Effects

The positive effects of the synergies of research and university teaching are aware of any successful country and are in the very heart of the principle of Humbolt of the concept of research universities. The quality of the University, most notably the doctoral education is closely linked to research the quality of the professors. Good graduates get when they are raised by good teachers, good teaching can be found only among those teachers who are good researchers – otherwise, it sold the old knowledge. Less research activity, of course, means lower quality students to obtain less really current knowledge. The structure of the resources of the University to spend for their work, Slovenia, since the proportion of research funding (less than 20%) are among the lowest in the EU. (Eurostat, 2016)

4. INNOVATION AND RESEARCH AS RELATED TO UNITED STATES AS A MATTER OF SOCIAL ECONOMIC INDICATORS

Currently the United States is ranked 4th in the Global Innovation Index 2016. It follows behind in the rankings from Switzerland, Sweden, and United Kingdom. In general, among the leaders (top 20 in the Global Innovation Index), “Japan, the US, the UK and Germany—stand out in ‘innovation quality,’ a top-level indicator that looks at the caliber of universities, number of scientific publications, and international patent filings” (Dirlea, 2016). With particular reference to the United States, the presence of international firms conducting research and development projects, the overall financial market infrastructure including a mechanism for research and development through venture capital, software spending, and its scientific publications has fostered a strong environment for innovation. (*Global Innovation Index 2016: Switzerland, Sweden, UK, US, Finland, Singapore Lead; China joins top 25*, 2016). While these identified strengths are significant to the United States rankings, it does have a few weaknesses that may affect its future progress. The lesser ratings are in the area of government expenditures in education, energy efficiency considerations, and a relatively low share of science, technology, engineering and mathematics (STEM) graduates.

However, the United States leads with innovations in the education practice and process:

1. Student outcome assessments prevail throughout the education system. “Between 2000 and 2009, the United States saw a 24% point difference in the percentage of 15 year old students in schools where assessments are used for monitoring progress from year-to-year; as of 2009 over 97% of all American secondary schools were enrolled using this practice;”
2. Assessments for national benchmarking;
3. Assessment data to share with parents;
4. External evaluations of secondary school classrooms;
5. More parental involvement and participation on secondary school committees (OECD (2014).

This educational assessments and its measurement can be argued to be a significant factor in the overall influence on future research. In particular certain pedagogical innovations in the United States has fostered the environment and demand for good universities and for scientific research and its publication. Some of the innovation in United States Education pedagogy that drives this is as follows:

6. Emphasis on observation and description within secondary school sciences classes;
7. Emphasis on individualized reading instruction;
8. Use of answer explanation in primary school mathematics;
9. Emphasis on applying primary school lesson to everyday;
10. Emphasis on text interpretation in primary lessons (OECD (2014)).

Furthermore, the United States, while ranking number 4, in the Global Innovation Index because of the preponderance of high quality universities, scientific research and publication, and financial institutional infrastructures to support research and its dissemination such as venture capital, is not an easy comparison to Slovenia or Europe

5. CONCLUSIONS

5.1. Scientific

There are a number of developed and successful methods that maximize the socio-economic effects on research and, consequently, numerous documented cases of good practice in the world. This allows for good management of research projects, from their preparation, implementation, and completion later that dissemination of results and transfer to the economy and non-economy.

The European Innovation Index and the Global Competitiveness Index both provide data on the overall performance of all innovation management mechanisms in the country or region, therefore, the understanding of their content is important for evaluating the performance of instruments for stimulating the research effects.

The project will elaborate the link between funding instruments and the value of both Indexes, which up to now has not yet been addressed in the literature, and will this way influence the development of research in the field of innovation processes.

5.2. The Economic

And the last three-hundred years the role of research for the technological progress is undeniable. Successful societies have mechanisms for a quality knowledge transfer into the economy. The difference between the above-average research performance of Slovenia and its Innovation Index, which is slightly below the European average, shows that the knowledge transfer and Slovenia can be in significantly higher, which would undoubtedly boost economic growth.

The results of the project will identify poor mechanisms (criteria, indicators and instruments) when using the research on economic effects and Canada and identifying good practices of countries that are successful and appropriate for the United States.

The implementation of project results that SRA and the work of other institutions of the Slovenian innovation area will last but not least encourage faster economic development of Slovenia.

5.3. The Social

The results of the Global Competitiveness Index suggests that the knowledge transfer and all fields, especially in the field of social sciences to the field of political decision-making in Slovenia, is weak. Consequently, there are no relevant policy effects of research in these fields. Better management of research will lead to a improved socio-economic effect, e.g. a better knowledge transfer that the economy, which will encourage economic growth and thereby the development of society as a whole. The result of the project will be of the good practices of knowledge transfer into the research policy and more broadly and other social subsystems, the elaborated waymarks of monitoring and planning of political/societal effects of research will consequently contribute to the effective functioning of the Slovenian country and/or society as a whole.

However, it would suit Slovenia to alter its perception of applied research being of low quality. In comparison to other countries positive socio economic effects can be realized more readily from applied research given that it is valued and implemented at a faster rate by the private sector.

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