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Comparison of R&D within the Visegrad countries

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Abstract Knowledge is learning, as short explanation meaning. Knowledge is gained by long-term experience, continual learning, as well as by finding the right solutions for the issue. The longer we take the time for solving and analysing the issue the better given solution can be obtained. Knowledge is very closely linked with creativity, as Einstein had mentioned, Creativity has no boundaries, but it is a process that requires knowledge of the problem and longer term experience according to research. The knowledge economy is very important for growing economies. Countries which are rich of raw material resources yet don't need to be countries which are part of developed countries. This might be caused by not supporting the ideas of innovations, education, or research and development. Simply we can say that growing economics is based on knowledge.

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1. Introduction

Economists continue to search for the foundations of economic growth. Traditional "production functions" focus on labour, capital, materials and energy; knowledge and technology are external influences on production. Investments in knowledge can increase the productive capacity of the other factors of production as well as transform them into new products and processes. It is not a new idea that knowledge plays an important role in the economy. [1]

Slovakia is a small open economic dependent on exports and foreign investment. Its competitiveness now stands primarily on the comparative advantage of the relatively low cost of work. Slovakia is a small open economy dependent on exports and foreign investment. Its competitiveness now stands primarily on the comparative advantage of the relatively low cost of work. The following period, however, competitiveness will increasingly make the usage of knowledge on innovative processes as an important factor.

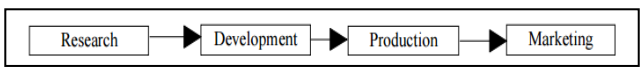

Figure 1. The linear model of innovation

The traditional theory held that innovation is a process of discovery which proceeds via a fixed and linear sequence of phases. In this view, innovation begins with new scientific research, progresses sequentially through stages of product development, production and marketing, and terminates with the successful sale of new products, processes and services. [1]

2. Theoretical background

Typical examples of knowledge-intensive services include research and development (R&D), management consulting, information and communication services, human resources management and employment services, legal services (including those related to intellectual property rights) accounting, transportation, financing, and marketing-related services activities etc. [2].

In importance particularly in the context of the Lisbon strategy, the aim of which was to create a presumption of intensifying competition based on knowledge, quality and innovation and other related documents. Currently, the most important is the Europe 2020. [3]

Five targets for the EU by 2020

1. Rate of employment increase by the population aged 20-64 years to 75%.
2. To increase the level of investment into research and development to 3% of GDP.
3. Climate change and energy sustainability of reducing greenhouse gas emissions by 20% (or providing a broader global agreement by 30%) compared to 1990 levels of 20% of renewable energy to reach 20% increase efficiency in energy use.
4. Reduction of early school leaving to below 10% at least 40% of the population aged 30-34 years should complete the university education.
5. Reduction of a number of people at risk and underprivileged people by at least 20 million. [4]

Research and development is a national priority in the knowledge-economy and has been placed on 2nd place in the objectives of the EU by 2020.

2.1. The characteristics of the economic activity

Service sector by knowledge intensity is divided into knowledge-intensive services:

- knowledge-intensive services - high technology:
  - post and telecommunications,
  - computer and related services,
  - research and development.
- knowledge-intensive market services (excluding financial services and high technology)
  - water and air transport,
  - real estate activities,
- knowledge-intensive financial services:
  - financial intermediation without insurance
- other knowledge-intensive services:
  - education,
- knowledge-demanding market services:
  - trade in vehicles and fuels,
  - wholesale etc., [5]

3. Comparison of selected indicators

Table 1. Research and development expenditure, by sectors of performance in % of GDP in the business enterprise

Year	Slovakia	Poland	Hungary	Czech Republic
2002	0,36	0,11	0,35	0,67
2003	0,31	0,15	0,34	0,7
2004	0,25	0,16	0,36	0,72
2005	0,25	0,18	0,4	0,69
2006	0,21	0,17	0,48	0,74
2007	0,18	0,17	0,49	0,77
2008	0,2	0,19	0,52	0,73
2009	0,2	0,19	0,65	0,73
2010	0,26	0,19	0,69	0,77
2011	0,25	0,23	0,75	0,86
2012	0,34	0,33	0,84	0,96
2013	0,38	0,38	0,98	1,03
Average	**0,27**	**0,2**	**0,57**	**0,78**

In table no. 1 are compared Visegrad countries from 2002 to 2013 in research and development expenditure, by sectors of performance in %. Results were then compared and averaged in order to show which out of four countries has the largest expenditure on R&D. In this case, table 1 shows that the Czech Republic has the largest expenditure on research and development. Thus, the sequence would be as follows; the Czech Republic, followed by Hungary, Slovakia and the least spending on R&D is Poland. Poland is more concentrated on quantitative production then the production based on innovation.

Table 2. Research and development expenditure, by sectors of performance in % of GDP government

Year	Slovakia	Poland	Hungary	Czech Republic
2002	0,15	0,25	0,32	0,25
2003	0,18	0,22	0,29	0,27
2004	0,15	0,22	0,26	0,26
2005	0,15	0,21	0,26	0,26
2006	0,16	0,2	0,25	0,27
2007	0,16	0,2	0,23	0,3
2008	0,15	0,21	0,23	0,28
2009	0,16	0,23	0,23	0,3
2010	0,19	0,26	0,21	0,29
2011	0,18	0,26	0,19	0,31
2012	0,2	0,25	0,18	0,33
2013	0,17	0,23	0,21	0,35
Average	**0,17**	**0,23**	**0,24**	**0,29**

Table 2 shows R&D expenditure, by sectors of performance in % of GDP government. Based on calculation average of shown data we came out with the following result: Czech Republic (0,29%), Hungary (0,24%), Poland (0,23%) and the least is Slovak Republic (0,17%). We of course, must consider into account the population, the GDP growth in the country and other macroeconomic indicators that may have an impact on the overall output of R&D. It is believed that the greater costs on R&D the greater the share of the output produced during the period.

Table 3. Research and development personnel, by sectors of performance (% of the labour force) business sector environment

Year	Poland	Slovakia	Hungary	Czech Republic
2002	0,05	0,17	0,18	0,25
2003	0,07	0,14	0,17	0,27
2004	0,08	0,13	0,16	0,29
2005	0,08	0,13	0,18	0,42
2006	0,08	0,12	0,22	0,46
2007	0,09	0,1	0,24	0,49
2008	0,08	0,1	0,27	0,5
2009	0,08	0,1	0,31	0,49
2010	0,11	0,12	0,35	0,51
2011	0,11	0,12	0,4	0,57
2012	0,15	0,14	0,46	0,61
2013	0,17	0,13	0,51	0,64
Average	**0,096**	**0,125**	**0,288**	**0,458**

Based on table 3 we can determine the number of employees in the business sector since 2002-2013. Average of years studied indicates the country with the highest number of researchers in the business sector as following an order

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from highest into the least: Czech Republic, Hungary, Slovakia and Poland. The outcome is based on the assumption of the costs incurred in R&D. We can also foresee an increased total output from the research according to expenditures spent on R&D.

Table 4. Research and development personnel, by sectors of performance (% of the labour force) by Government

Year	Poland	Slovakia	Hungary	Czech Republic
2002	0,14	0,15	0,19	0,14
2003	0,12	0,15	0,19	0,16
2004	0,12	0,13	0,18	0,15
2005	0,1	0,14	0,18	0,2
2006	0,1	0,14	0,19	0,21
2007	0,1	0,16	0,18	0,22
2008	0,11	0,16	0,19	0,22
2009	0,11	0,15	0,2	0,21
2010	0,12	0,16	0,19	0,21
2011	0,12	0,15	0,2	0,21
2012	0,13	0,15	0,17	0,22
2013	0,13	0,13	0,18	0,22
Average	**0,115**	**0,148**	**0,187**	**0,198**

Table 4 indicates the status of employees in R&D. According to calculated average, from the following years 2002-2013 we came to the result, that country with the highest number of employees according to order from highest are as following: Czech republic, Hungary, Slovakia and Poland. We must consider the factors such the growth of HDP, population and other factors which can influence the number of employees in R&D mainly in the government sector. Increased employment in R&D government sectors may also cause the reduction in competition. The economic growth is considered in particular on GDP growth. GDP growth affects the qualitative and quantitative growth factor. Quantitate methods are mainly on the volume of production in the country, the use of technology and techniques. Assuming that the country which supports R&D supports overall economic growth.

3.1. Government projects supporting R&D

"Support for projects involving basic research, applied research and experimental development,

- support for technical feasibility studies,
- support for small and medium enterprises in intellectual properties,
- supporting technology transfer,
- supporting innovative enterprises,
- support for process innovation and organizational innovation in services,
- support of counselling in services for innovation,
- encouraging mobility of highly skilled workers in small and medium-sized enterprises
- supporting the creation of innovation networks. "[3]

4. Conclusion

A country which supports R&D simply supports economic growth. Economic growth is the result of increasing employment, innovation, production, and motivation for foreign investors. The most important consideration is the know-how of the best uses of our raw materials. Knowledge is contracted in development and examination based on the information received. Today, many economists agree that one of the primary factors for economic growth is knowledge. It is a wealth that can be transformed into the country's wealth. Countries which have mineral resources are mostly countries with weak economies. These countries don't consider the importance of innovation and knowledge. In simple way to say, that money can be spent whereas knowledge can be transferred into a meaningful source. This is probably due to the fact that countries with raw materials rely on their resources and not based on innovation and a growing economy. Countries such Germany, France, are countries which don't belong to countries with mineral sources, but they fully support innovation, R&D and knowledge. This is probably due to the fact that countries with raw materials rely on their resources and not based on innovation and a growing economy. Civilization must learn and obtain knowledge and experience which can then be converted into an inexhaustible source.

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VEGA – 1/0515/15 Endogenous factors of the IPR intensive Industries in the regional enterprise environment in Slovak Republic

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