INNOVATION AND INTERNATIONAL COMPETITIVENESS OF A COUNTRY

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Abstract: *The success of economies or firms has been explained in the recent decades by the degree of innovation they have. Companies innovate to conquer markets through new products and services, to reduce production costs, to have an effective management system. It has been statistically demonstrated that there is a direct link between performances, profit level and degree of innovation. The ranking of countries by their degree of innovation prompted the reassessment of how innovation is quantified. The pillars that measure the degree of innovation do no longer refer strictly to research and development costs or number of patents and inventions. There are institutions, human and research capital, infrastructure, market environment, business environment, knowledge and technology outputs as well as creative outputs when we speak about the assessment of the degree of innovation of companies / countries. More and more indicators measuring innovation are focused on items that are not necessarily related to the number of patents or inventions obtained. The developed countries of the world have understood that their success on the international market is related to the degree of novelty and innovation their economy has. Due to globalization, companies and emerging countries are under pressure to engage continuously in innovation: R & D, software, design, engineering, human resources, marketing, etc. - all play an increasingly important role in what we call international competitiveness. We can also state that innovation has evolved along with the development of the human society, from a simple concept of invention or technological novelty to a very complex concept that takes all forms and sectors of economy. Innovation has become a fundamental factor in the whole value chain. Social changes, both in the developed and in the emerging countries, have recognized lately the importance of innovation, and therefore tried to introduce development policies that bring the education and R&D system closer to market requirements.*

Keywords: innovation, economic effects, measurement, types of innovation

JEL classification: F510, F370, K220

1. Introduction

The economic development of a country should be linked to a national research – development framework, and part of the national research and development system, namely the national education system. Establishing a national innovation framework that recognizes the characteristics and qualities of the economic and social innovation would automatically impose a range of local/regional/national management skills and capabilities resulting from the innovation process.

As a multidirectional tool for economic development, the education and research system requires the involvement of many stakeholders that should ask for several strands. The first area concerns the governance, strategy and investment decisions in a country / region / local community. The national / regional authorities and representatives of private/state economic environment should be interested in developing a national research and education project. The benefits of the links between higher education institutions and the business environment will focus on the idea of innovation. The examples offered by the industrial parks, developed in most cases as a combined public – private association and had an approach related to high-tech projects, can be leveraged for national development strategy.

Essentially, innovation should contribute to economic development not only through invention or industrial technologies but also by adding value to the general business environment, by improving skills and access to finance, by streamlining rules and government regulations and through a workforce trained according to the labour market needs. A question arises: What is less expensive – the economic development policies should build on skills, competencies, human resources training in the respective country and create a macroeconomic system based on these skills or should it continue to build and adapt the existing research and education systems to a new type of macroeconomic structure. To answer this question we should analyse the effects of innovation on economy and learn how to translate the impact of this innovation into economic terms. In order to understand the effectiveness of some research - development – innovation strategies designed and applied macro-economically, the research focused on the connection between innovation results and macroeconomic indicators.

2. Materials and methods

All research have a common element: innovation is an important factor affecting economic efficiency, shaping in time a country's macroeconomic structure. Feldman believes that, in any situation, the innovation capacity is the main source of competitiveness of a producer / company, regardless of activity (Feldman and Florida, 1994). Discussions on innovation support the view that any R & D input will determine the innovation output that will automatically add value (Hollenstein (2003) and HAGEDOORN and Cloodt (2003)). Nevertheless, innovation can be viewed from two different perspectives: the R&D expenses incurred by the producer or the inventory of the number of patents or new products introduced into the economy.

Many studies measuring the innovative activity have focused on the number of new products or patents (ACS et al, 2002. Feledman and Florida, 1994; Jaffe, 1986). However, innovation is a complex process that extends from the initial concept, the basic research to new products and marketing design. Therefore it is difficult to use a single indicator to measure this process (Hollenstein, 2003). Patents and new products involve a real finality of the R&D process. On the other hand, there are research and development processes concluding with partial results and thus, these terms are not quantified as innovation, even if they will constitute the starting point for other innovative processes. Under these circumstances, understatement /underassessment problems of the innovative process may occur (Griliches, 1990; Gu and Tang, 2004).

Hollenstein (2003) proposes the following indicators to measure innovation: R & D expenditure, number of patents, patent citations and the number of new products. In addition, Hagedoorn and Cloodt (2003) consider that the R & D expenses are always directly related to the production of innovation, regardless of the number of patents or products obtained. A producer's contribution in the chain of innovation or for obtaining a patent - whether this contribution is small or large – must be considered. This theory suggests that all tacit knowledge, all knowledge transfer effects, technical upgrades should be included in the innovation process. The empirical results show that, when producers share certain expenses connected to production elements, such as infrastructure, engineering and production resources, they may reduce production and trade costs and may generate external savings (Evangelista et al, 2002; Gordon and McCann, 2000). Thus the effective functioning of local production is enhanced while regional competitiveness improves (Cainelli, 2008; Lee et al, 2000; Porter, 2000). The support for knowledge, research and intensive technology, new industries that tend to replace the traditional ones,

the development and expansion of new economic sectors, all these are exponents of the innovation process.

Globally there is no generally recognized system to determine innovation. The tool called the *European Innovation Scoreboard (EIS)*, which allows the benchmarking of the innovation activities performance of the EU Member States, as well as of other innovative nations, was developed at the European Commission's initiative in order to assess the European innovation (European Commission: European Innovation Scoreboard. Comparative analysis of innovation performance, January, 2009). Innovation is characterized by 29 innovation indicators, divided into three main blocks: a) key drivers for innovation; b) activities of companies; c) results. The Summary Innovation Index (SII) was created to summarise the performance of national innovation; it is an index composed of the 29 assessment indicators; its value can range from 0 (worst performance) to 1 (highest performance). The index synthesizes the innovation performance by aggregating the indicators, different for each country, in a single digit (Bogliacino, F. Pianta, M. (2009), *Innovation Performances in Europe: a long term perspective*, March, 2009). In the EU, innovation is also measured by some other indicators and metrics.

- *Trend Chart on Innovation in Europe* - Practical tool introduced by the European Commission in 1998 to monitor changes in innovation policies in the Member States,
- *Community Innovation Survey (CIS)* - Statistical analysis coordinated by the statistical office of the European Commission, *Inno-Barometer*
- *European Sector Services Innovation Scoreboard (SSIS)* - a collection of opinions obtained under the auspices of the European Commission, which explores the views of the European managers on the needs of companies, investments in innovation and results *(Celikel-Esser, F.et al. (2008). the Lisbon strategy and development of metrics to measure innovation in Europe.In: Yearbook on Productivity 2007, Statistics Sweden, 2008, pp.7-33).*

A major tool for measuring global innovation is the Global Innovation Index (GII) conducted and published annually under the auspices of the World Intellectual Property Organization (WIPO, a United Nations agency) and INSEAD. The GII annual report consists of a ranking of capacities and innovation results of different countries. The Global Innovation Index (GII) aims to capture the multidimensional aspects of innovation and provide the tools that can help adapt policies to promote long-term production growth, to increase productivity and to grow employment. The GII helps create an environment in which innovation factors are evaluated continuously. The Global Innovation Index -GII is based on two sub-indices: input for innovation and output of innovation, each built around some pillars. The innovative character of national economies is assessed based on five input pillars: (1) Institutions, (2) Human and research capital, (3) Infrastructure, (4) market environment, and (5) business environment and also on two output pillars: knowledge and technology outputs and creative outputs. Each pillar is divided into sub-sub-pillars and each pillar is composed of individual indicators (79 in total). Sub-pillar scores are calculated as the weighted average of individual indicators. (*https://www.globalinnovationindex.org/content/page/GII-Home*)

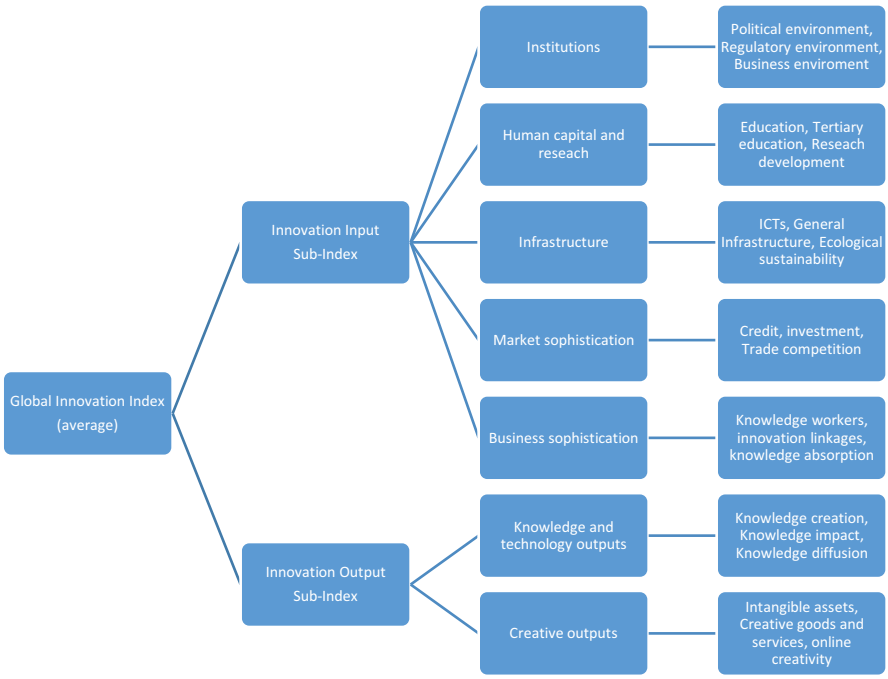

Figure 1: Framework of the Global Innovation Index 2015
Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

According to data from UNESCO-UIS Science & Technology Data Centre, although growth has experienced periods of decline, in many advanced economies the global R&D expenditure (public and private expenditure) has grown steadily, increasing by 3.7% in 2010, 5.3% in 2011, 5.6% in 2012 and 4.3% in 2013 (UNESCO-UIS Science & Technology Data Centre, updated February 2015).Data used: GERD, performed by business enterprise (in '000 PPP$, constant prices, 2005). Gross domestic expenditures on R&D (GERD) in the high income economies of the Organisation for Economic Co-operation and Development (OECD) increased by 1.4% in 2010, 3.6% in 2011, 3% in 2012, and 2.6 % in 2013.2 (*Science, Technology and Industry Outlook 2014.* Paris: OECD Publishing.)
The global recovery of the expenditure on research and development (EBRD) was fast, reaching an increase of 3.2% in 2010 and gaining faster pace of 7.2% in 2011, 6.6% in 2012, 5.1% in 2013 (UNESCO-UIS Science & Technology Data Centre and OECD 2005). Businesses in high-income countries of the OECD contributed to the recovery of R&D expenditure with 4.8% growth in 2011, 4% growth in 2012, and 3.2 % growth in 2013 (*OECD MSTI, updated 4 February 2015.)*
According to PricewaterhouseCoopers and Strategy&, R&D spending by the top R&D performing 1,000 companies worldwide grew by 9.7% in 2012 and 3.8% in 2013, but only 1.4% in 2014 *(PricewaterhouseCoopers and Strategy&, 2014.* Available at http://www.strategy-business.com/article/00 295?gko=b91bb&tid=27782251&pg=all)
Factors that accelerated the innovation process at the firm or country level are: globalization, social change and policies to support innovation in emerging countries.

Globalization and innovation - the pace of innovation has grown along with the development of international trade and global production and marketing chains. Companies' compliance and adaptation to changing international standards have forced their capacity for innovation both in technology and human resources. However, there is great heterogeneity between firms from emerging countries: some companies operate with an extremely low technological level, relying on national markets, while others seek to develop new products or services through their own efforts or in collaboration. Companies that are hosted by emerging countries like India, China, Korea - leaders in technology, attract much of the competitive advantages offered by the host country. It also calls for the boomerang effect – the development of these companies will generate substantial aggregated impact on the economic growth of the country concerned: employment, poverty reduction, modern education system and sustainable development

Social changes are determined by the demographic development of the world. All developing countries have a young and growing population, facing high levels of unemployment and social inequalities. Another problem arising from the rapid development and demographic change is the increased pressure on natural resources and the pollution expansion. In developing countries, innovation is considered essential when addressing the pressing problems of the country - pollution, health problems, poverty and unemployment. The role and importance of innovation goes beyond purely economic objective - achieving higher profit. It should rather be seen as an instrument of inclusive development as it can combat poverty, pollution, health problems etc. In contrast, developed countries have a variety of instruments and government budgets to stimulate firms to invest in innovative research areas. Governments in developing countries with limited budgets provide support for issues of macroeconomic imbalances and less for next-generation innovation. In these circumstances, firms from emerging countries rely on their own resources (most often limited) to do research and innovation, as opposed to companies in industrialized countries which have a range of incentives (political stability, infrastructure, tax cuts, subsidized loans, national programs, subsidies etc.).

Bogliacino (Bogliacino, F., G. Peran, M. Pianta, and S. Supino. 2012. "Innovation and Development: The Evidence from Innovation Surveys'. *Latin American Business Review* 13 (3): 219-61) conducted an aggregated comparison on what innovation means in developed and emerging countries. The difference is determined not only by the technological level, scope, complexity of business and size of the company, but also by the institutions and infrastructure with which the company operates. In emerging countries innovation is likely to mean technology and equipment rather than processes, methods, research laboratories and new products (see Table no. 1 and Table. 2)

Table 1 High-tech net imports (% of total trade) 2013

Rank		Country/ Economy	Value	Score (0-100)
1.		Hong Kong (China)	41,48	100
2.		1 Malaysia	23,42	100
3.		3 Fiji	23,14	98,7
4.		4 Viet Nam	22,04	93,55
5.		5 Costa Rica	20,89	88,21
6.		6 Singapore	20,75	87,54
7.		7 Panama	20,19	84,93

8.		8 China	18,76	78,27
9.		9 Mexico	17,67	73,19
10.		10 United States of America	16,12	65,99

Source:*The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Table 2 High-tech net exports (% of total trade) | 2013

Rank	Country/ Economy	Value	Score (0-100)
1.	China	28,37	100
2.	Malaysia	27,82	100
3.	Singapore	26,81	100
4.	Viet Nam	23,58	100
5.	Korea, Rep	22,08	93,66
6.	Panama (2011)	18,36	77,87
7.	Switzerland.	17,06	72,36
8.	Costa Rica	16,77	71,12
9.	Czech Republic	16,29	69,10
10.	Mexico	14,42	61,15

Source: *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Moreover, when we refer to innovation in the developed countries, we talk about: government policies, institutional support, legal system, management and marketing tools, organizational elements and especially the education system (see Table no. 3, 4, 5, 6, 7).

Table 3 Political stability and absence of violence/terrorism 2013

Rank	Country/ Economy	Value	Score (0-100)
11.	New Zealand	1.45	100.00
12.	Switzerland	1.37	98.09
13.	Finland	1.36	97.76
14.	Austria	1.34	97.36
15.	Singapore	1.33	97.14
16.	Luxembourg	1.33	97.09
17.	Norway	1.33	97.08
18.	Barbados	1,29	96,12
19.	Iceland	1,26	95,32
20.	Qatar	1,22	94,26

Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Table 4: Rule of law - 2013

Rank	Country/ Economy	Value	Score (0-100)
1.	Norway	1,97	100
2.	Sweden	1,95	99,63
3.	Finland	1,93	98,87
4.	Denmark	1,87	97,48
5.	New Zealand.	1,86	97,13
6.	Austria	1,83	96,30
7.	Netherlands	1,81	95,77
8.	Switzerland	1,79	95,28
9.	Luxembourg	1,79	95,20
10.	Australia	1,75	94,30

Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Table 5: Researchers, FTE (per million population) - 2013

Rank	Country/ Economy	Value	Score (0-100)
1.	Israel	8,33	100
2.	Denmark	7,27	87,21
3.	Finland	7,22	86,63
4.	Iceland	7,012	84,10
5.	Korea Rep	6,53	78,35
6.	Sweden	6,50	78,05
7.	Singapore	6,43	77,20
8.	Norway	5,57	66,85
9.	Japan	5,19	62,28
10.	Luxembourg	4,93	59,11

Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Table 6: GERD: Gross expenditure on R&D (% of GDP) - 2013

Rank	Country/ Economy	Value	Score (0-100)
1.	Israel	4,20	100
2.	Korea Rep.	4,15	98,81
3.	Japan	3,49	82,94
4.	Finland	3,46	82,18
5.	Sweden	3,42	81,41
6.	Switzerland	3,13	74,36
7.	Denmark	3,10	73,82
8.	Germany	3,01	71,62
9.	Austria	2,9	68,89
10.	United States of America	2,79	66,35

Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

Table 7: Logistics Performance Index 2014

Rank	Country/ Economy	Value	Score (0-100)
1.	Germany	4,12	100
2.	Netherlands	4,05	96,22
3.	Belgium	4,04	96,06
4.	United Kingdom	4,01	94,53
5.	Singapore	4,00	94,01
6.	Sweden	3,96	91,81
7.	Norway	3,96	91,65
8.	Luxembourg	3,95	91,06
9.	United States of America	3,92	89,59
10.	10 Japan	3,91	89,43

Source : *The Global Innovation Index 2015 – Effective Innovation Policies Development*, Cornell University, INSEAD, and WIPO (2015), Fontainebleau, Ithaca, and Geneva

The hierarchy shown on the 5 indicators clearly demonstrate that industrialized countries have evolved into the innovation process from the bottom tray - innovation seen as a sum of patents, inventions and R&D expenses- to the upper tier of innovation - that of giving businesses an economic and social framework conducive to business development.

According to OECD principles (OECD, 2005 for the OECD's definition of 'innovation' see also http://www.oecd.org/ site / innovation strategy / defininginnovation.htm.) innovation may entail a new product, a new organizational process, a new marketing method or a new organizational innovation. Keely and Waters (Keeley, L. and H. Waters. 2013) differentiate business innovation on several levels: network innovations, business structure innovations, service innovations and channel innovations. The data presented clearly show the developing countries' orientation towards giving businesses a framework conducive to economic and social development of business, and less tangible elements of technology (patents, inventions).

In conclusions

States attempt to monitor the innovation activity by the number of patents and inventions, research-innovation expenses, education systems, trademark database etc. The accuracy and quality of these indicators provide information about the effectiveness of policies and strategies for developing innovation systems. Despite the efforts made by UN, OECD, EC there are still countries that are not included in any statistic related to the degree of innovation. In very many emerging countries, when talking about innovation at governmental level the reference is only made to the high-tech production, which is highly valuable also to the manufacturing industries with tradition in that country. Nevertheless, the innovation activity should not focus on specific industries, instead it should take into account all innovation aspects. The main argument is that innovations can occur at different points in the development process, including design, research and development, transfer (displacement from "technology" to the organization of production) and implementation or use on the market.

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