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## The Role of Innovation for the Economic Growth and Development of the States. The Case of the Emerging Countries

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# **The Role of Innovation for the Economic Growth and Development of the States. The Case of the Emerging Countries**

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## **Abstract**

At the beginning of the XXI<sup>st</sup> century, the importance of innovation is brought in light mainly due to the huge differences that exist between the living standard of the richest and of the poorest nations, differences that could be partly explained through the fact that the most advanced countries pay a greater attention to the intensive side of economic activity.

The purpose of this paper is to determine the way in which innovation actually influences the economic growth and the prosperity of a country. Being known that between the stock of human and social capital, on one side, and the innovation, on the other side, there is a strong positive correlation, we will try to identify the possibilities that developing economies have to foster the innovation. The relationship between human capital and innovation will be analyzed in order to see how it could be optimized so that to obtain the best results on both micro and macroeconomic level. The example of China, whose fast development astonished the world, will serve as a model in reaching out our purposes.

## **1. Introduction**

During the last decades, it increased the importance given to the knowledge intensive side of the economic activity. This aspect raised the interest of the annalists to determine the various factors that contribute to the knowledge creation and transfer within and between countries (Crosby, 2000). One of these, considered by Collinson (2000) to be the most important, is innovation, which is closed related to the human capital accumulation. Therefore, at the beginning of the XXI<sup>st</sup> century, the importance of the human capital and, implicitly, of the innovation, is brought on the light mainly due to the huge differences that exist between the richest and the poorest nations, from the living standard point of view. The problem of the economic convergence between nations has raised two questions: is there a

tendency, regarding the poorest countries, to develop faster than the richest ones or, on contrary, the differences between nations become deeper and deeper, the richest ones becoming richer and the poorest poorer? Trying to answer this question, some authors are talking about a “convergence club”, defined through a group of countries for which the convergence principles may be applied: “It is obvious that for the poorest economies of the world it is impossible to think about convergence, although the boundary that separates the members from the non-members hasn’t been established for good”<sup>1</sup>. They argue that only the countries with an initial adequate level of human capital may take advantages from the modern technology, being able to adopt it and to innovate; they are the ones who have the opportunity of a convergent growth. The same conclusion is drawn by Barro (1991) who believes that a poor country would grow faster than a rich one only if the level of human capital of the first one surpasses a certain level which is usually correlated to the low income per inhabitant.

Previous researches have analyzed how countries differ in terms of their innovative activity, using cultural dimensions pointed by Hofstede (1980) – power distance, individualism, uncertainty avoidance, masculinity and long term orientation – in order to explain why some countries are more innovative than others. For example, Shane (1992, 1995) argued that individualistic and nonhierarchical societies are more innovative than other societies; more than this, in the nations that allow the existence of the uncertainty, the role of innovation is greater than in those that does not accept it. Other studies have analyzed the ways in which societies may differ in terms of “entrepreneurial behavior”, based on the prevalent cultural values. In this way it was found that the individuals from “doing-oriented” cultures fulfill much better their tasks and obtain faster goal achievements than people from “being oriented” cultures<sup>2</sup>. Recent researches notice two other factors that influence the innovation activity at the social level – the human capital and the social capital.

The present paper underlines the way in which innovation, as a result of human and social capital accumulation, may foster the welfare state not only at individual level but also at macroeconomic one, pointing out the importance of innovation for the developing countries.

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<sup>1</sup> Baumol, William J., Richard R. Nelson and Edward N. Wolf, 1994, *Convergence of Productivity*, Oxford: Oxford University Press

<sup>2</sup> Adler, Nancy J., 1997, *International dimensions of organizational behavior*, 3rd ed., USA: South-Western College Pub

## **2. Technological innovation – a major determinant of the economic growth**

Solow (1957), analyzing the US productivity between 1909 and 1949, concluded that the main factor responsible for the majority of the economic growth (87,5%), during that period was the technical change. Previously, the same idea was mentioned by Fabricant (1954), who estimated that about 90% of the increase in the output per capita in US between 1971 and 1951 was attributable to technical progress. Yet, even recent studies (such as Matthews et al, 1982; Denison, 1985; Jorgenson, 1990) still suggest that technical progress is responsible for an important part of economic growth, usually about one third. As Cameron (1996) noticed, the main shortcoming of these studies is that they estimate the rate of technological progress but they do not mention the factors that are influencing it. Or, in the absence of the high skilled human capital, of the investments in the research and development field and in the infrastructure, the technological progress and, consequently, the economic growth could not occur.

Huw Lloyd-Ellis and Roberts (2002) developed an endogenous economic growth model in which the technology, the skills and the innovation are complementary linked and are completing each other up to a certain point after which the impact of each factor is constrained by the others' levels. This relation is generating endogenous interactions between technology, innovation and economic growth. Both the technological progress and the human capital accumulation are important for a sustained economic growth, but, being independent one from the other, they are not sufficient. The rapid technological progress involves high returns to the educational progress, stimulating each generation to spend more time learning. Meanwhile, the rapid human capital accumulation increases the feasibility and the profitability of innovation, encouraging the private sector to allocate more resources for research and development.

Analyzing the relationship between innovation and the economic growth, Rosenberg (2004) considers that there are two ways of increasing the output of an economy. While the first one suggests that it could be increased the number of inputs necessary for the productive process, the second one stresses the fact that it could be obtained more output from the same number of inputs. Trying to find out which of the two is more important, Abramovitz (1956) measured the output growth of the American economy between 1870 and 1950 and the raise in inputs (capital and labor), for the same period of time. Then, he analyzed how much a unit of labor and a unit of capital may increase the total output of an economy. Abramovitz concluded that the increase of the inputs could only account for about 15% of the actual growth in the output of the economy, between 1870 and 1950. Most economists considered

that the rest of 85% was given by the technological innovation, a major force in the output growth of the highly industrialized economies. As Rosenberg (2004) noted, this huge percentage represented the “wake-up call” for the economists who had previously considered that the economic growth was a matter of adding more inputs into the productive process, especially capital.

Some empirical researches have analyzed the factors that influence the productivity growth using data on innovation. It was the case of the studies conducted by Griliches (1980), Mansfield (1980), Nadiri (1980), Scherer (1982) and Terleckyj (1974), who derived the estimates regarding the productivity growth using a Cobb-Douglas approach and then they correlated these estimates with various measures of innovation input, such as research and development spending.

### **3. The Relationship between the Human Capital, the Social Capital, the Innovation and the Economic Growth**

As we argued before, the impact of innovation on both micro and macroeconomic growth is usually correlated to the concepts of human capital and social capital. The relationship between human capital and innovation is based on what Bourdieu (1986) called “conversions”, referring to different forms of capital that can be converted into resources. Considering that human beings possess skills and abilities that can be improved and so they can change the way they act (Becker, 1964), human capital is seen as an important source of competitive advantage not only for the companies but also for the societies (Gimeno et al., 1997). Some analysts, such as Florin and Schultze (2000) pointed out the existence of different types of human capital: firm-specific human capital, industry-specific human capital and individual specific human capital.

#### *3.1. The Relationship between Human Capital, Innovation and Growth at Microeconomic Level*

Firm-specific human capital refers to skills and knowledge that are valuable only within a certain firm. They are directly correlated with its tradition, culture and business practice and they can be applied only within that company. Although they can represent a competitive advantage for the firm that have them, due to the fact that they cannot be transferred to other companies (Grant, 1996), the limited interaction and communication capacity attached to those abilities makes this type of human capital have only a limited

impact on the innovative activity from a region or society. Yet, there are various researches regarding the impact of the innovation on the microeconomic level. Authors such as Georghiou et al. (1986) and Baily and Chakrabati (1985), analyzing the relationship between innovation and the productivity of a firm, noticed that there is a positive correlation between the two aspects and that the innovation depends on the research and development spending. In practice, the impact of innovation on total factor productivity can be determined in two ways (Cameron and Muellbauer, 1995). The first way is to measure the stock of research and development capital with the help of a regression of the level of total factor productivity, as shown in equation (1). The second way is to determine the research and development intensity (relative to output) with the help of a regression of the change in total factor productivity, as considered in the equation (2).

$$(1) \quad \log TFP_t = \log A + \gamma \log RDK_t + \beta t;$$

$$(2) \quad d \log TFP_t = \rho RD_t / Q_t + \beta,$$

where: “RDK” is the stock of research and development capital, “RD” is the flow of research and development, “TFP” represents the total factor productivity, “Q” is the output, “d” and “β” are variables.

The equation (1) measures the elasticity of the output with the respect to knowledge (parameter  $\gamma$ ), while the equation (2) shows the social gross rate of return to knowledge (the parameters  $\rho$ ).

There are a few problems regarding these two approaches, not only theoretical but also empirical ones. From the theoretical point of view, it is not clear that knowledge is separable in the production function and, due to the fact that the factors of production are not always paid their marginal products, the factor-share assumption may be invalid. From the empirical point of view, measurement problems may occur, especially in the construction of value-added, research and development data.

Yet, various analysts have drawn up three conclusions regarding these two equations. First of all, as Griliches and Lichtenberg (1984) noticed, the returns to the research and development process are higher than the returns to research and development product. Secondly, the returns to basic research and development are higher than those to applied research and development (Griliches, 1986). The third conclusion, drawn up by Englander, Evenson and Hanazaki (1988), is that the returns to research and development vary significantly between industries, with research-intensive sectors generating higher returns, and these inter-industries differences are more important than inter-country differences.

Some other authors tried to establish a link between the innovation and profits, but it turned out to be difficult due to the fact that there are more factors influencing the profits than the factors determining the productivity. Conducting a research on 721 UK firms between 1982 and 1993, Geroski, Machin and van Reenan (1993) argue that innovation had a positive profit effect, although modest in size. Although they said that it was not possible to determine if this effect was greater than the cost of research and development, it was clear that the innovative firms had higher profit margins in downturns, larger market shares and were less sensitive to downturns than the non-innovative firms.

The externalities of innovation, or technological spillovers, are considered to be a very important component of the growth process (Coe and Helpman, 1993). Being the result of the fact that firms are unable to fully take advantages from the gains of their innovations, these externalities have three forms. First of all, network externalities may arise because the payoffs to the adoption of innovation may be complementary (David, 1985; Katz and Shapiro, 1994).

Secondly, the technological spillovers reduce the rival firms' costs due to the knowledge leaks, imperfect patenting and to the migration of the skilled labor to other companies (Mansfield, 1985). The same happens at the macroeconomic level. As Harmon, Oosterbeek and Walker (2000) argue, more educated countries grow faster because the education gives the opportunity to develop new technologies and to adapt the existing ones to local production. Consequently, the opportunities of grow may be greater for economies that are inside the technological frontiers (Barro and Sala-i-Martin, 1995). Yet, paradoxically, states with low schooling rates may benefit of adopting the technologies developed in a foreign country, through imitation. Despite this opinion, Howitt (2005) considers that the technologies which are the result of the innovation of one country cannot be adopted by another state without changing them first, because much of the technological knowledge are tacit (Polanyi, 1958) and cannot be codified. Therefore, those who want to imitate it have to spend time, financial and material resources, learning and experience in order to master what has been implemented in another part of the world.

Thirdly, even if there are no technological spillovers, the innovator does not benefit from all the social gains of innovation, unless he can perfectly sell the right of using that innovation through licensing (Griliches, 1991).

### *3.2. Human Capital, Innovation and Growth at Macroeconomic Level*

In the analysis of the innovation's impact on the macroeconomic level, a very important role is played by the industry-specific human capital. This kind of capital regards

the knowledge resulted from experience specific to an industry. The measure in which this experience allows obtaining economic performances and social development was analyzed both by Siegel and MacMillan (1993), and by Kenney and Von Burg (1999). Further researches demonstrated that this type of human capital may play an important role in generation of innovative activities only if it takes place a knowledge, personnel and technology exchange within that industry. So, creating innovations is possible when new products or ideas result from the combination of communication among industry's partners, on one hand, and, on the other hand, when knowledge is present in existing technologies (Bianchi, 2001). An important correlation is represented by different types of public-private or private-private partnerships: large research programs imply sometimes substantial costs which cannot be sustained only by one firm. A well-known example in this case is Silicon Valley, the most innovative region of the world, developed around the Stanford University. The advantage is mutual, firms having specialists well prepared and a growing innovative environment – inside the universities – and the faculties profit by resources and logistics for research. Although there is a strong public source of financing, the decision is decentralized and the allocation is done by performances criteria. As a consequence, the result is a spectacular one. It has to be mentioned that the centralization of the research and its public financing do not have the same effect. It is the Germany's case in which the state plays a decisive role in initializing, financing and dissemination of the research. In the case of Romania, a developing country, we can speak, at least for the moment, about two completely different systems: a centralized one, in which the decision is not taken according to the efficiency criteria and which generates a weak and uncompetitive innovation, and one financed through European funds, in this case prevailing the decision' decentralization, partnerships and the efficiency of the results. Consequently, we cannot completely speak about an augmentation effect on which we call industry-specific human capital due to the fact that, even cumulated, the resources are very scarce.

### *3.3. Social Capital, Innovation and Economic Growth*

Some researchers underlined the role that social capital has in the creation of human capital (Serageldin and Dasgupta, 2001; Coleman, 1990) as well as the positive impact of the first one on the innovation. Analyzed at individual level, social capital was considered to be the sum of the resources used by a person in relationships with the others; so, in this situation, the accent is on the real or potential benefits that result from the formal or informal relationships of an individual with the others. At macroeconomic level, Putnam (2000)



defined the social capital with the help of the social organization characteristics – relationships, norms and trust - which facilitate the coordination and the cooperation in order to obtain the social welfare state. In a close relation with the innovation, the analysts argued that in those regions where there is a large number of small firms that strongly interact one with the others (the big companies may be included in these networks of small firms), it is more likely to obtain the economic prosperity than in those areas where the big enterprises are dominant (Herrigel, 1996). Moreover, a research conducted by Knack and Keefer (1997) on 29 market economies demonstrated the direct relationship between the social capital and the economic performance. Nichols (1996) mentioned the same idea, considering that the socio-economic problems that Russia had to face at the end of the XX<sup>th</sup> century were caused by the lack of social capital because the communist period had eroded the people's trust and the civic behavior. Consequently, the social capital of a country can also be defined as the sum of the social characteristics that include trust, voluntary activities and norms of civic behavior that together are facilitating the coordination and the cooperation, in order to ensure the national welfare and the economic prosperity (Paxton, 1999; Nichols, 1996; Helliwell and Putnam, 1995).

Trust, as a component part of social capital, may foster the innovation. Trust is not necessary only to develop the innovation at the organizational level, but also to promote it between the organizations. The researches regarding the innovation revealed the fact that the development and the adaptation of some new processes and products inside a country are the result of the interaction between the capacities specific for each firm or industry (Dosi, 1988). Consequently, the possibility to have a continuous innovative flow in a country depends on the ability of spreading out the specific knowledge to the organizations involved in the production, research and development activities. In the economic literature of social capital, trust has been identified as an important determinant in explaining the differences in income. As Zak and Knack (2001) noticed in a research, the countries with higher levels of trust are richer.

The voluntary activities are describing the general trend of people from a society to become active members of voluntary associations and organizations (Knack and Keefer, 1997). These activities, as Putnam (1993) underlines, are generating mutual solidarity and help between the members of a society. The presence of a dense network of associations from a particular region may play a very important role in attracting the capital, fact that can contribute to the increase in the investments in the innovative activities. The explanation is brought by Akçomak (2008) who argues that financing risky innovative projects requires that

researchers and capital providers trust each other. When they do so, more projects are carried out, fact that improves the innovation outcomes because it increases the number of patents. Some authors define the “total number of patent applications to the European Patent Office by year of filing excluding patent applications to the National Patent Offices in Europe”<sup>3</sup> per million inhabitants as a proxy for the innovation output. These ideas might not reflect the true regional innovative potential, but it shows “commercially significant innovations at the world’s technological frontier”<sup>4</sup>, patents being the only well-established source reflecting the innovative activity (Trajtenberg, 1990). It was noticed that the number of patent applications seems to be correlated to the level of development of a country, in the northern European states the average number of patents being almost ten times higher than in the southern ones (Akçomak, 2008: 12) Considering the aspects mentioned above, it might be argued that trust leads to higher innovation outputs which yield higher income per capita (Grossman and Helpman, 1991; Aghion and Howitt, 1992).

The norms of the civic behavior are describing the general tendency of members of a society to subordinate the individual interest to the social one (Knack and Keefer, 1997). A research conducted by Kilkenny, Nalbarte and Besser (1999) in a few Iowa cities shows that the involvement in community activities has a positive impact on the economic success. In a similar way Putnam (1993) argues that some Italian regions had a more prosper economy than others because they have proven a developed civic behavior. At national level, Knack and Keefer (1997) underline that those countries that have rules regarding the attitude of the citizens towards the society enjoyed a greater economic growth between 1980 and 1992 than the rest of the states. The norms of the civic behavior may improve the innovation process through the effect that they have on the changes of knowledge and ideas, aspect considered by some analysts to be a side of the cooperation behavior. As Tjosvold (1988) has mentioned, the cooperation is directly correlated to the innovation or, in other words, when there are strict rules of civic behavior, there is also a strong tendency of changing ideas and information and, consequently, the knowledge transfer would be more ample.

In conclusion, while the regions with higher level of social capital may facilitate a structure in which it is easier to implement policies to foster innovation and stimulate the economic growth, the backward areas cannot improve fast in terms of innovation and per

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<sup>3</sup> Pavitt, Keith, 1988, “Uses or Abuses of Patent Statistics,” in A. van Raan, ed., *Handbook of Quantitative Studies of Science Policy*, Amsterdam: North-Holland

<sup>4</sup> Furman, Jeff L., Michael E. Porter and Scott Stern, 2002, “The Determinants of National Innovative Capacity,” *Research Policy*, 31(6), pp. 899–933

capita income growth because the shaping of social capital is essential and takes long time to develop.

#### *3.4. Innovation and the Developing/Emerging Countries*

From all the aspects mentioned above, we can conclude that innovation, fostered by a high level of human and social capital, has a significant impact on the economic growth both at the national and regional scale. Consequently, for the developing countries it is essential to put a greater accent on the accumulation of human and social capital, which can generate innovative activities, in order to catch up with the advanced levels of the industrialized economies. An example of country that did so is China, whose development over the past 20 years astonished the world. Many analysts have attributed this record to the large market of the country and to the low costs, especially in the manufacturing sector. Recent researches have noticed that China's significant rate of talent production, particularly of scientists and engineers, and its ability to generate technological innovation and attract research and development facilities of the multinational firms have also contributed to the economic growth of the country.

In 2006, the government allocated 250 million Yuan (about 33 million US dollars) in order to finance 62 programs meant to boost the technological innovation in local enterprises. Located in the Eastern part of China, the Jiangsu province is among the coastal regions which pursue fast economic growth through science and technology advancement. The spending on science and technology development in this zone rose by 63,7% in the first half of 2007, and currently more than 50% of its economy benefits from technological progress (Shutao, 2007). Actually, China has set the goal of raising the contribution to economic growth by science and technology advancement from 39% to more than 60% in 2020.

The talent production, measured through the number of leading universities in a particular area, and the technological innovation in China are highly concentrated and uneven. The top 10 regions of China house 16% of its population but account for a third of its DGP, 43% of its talent-producing universities and 58% of the technology, while the top 50 areas house half of the population, account for 80% of GDP, 90% of talent and 95% of the technological innovation (Li and Florida, 2006). As we can see, the talent production does not depend on the city size and its dimensions are not associated with the number of population.

Underlying the considerable differences in human capital across regions, Florida argued that it is important to understand the factors that not only produce human capital but which enables the regions to attract it, suggesting that human capital operates less as a static

endowment and more as a dynamic flow (Florida, 2002). While some researchers noticed that talent is attracted by quality-of-life factors or amenities, other found a positive relationship between technological creativity (measured with the help of innovation and high-technology GDP) and cultural creativity. There are also a few voices that suggested that talent is attracted to openness to diversity, which is an important factor for the regional economic growth. The diversity acts on innovation and growth by creating low barriers of entry for talents, fact that allows the potential talents go into a certain region. These factors are included by Li and Florida (2006) in a model in which the economic growth occurs in three distinct but interrelated phases. In the first phase, the non-market factors (such as amenities, quality of life and diversity) create the ability of different places to produce, attract and retain talents. In the second stage of the model, the higher levels of talents generate spillovers that lead to a greater level of technological innovation. In the last phase, this technological innovation fosters the economic growth and development.

The conclusions of this model suggest that China's economic growth is the result of a cumulative process that involves a progression from non-market factors to human capital externalities and to the role of technological innovation.

#### **4. Conclusions**

As Zhang Weiguo, the director of the Institute of Economics under the Shandong Provincial Academy of Social Sciences, has noticed, "pursuing economic development through innovation is a reflection of the scientific concept of development"<sup>5</sup>. Indeed, as we have argued in the present paper, innovation is an essential determinant of the economic growth and development, which can be achieved only by those countries with a high level of human and social capital. So, in order to catch up with the advanced levels of growth from the industrialized states, the developing countries have firstly to improve the stock of these two types of capital, by promoting policies that foster the accumulation of this capital. In the case of the human capital, one method of improving its level would be stopping the migration of the talents, problem that the majority of the developing countries confront with. Moreover, as the Chinese case illustrates, talent production, innovation and the economic growth are all powered by a small number of large urban centers. Therefore, it is important to think about

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<sup>5</sup> Shutao, Song, 2007, "Boosting Innovation, Boosting Economic Growth", *Scientific Outlook on Development*, 17<sup>th</sup> CPC National Congress, [http://news.xinhuanet.com/english/2007-09/29/content\\_6814155.htm](http://news.xinhuanet.com/english/2007-09/29/content_6814155.htm) (accessed September 7, 2008)

the economic growth less as a national phenomena and much more in terms of regional dynamics. Yet, although the benefic effect of the human capital on the economic growth is partly based on the fact that the resources, the experience and the education are used in the interactions inside a certain region or community, the global level of human capital of all the persons from one country may have a positive impact on the whole innovatory activity.

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