RESEARCH AND DEVELOPMENT TRANSFER AS DRIVER OF ENTREPRENEURIAL ACTIVITY

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Abstract. Entrepreneurship is the main driver of innovation and a catalyst for technological changes in the economy, and the governments should ensure that different results of research and development find their way to the market. However, just a small number of inventions as results of the government funded scientific research experience commercialization. Data from Global Entrepreneurship Monitor (GEM) was used in order to investigate the role of the research and development (R&D) transfer as one of the entrepreneurial framework conditions. Paper concludes that R&D transfer is one of the least favourably conditions, which significantly affects the degree of innovation and the competitiveness of businesses, especially in factor-driven and efficiency-driven economies.

Keywords: entrepreneurship, research and development, transfer of technology.

Introduction

World experts from the fields of politics and economics agree that entrepreneurship plays a significant role in the development of society and economy of each country. Many agree with the theory established by Joseph Schumpeter in the first half of the twentieth century, which states that entrepreneurship is an essential driver of innovation and a catalyst for technological change in the economy (Schumpeter, 1942). By creating a higher degree of competitiveness in the long run, entrepreneurs contribute to increased productivity (Audretsch and Keilbach, 2004). New investments positively impacts supply and demand: newly created capital expands capacity growth (supply), while increased spending facilitates the use of new capacities and production (demand).

In spite of the importance of investment and innovation for economic development, process of product evolution is still not completely understood. In this process innovation is developed and commercialized as a result of entrepreneurial activities, thus stimulating economic growth. The process of evolution of the product starts from the basic scientific knowledge, which eventually brings products or services to the market through commercialization.

The key point in this process is the intersection of knowledge and a recognized social need, at the very beginning of product development process. This point is called the “iterative synthesis”, which in many cases does not lead to innovations that can be placed on the market. For this reason, an entrepreneur must make great efforts in this phase. The main problem of technology transfer occurs precisely at this point - the harmonization of technology with the market needs.

Since entrepreneurs as any other market participants are embedded in regional contexts, the institutional setting affects both entrepreneurs and their interactions (Acs et al. 2004). Entrepreneurship supported from institutional factors, becomes a channel able to transform created knowledge in economic growth. As a result, economic growth at company and region level (ranging from city to country) is influenced by the institutional setting able to support high technology transfer and entrepreneurship (Audretsch and Caiazza, 2016).

The purpose of this paper is to provide an overview of the current capabilities of government supported technology transfer on a global scale. Better understanding of research and development as one of the key entrepreneurial framework conditions should emphasize the importance of technology transfer for entrepreneurial activity and economic growth and thus facilitate further research in this field.

R&D transfer and entrepreneurship

Regardless of the product or industry, any innovation evolves toward market using one of the following mechanisms: national initiatives, corporate entrepreneurship or independent entrepreneurship. The government may be a channel through which innovations can be launched on the market, as a result of the synthesis of social needs and new technologies. The process in which technology developed in the laboratories is transferred into new commercial products is called technology transfer. Although many research efforts strive to achieve commercialization, only a small number of inventions developed as the results of government funded research reach market (Hisrich et al. 2012).

Most often the results of scientific research are not fully commercially useful, and when they are, substantial changes are needed in order to be accepted by the market. Although most of the countries have a sufficient budget needed for the successful transfer of technology, they usually do not provide the necessary business skills - primarily in the areas of marketing and distribution. In addition, the state bureaucracy and excessive regulation often slow down the creation of new enterprises.

In order to examine the possibility of commercialization of R&D results on a global scale, data from Global Entrepreneurship Monitor (GEM) was used. GEM was established in 1997 with the aim of measuring the differences in entrepreneurial attitudes and activities of various countries, defining the factors that determine the nature and level of entrepreneurial activity. GEM considers that the prosperity of each country largely depends on the dynamics of entrepreneurship, regardless of the stage of economic development, and geographic area.

Many policy-makers agree that entrepreneurs and new businesses they run, play a key role in the development and prosperity of their societies. The aim of GEM is to investigate and assess the role of entrepreneurship in economic growth of the country. GEM defines entrepreneurship as "any attempt to create a new business or a new venture, such as self-employment, new business organization or expansion of existing enterprises, by an individual, group of individuals or an established company" (Bosma et al. 2012).

Entrepreneurial framework conditions (EFC) are one of the most important components of any entrepreneurship ecosystem and constitute “the necessary oxygen of resources, incentives, markets and supporting institutions for the creation and growth of new firms” (GEM, 2016). GEM has identified several groups of conditions, which are necessary for creation of functional business environment, innovation and entrepreneurship in any society. Each of these groups of conditions should be in the centre of attention of the public and policy makers regardless of the stage of economic development.

The World Economic Forum provides an analysis of many of the drivers that enable national economies to achieve sustained growth and long-term prosperity. It divides countries into three different stages, which are consistent with general economic development theory (WEF, 2016):

Factor-driven economies - countries compete primarily on the use of unskilled labour and natural resources and companies compete on the basis of price.

Efficiency-driven economies - growth is based on the development of more efficient production processes and increased product quality.

Innovation-driven economies - companies compete by producing and delivering new and different products and services by using the most sophisticated processes.

The basic preconditions such as macroeconomic stability, institutions, infrastructure, and education are the foundation of a healthy business environment, even in the factor-driven economies. When these conditions are present, the economy starts to move towards the efficiency, and financial resources and development efforts should be focused on the factors that encourage efficiency. These factors are related to higher education and training, efficiency of production and labour, financial market sophistication, technology improvement and increase of market.

Table 1. GEM Entrepreneurial Framework Conditions (EFCs)

Entrepreneurial Finance	**Government Policy**	**Government Entrepreneurship Programs**
The availability of financial resources—equity and debt—for small and medium enterprises (SMEs), including grants and subsidies.	The extent to which public policies support entrepreneurship (entrepreneurship as a relevant economic issue and taxes or regulations).	The presence and quality of programs directly assisting SMEs at all levels of government (national, regional, municipal).
Entrepreneurship Education	**R&D Transfer**	**Commercial and Legal Infrastructure**
The extent to which training in creating or managing SMEs is incorporated within the education and training system at all levels.	The extent to which national research and development will lead to new commercial opportunities and is available to SMEs.	The presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote SMEs.
Entry Regulation	**Physical Infrastructure**	**Cultural and Social Norms**
Market Dynamics: the level of change in markets from year to year; Market Openness: the extent to which new firms are free to enter existing markets.	Ease of access to physical resources — communication, utilities, transportation, land or space — at a price that does not discriminate against SMEs.	The extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income.

According to the GEM model, attention is then directed to the factors that stimulate and support innovation and entrepreneurial activity. Factors that are considered to have a significant impact on the entrepreneurial activity are represented by nine entrepreneurial framework conditions, described in Table 1. Interviews with national experts from the field of entrepreneurship give an insight into the ways in which these entrepreneurial framework conditions encourage or limit the development of entrepreneurial climate, activity and development. The sample of experts in the study is defined by GEM methodology for all countries participating in the study.

In order to assess conditions affecting entrepreneurial activity in the country, it is necessary to interview at least 36 experts, through a questionnaire relating to the factors affecting the entrepreneurial environment of the country. Respondents' answers are shown on the Likert scale, where lower score means that the statement is completely untrue, a higher score means that the statement is absolutely true. The sample includes entrepreneurs, investors, financiers and bankers, employees in the institutions which deliver policies related to entrepreneurship, teachers and educators.

Results and discussion

In 2016 GEM provided data on the entrepreneurship ecosystem components, and Fig. 1 summarizes these by development phase averages for 66 economies. Globally, physical infrastructure was graded as the most positive EFC (average above 6 for all development phases), while school-level entrepreneurship education was graded as the weakest condition (average value below 4). Overall, the entrepreneurship ecosystem is the strongest in the innovation-driven economies, while both the factor- and efficiency-driven groups of countries report several unfavourable conditions, with average ratings lower than 4) (GEM - Global Report, 2016).

In factor-driven economies R&D transfer, entrepreneurial finance and internal market burdens/ entry regulations are highlighted as areas constraining entrepreneurship; in efficiency-driven economies R&D transfer also features, as well as government policy, and taxes and bureaucracy. From a regional perspective, North America has the most supportive entrepreneurship ecosystem while Africa and Latin America struggle with the least favourable entrepreneurship conditions. The last two regions both report average ratings below 4.0 for finance, school-level entrepreneurship education, R&D transfer and market regulations.

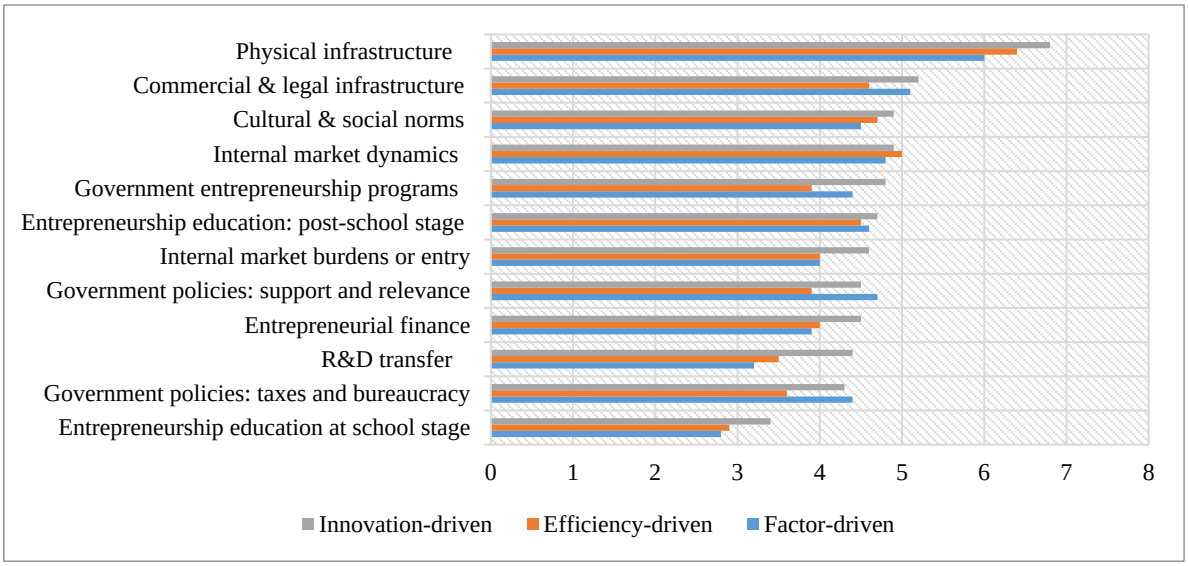

Figure 1. Average score for entrepreneurial ecosystems for 66 economies in 2016

Africa's average rating for R&D transfer is the particularly low (2.9). Among the individual economies, a few stand out for high ratings across the majority of components of entrepreneurship ecosystem. As in 2016, Switzerland again reports among the ten highest values in the sample for 11 of the 12 conditions assessed, with highest R&D transfer grade of 5.7. The Netherlands has ten highly-rated conditions (R&D 5.3), Finland and the United Arab Emirates have seven (R&D 4.6 and 4.2) and France has six with R&D of 5.3 (GEM - Global Report, 2016).

R&D transfer was rated below grade 4 in all six geographical regions, and 34 countries were rated below average grade (3.8). Senegal is a country with the worst recorded R&D condition (2.1). Similar

results regarding overall EFC were observed in the past 5 years, which is presented by Fig. 2. Factor-driven economies struggle to improve their R&D transfer score, which is varying around 2 (scale 1-5). Although innovation-driven economies maintain their score above 2.5, it is still insufficient and far away from the average of the other EFC conditions.

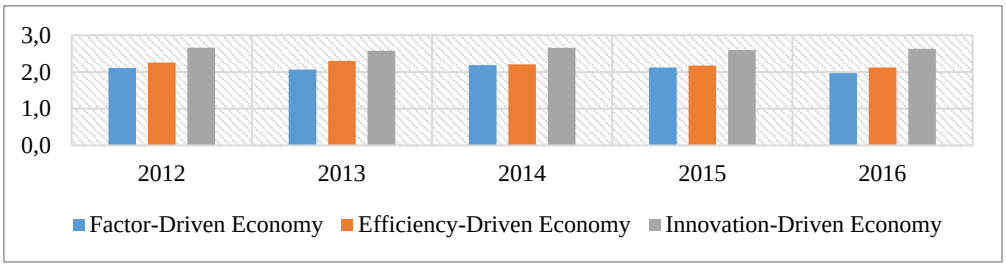

Figure 2. Average R&D transfer scores for 107 economies in period 2012 – 2016

Conclusions

Entrepreneurial climate in developing countries is determined by the quality of government policies and programs, infrastructure, availability of finance, openness of the market and its dynamics, as well as educational, cultural and social norms. Significantly lower average score of entrepreneurial framework conditions in developing countries, compared to the average score for all 66 countries participating in GEM research confirms the poor entrepreneurial framework conditions for business. Average grade of entrepreneurial conditions is the mainly constant, indicating that there is no significant intervention in improving the entrepreneurial framework in most of the countries.

Globally, research and development transfer is graded as one of the most unfavourable entrepreneurial framework conditions, which reflects the low level of innovation and competitiveness of businesses. Low R&D grade reflects low perception of value of innovation from the standpoint of the businesses and a lower level of business services that are necessary for the technology transfer. Therefore, it is necessary to develop appropriate measures and infrastructure in order to support research and development and entrepreneurial activity.

Some of these measures can include reform of the regulatory environment, awareness about government entrepreneurship programs, building support structures to assist entrepreneurs, building experiential incubators and accelerators, creation of clusters and business hubs, incentives for high-tech entrepreneurial ventures, focus on high-growth entrepreneurs, etc. Other indirect measures may include improving quality and relevance of education system, building efficient IT infrastructure, introducing funding and micro-funding models, and building national entrepreneurial culture.

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