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Current trends in government policies on development of global ecosystems

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Science parks and the new industries: business models and entrepreneurial profiles

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Current trends in government policies on development of global ecosystems

Executive summary

Triple Helix model represents an innovation center as a result of interaction between industry, academia and government. The article seeks to discuss an approach towards profiling of countries and STPs based on their impact on research and economic development, as well as presents a review on the role of state and instruments needed to facilitate the growth of a global innovation center. University-driven innovation centers in developed countries focused on research represent stand on the one pole and industrial parks focusing on hi-tech production stand on the other. Government support is a prerequisite; the measures depend on the type of innovation center and vary from changes in regulatory environment, tax and investment incentives, provision of public capital and subsidies.

Introduction

Before a brick was laid at the Skolkovo Innovation Center, we carried out extensive research to identify the best practices to implement[1]. Now, with the project in its fifth year, there is much to be gained from sharing our experiences and offering our thoughts on the current trends in creating a global ecosystem – as well as the role of government in that process.

Every global innovation center is a unique story. These centers rise up in various social and economic landscapes, business climates, states of national industry, and governments. The common thread, however, is that government support has been a critical success factor for them all, no matter which type they belong to – Western or Asian, though the actual instruments used varied from country to country.

Recent surveys[2] show that a science or technology park is not only a building, but rather a complex business and research environment connected to a global research network of innovation centers. As the world economy becomes increasingly interconnected, this global dimension is becoming a critical success factor.

The R&D process, in turn, becomes more intensive and demanding as it requires more investment, intellectual resources and sophisticated equipment in the rush to hurry solutions to market. Building a highly successful team with the full spectrum of research and commercialization capabilities on a local level is very difficult. Connectivity to a global network is the only way to build an all-star team and truly succeed.
The objectives of this paper are to:

- Provide a framework for analysis and evaluation of impact of innovation centers on economy.
- Review main stages of an innovation center development.
- Outline the key instruments of government support.

Approach and qualitative analysis

This section presents a theoretical approach and results of qualitative analysis. Our framework is based on the Triple Helix model of university-industry-government relationships, firstly introduced in the works of Etzkowitz (1993) and Etzkowitz and Leydersdorf (1995).

The qualitative analysis was performed on an illustrative set of 9 countries representing both developed and developing groups which were mapped on a matrix in two dimensions: research potential vs economic development. For the purpose of the analysis, Research potential is estimated through patent applications of residents (internal and abroad)[3] per 1 million of population. Economic development is measured through GNI per capita[4].

The distribution provides insights on the research and development potential of the countries and what is more important can be used for gap analysis and policymaking (see Fig 2).

1. “Creating and developing innovation centers: guide. Technologies and key principles”, 2012, https://sk.ru/news/m/skmedia/985/download.aspx
2. Deong-Sung, O., Gri-Don, A. (2012), “Three stages of Science Park Development: the Case of Daedeok Innopolis Foundation”, http://dl.ueb.edu.vn/bitstream/1247/4296/1/11.%20Oh%20Deong%20Sung.pdf
3. WIPO, http://www.wipo.int/ipstats/en/statistics/country_profile/
4. World Development Indicators, http://wdi.worldbank.org/tables

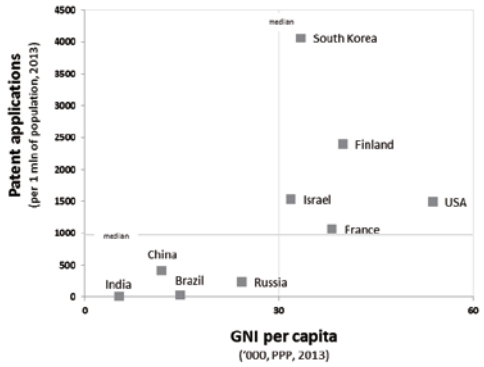

Figure 1: Distribution of countries in terms of research potential and economic development.

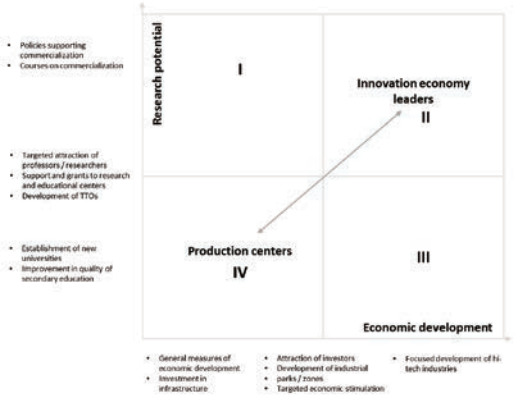

Figure 2: Gap analysis matrix and key policy measures.

Quadrant II (Innovation economy leaders) contains countries with the highest research potential and economic development. These countries have favorable conditions to set up university-driven innovation centers focused on research and being able to become knowledge hubs of the global innovation ecosystem. Elements of Triple Helix - academia and business are mature enough to play an active role in creating innovations.

Quadrant IV (Production centers) is a location for countries which have competitive benefit in terms of low wage but lacking research potential. These countries could pursue policy of developing industrial parks and further transforming them into innovation centers through adoption of technologies and growing necessary research skills (moving to QIII and furthermore to QII). Growth of innovations in such countries is majorly government driven due to low level of maturity of business and academia.

Roadmap for economic development may include the following set of measures:
· Low level: investment in infrastructure, attraction of investors, launch of industrial parks for mass-production and obtaining technologies and developing initial critical mass of educated workforce.
· Medium level: targeted economic stimulation, further development of industrial parks and zones, attraction of foreign investors, building potential for hi-tech production
· Hi level: focused development of hi-tech industries and breakthrough technologies

Roadmap for building research potential would contain the following actions:
· Low level: Improvement in the quality of secondary education and establishment of new universities
· Medium level: Targeted attraction of research staff and professors and providing support (financial and organizational) to research and educational centers. Development of TTOs to foster transformation of research into commercialization.
· Hi level: Setting up regulatory framework favorable for commercialization of research, developing educational courses on commercialization.

Finally, the matrix provides insight on the role of innovation center on development of a country considering “push” or “pull” models of development. Taking the case of Russia, the Skolkovo innovation center is a driver of the whole innovation activities in the country aiming to move it to Quadrant II. The Skolkovo innovation center facilitates both the research potential development (setting up Skoltech university and

fostering modernization of academia) and economic development (creating the sound system of support for innovations in a country scale). Example of Chinese industrial parks demonstrate more evolutionary model of gradual development from production-centric to research-focused model. It is worth mentioning that the government plays a key role in both models.

Government: role and instruments of an innovation center development

Generally speaking, the role of the state as an active participant in the innovation process is to create conditions for the emergence and commercialization of new technologies. Every stage of development requires a minimum level of government support, involvement and instruments that depend on maturity of the innovation center and the particular challenges it faces.

Certainly, a degree of generalization is inevitable when composing analyses like these. But in all of the global innovation centers that we have reviewed, and which have proved their effectiveness, every stage served to solve a strictly defined set of top-priority managerial problems, without which moving onto subsequent stages would be impossible.

On a practical level, the tasks that need completing can be defined as follows:
· To form a creative environment by providing government funding to national science, academic and educational institutions.
· To ensure the payback of new innovations by means of protectionism in key industries and limited access of foreign companies to government contracts.
· To create fiscal and other incentives to attract investment and reduce the risks of raising funds in innovative technology development.

These goals are gradually achieved during the three key stages of developing of an innovation center, which may be specified as follows:
· Concentrating resources and achieving a critical mass of economic activity in a local region.
· Formation of interconnections within, and transforming the elements of local economy into the innovation ecosystem to achieve innovation and technological breakthrough.
· Setting up connections and making the ecosystem global and integrated.

Let's review each stage in greater detail. The suggested framework is to look as the typical set of tasks the managers or founders of a new-born innovation center face and analyze what impact the government can make to facilitate its development.

At the initial stage – regardless of whether it is a brownfield or greenfield innovation center that is being established - the most pressing management problems are as follows:
· Developing a favorable business climate in the country and region, primarily for startups and small companies.
· Creating the necessary R&D and office infrastructure, where the government usually acts as a core investor and source of initial financing.
· Attracting first-class research and engineering staff into the region, as well as bringing in new research centers – both corporate and scientific.
· Attracting anchor investors (large hi-tech corporations) into the region - and especially their R&D departments.

To put it simply, an ecosystem - especially a global one - is all about the business climate and investment attractiveness of a given country. The ease of doing business and overall positioning of the country are preconditions for the eventual success of an innovation center. But the government's commitment and clear track-record of improvement may be of more importance than the initial position in the "ease of doing business rating," as innovators (global companies, venture investors, research institutions) make forward-looking decisions with a distant time horizon. That is why business climate improvement is surely a primary, national-level task for the government in the early stages of an innovation center's development. The government at the federal level (and to some extent, at the regional level) plays a key role here due to the complexity of the tasks at hand and the amount of resources to be committed.

To grow an innovation center both physically and financially, the government should be a 'super-anchor' investor as it creates a core infrastructure and bears key risks at the start of the project. As the successes of the innovation center become more and more evident, private investors could take the lead and provide additional financing for development.

In this infant stage, the role of applied research activity should not be underestimated. This is extremely important for a center to launch the process of generating innovations. Research activities conducted in university labs or R&D centers provide the initial flow of startups (spin-offs of scientific teams) which may further be converted into commercial enterprises and kick-start a long line of success stories.

Few innovation centers can boast of being built upon developed academic foundations (e.g. Research Triangle, Leuven). Some others emerged from corporate or state research centers. But those new centers which do not have a university or advanced corporate R&D centers in the vicinity need to create them.

At the innovation centers we studied, this problem was solved by the focused support of the central government, as well as lobbyism of regional and local authorities. The international aspect can play an important role for developing countries, as bringing in local companies and staff is not sufficient. And here again the country positioning, quality of life and ease of business play a key role in attracting talent capital.

Large hi-tech companies are one of the critical elements of the innovation ecosystem, the purpose of which is to create and develop research infrastructure and support the activities of startups. The key role of industrial partners of the innovation center lies in supporting business activities in the ecosystem and providing input to research and investment priorities. Industrial partners integrate the research and business environment of the center with the global market for innovations; they support the market for startups (both supply and demand side); and provide mentoring and business support.

Prompting industrial companies to invest is a challenging task which usually requires two conditions: long-term commitment from the government, and set of benefits and incentives relating to investment, the regulatory environment or taxation. There is growing competition for resources between countries and innovation centers, so a targeted PR campaign supported by a tailored approach to attract key companies on a national level is usually a requirement. This is a difficult but rewarding activity as the transformation of a country's business environment may begin in a single global innovation center, as its best practices will start being implemented on a wide scale in the economy.

At the second stage the innovation centers begin forming steady clusters of science-intensive companies. The best examples show governmental support of innovation entrepreneurship, and creating the infrastructure, played a critical role in setting up the ecosystems. Measures of support also include large-scale PR campaigns to form a brand out of the innovation center.

The most important managerial issues at this stage are as follows:

· Creating a system of financial support for innovation startups at the pre-investment stage (support through grants and loans).

· Forming a pool of investors loyal to the innovation center, enticing private investors into creating support infrastructure for innovation businesses.

· Building an effective system of services for early-stage technological companies, primarily business training services (business incubation).

· Organizing advertising and PR campaigns to position an innovation brand in the national and international arena, and to strengthen the brand wherever possible.

The need for financial support of innovation projects by means of state programs in the form of grants, shared financing and conditionally reimbursable loans is now recognized in practically all countries with an active innovation development policy. In the majority of countries where the innovation centers studied operate, the problem of financing innovation projects at the pre-investment stage of development has been successfully resolved due to nationwide state programs of financial support for high-tech startups. Nevertheless, in several cases, the volume and type of financing are insufficient and wrong, which creates a great problem for the management of the innovation centers. Regional and municipal authorities do not typically have either the experience or budget to support startups on a large scale, something which is beyond the budget the innovation center's managing company. In these conditions, regions and some innovation centers have to create their own instruments for financing, which could compensate the deficit of financing from nationwide programs. In particular, such instruments include public-private funds which offer interest-free or conditionally reimbursable loans to investment projects. Other than enhancing their reputation, private investors who invest in such funds may also be motivated by regional and municipal tax benefits.

As we have established, state support in the form of grants or loans plays a crucial role at the beginning of an innovation center's life, but if private capital fails take the reins in the following years, the center tends to be unsuccessful. The establishment of communications and efficient intermediation between resident companies on the one side and venture investors and business angels on the other is a mandatory condition for the success of every innovation center, and one of its most important functions. This intermediary may be fully successful under two conditions: the presence of solid demand for venture investments (sufficient high-quality projects that have been properly thought through and for investors) and sufficient supply.

The most important instrument for resolving the demand problem is forming a stable pool of loyal investors around the innovation center. Networks of venture investors and business angels, with the support of state development institutions, play the leading role. The state can facilitate the process of forming a venture community through direct and indirect support and the participation of development institutions. Its presence is absolutely necessary to cover the market gaps and provide financing to some long-term projects in science and aerospace, as well as industrial areas.

Another problem which a newly created innovation center has to resolve along with finding financing can be simply formulated as the lack of successful startups with proper business background and experience. The reasons why the number of startups may be low, or why their growth may be hindered, can be described as follows:

· The people who could potentially hi-tech businesses do not have basic business knowledge or are afraid of establishing a startup.

· Young companies cannot find necessary contacts and commercialization support. The people who create startups are unable to find others who possess the knowledge, skills and contacts necessary for their business.

A general approach to this problem involves creating a system of business education and the transfer of business skills to the innovators. Providing for an efficient business environment in the center, as well as establishing horizontal links between startups, investors, industrial partners and researchers, can expedite the process. The main principles of organizing business education in innovation centers were developed in the first European centers in the 1970s and 80s in Britain and Scandinavia, and then, with varying degrees of success, through most of developed and large developing countries.

Regional and municipal authorities can do a lot through the educational programs and promotion of communication between local communities of entrepreneurs to improve the overall level of business education and awareness.

The ability to establish a comprehensive dialogue with society, in the broadest sense, and its single elements (business and academic environment) is a critical factor if innovation centers and science parks are to grow steadily. The issues of identity, positioning and choice of an efficient strategy for developing individual brands have recently become especially relevant in light of the increasing proliferation of innovation centers around the world, the escalation of competition between them and the growing vagueness of the basic “science park” brand. Here is another challenge of appropriate positioning, PR support and promotion of the innovation center. The government at all levels, right down to municipalities, can support and promote the idea of an innovation center, obtaining buy-ins from various stakeholders.

Firstly, the development of a science park’s brand should ensure the attraction and support of key groups of interests: the state, universities and resident companies themselves. The process of strategy formulation should be based on identification of their demands and include the elaboration of answers to the question of how innovation center may add to their satisfaction. Secondly, the brand should emphasize the positioning of the innovation center across the globe and across the nation. Under intense competition for development resources (promising innovations, venture financing and qualified personnel), the innovation center needs to formulate a unique offer just for those potential residents and counteragents, which may be maximally useful for achievement of its strategic targets. Thirdly, the brand development strategy should be dynamic, and consider changes in the level of development of the innovation center itself and its residents, as well as flexibly respond to the changes in the external socioeconomic environment. It is important to note that a strong brand is not only an obligatory condition for the successful development of the center itself, but also an instrument for supporting the transfer of its experience to the country’s economy.

The main features of the third stage in the innovation centers are the rapid growth in turnover of large anchor companies and their transformation into global players, the emergence of new large companies, and a considerable growth in the number of technological startups. On the one hand, a considerable share of startups appearing at this stage at effective innovation centers were projects that have separated from large companies working in the region.

The most important management goals at this stage are as follows:
· Augmenting business support infrastructure meant at the right time, scaling and reproducing the system of services created at the previous stage.
· Creating mechanisms for sharing risks of private venture investors, in particular private and state venture funds.
· Giving a global dimension to the innovation center and ensuring it is plugged into international networks of innovation centers, science parks, research institutions, investors, etc.

As previously stated, the government plays a crucial role in creating a core infrastructure, and bears key

risks at the start. Extending the infrastructure is usually the job of investors, because by this point in time the business model has been verified, allowing for a long term investments.

The term 'infrastructure' refers not simply to a building and its associated facilities, but rather to a complex business and service environment designed to enable the growth of resident companies. It is formed taking into account specific local conditions, research priorities and market demand. There are three general groups of residents of an innovation center: technology startups of various size and maturity, large industrial companies both local and international, and university research centers.

The experience of successful innovation centers shows that irrespective of the 'resident mix,' the infrastructure and the service offered should be oriented primarily at the startups. Business and technology services are usually of limited value for industrial companies, as they generally rely on their own infrastructure and facilities. If innovation centers are viewed as development institutes and hot spots that transform and modernize economies, focusing on startups and small innovation enterprises creates the maximum number of jobs in knowledge-intensive areas.

Innovation centers should offer the infrastructure and a unique service offering that startups are unable to find elsewhere. For instance, these may be small laboratories (up to 60 sq.m.) that are fully equipped and meet all safety requirements. The adaptability of office and laboratory premises is an important factor of attraction of start-ups, ensuring the ability to achieve the required occupancy level. The experience of Finnish technology parks shows that office and laboratory facilities achieve a break-even point when their area exceeds 20,000 sq. m. at occupancy over 90 percent[5]. The services centers for shared use of scientific and research equipment are considered an important element of many innovation centers and science parks (e.g. the Research Triangle).

In terms of financing, at the mature stage of development a stable community of venture investors and business arises to support the startups. With the technological startup boom, a venture investment market began to form in European innovation centers. Business angels became a massive phenomenon in comparison with Asian countries. Nevertheless, both in Europe and Asia, government still plays a crucial role in supporting institutional investors through financing or guaranties.

Plugging the innovation center into the global ecosystem is the final task an innovation center needs to fulfill in our checklist. In the past, global flows were dominated by transfer of goods from low-cost manufacturing countries and commodity intensive flows from resource-rich economies. But nowadays, as the R&D process becomes more and more knowledge intensive, flows of knowledge obtain greater and greater importance.

Connectivity to the global ecosystem at all levels is a very important factor determining the success - and pace of growth - of an innovation center. Every local innovation center soon faces the lack of projects, as it wipes intellectual resources from a local area (e.g. university). At the initial stage of development, maintaining the growth of an ecosystem is a matter of keeping a constant flow of new startups from outside of an ecosystem. Depending on the size of an innovation center it is necessary to build an extensive network, attracting innovators on a regional or even a national level to provide it with a critical mass of successful companies.

5. "Creating and developing innovation centers: guide. Technologies and key principles", 2012, https://sk.ru/news/m/skmedia/985/download.aspx

Digitization and the increase in connectivity allows for the 'virtualization' of resources for R&D and innovations: both 'hard' resources (infrastructure, office and lab facilities through creation of remote workplaces and placing orders online) and 'soft' resources like knowledge, talent and entrepreneurial skills[6]

The broadening and deepening of knowledge and interconnections create myriad opportunities for policymakers and governments to drive the growth of local innovation centers at a pace which could not be achieved before.

Finally, a few words on management bodies and KPIs relating to innovation centers. Efficient innovation centers have various legal business structures and diverse management structures.

Recent research on delivery units[7] as well as our studies based on a detailed review of innovation centers show that the most successful share several important characteristics: an independent team, headed by a strong leader with a proven track record and business capabilities, direct access to top leadership of the country, and talented staff with excellent problem-solving and communication skills, preferably from various backgrounds – civil service, academic and business.

Despite the differences in legal and management structures, the governing bodies of innovation centers generally have significant autonomy in taking decisions with regard to its owners and founders. Firstly, this refers to owners represented by state and (or) local authorities if they directly or indirectly participated in the founding of the innovation center. It is important to stress that the government needs to actively participate in the development of an innovation center, but the management team should work independently.

The need for the management team's independence is based on several factors:
· An innovation center has a long-term project planning horizon – at least 15-20 years, while business owners and local authorities mostly have shorter timeframes and need clear and quick success stories.
· The managers of the innovation center should have experience of working in an organization that earns rather than distributes money. If the state, directly or via its representatives, starts bearing down too strongly on the management, there is high risk that an innovation center with a clear business model and strategy will be reduced to a vehicle for distributing state subsidies, grants and other benefits.
· Profit-making cannot be the sole task of the innovation center management company. This factor requires that the management should have autonomy not only from governmental authorities, but also from private investors and shareholders.

The autonomy of management is expressed not only in its independence in supervising the operation of innovation centers and investment solutions, but also by its personnel. Management bodies of successful innovation centers are formed, as a rule, from independent directors who are mostly professional managers with a proven track-record. This allows them to work in a multi-stakeholder environment and satisfy the competing interests of stakeholders from government, business, universities and research institutes, without forgetting about the startups themselves and venture investors.

Another fundamentally important feature that distinguishes the management system of successful innovation centers is the absence of a single decision-making center, which would coordinate the activity of the agents of an ecosystem using a strict top-down approach. The functions of management companies are, as a rule,

6. Global flows in a digital age: how trade, finance, people, and data connect the world economy (2014), McKinsey Global Institute
7. Creating growth clusters (2014), McKinsey Center for Government

limited to administering the property of the innovation center, as well as rendering services for business operation and development to resident companies. In “mature” innovation centers, services and support of innovation centers are rendered by various state, university, private and social institutions, the functions of which may intersect, and the actions of which are not always coordinated. However, as the experience of successful innovation centers proves, the only way to efficiently eliminate these contradictions is to organize regular meetings of the management company with independent support institutions working in the innovation center, and to strive for compromise, rather than to create a single coordination center, or a “super administrator.”

The launch and development of a startup innovation center requires a systematic and data-driven analysis to clearly define the challenges and find clear solutions. KPIs provide a data-driven basis for decision-making, the management reports not only aid in obtaining buy out of stakeholders by showing a clear progress but also help the managing company to monitor and update its agenda and priorities, as well as identify obstacles which may hinder growth. KPIs could include two groups of indicators: one for the ecosystem and the other for the development process. The ecosystem indicators trace the success of the ecosystem itself and provide insight on its inputs and outputs – e.g. workplaces created, total revenue, private investment attracted and impact on GDP. The development process indicators generally refer to the performance of the management company and may include: fulfillment of the budget and project development roadmap, and the results of satisfaction surveys.

Summarizing the findings from our research, we may conclude that the key factor of success is to develop an innovation center from the ecosystem perspective, to treat it as a long-term project and pay special attention to global cooperation. Government support should be focused on more aspects like creating better conditions for doing business and improving the overall business environment. The ecosystem is an excellent field to test and scale the best practices for higher growth, the overall impact on the economic development of the country through implementing best practices can extend far beyond the size of ecosystem’s GDP.

It is worth noting that it is impossible for an ecosystem to succeed without close partnerships with leading international education centers, science and technology parks, innovation centers, etc. That is why cooperation and close collaboration with IASP partners are more important than ever.

In contrast to the world’s leading innovation centers, the Skolkovo Innovation Center is in its infancy. But we have taken on board lessons learned elsewhere. We will apply the experienced we have gleaned from all around the ecosystem as we mature and grow, and we will strive to become a truly global player.