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The Triple Helix in transition economies and Skolkovo: a Russian innovation ecosystem case

Abstract

Public administrations undertake initiatives to foster knowledge ecosystems in scientific and technology hotspots. It is assumed that innovation ecosystems will create value networks through which participants can develop and commercialize their value propositions. Value networks refer to innovation ecosystems where the final product or service is offered by a constellation of businesses that complement each other. The innovation ecosystems literature suggests that innovation ecosystems lead to competitive advantages for each of the partners in the ecosystem, creating value for all its actors. Based on a longitudinal case study of the Skolkovo Innovation Center with more than 3000 innovative startups in the Moscow district in Russia, this study explores how value is created in innovation ecosystems in transition economies and the roles of the contributing stakeholders. Through a longitudinal case study and using the Triple Helix framework, this study finds that in transition economies, the state tends to undertake the leading role in establishing the pillars of innovation ecosystems, followed by solid support from state-related industry partners, being the role of universities underrepresented in the initial stages of the ecosystem development. These findings refine the applicability of the triple helix model in transition economies by adjusting the weighting of the different parts of the model when establishing an innovation ecosystem.

Keywords: Ecosystems, value networks, innovation systems, innovation ecosystems, Russia, innovative startups, public sector funding schemes, Skolkovo

La Triple Hèlix en economies de transició i el cas de Skolkovo: un exemple d'ecosistema d'innovació rus

Resum

Les administracions públiques emprenen iniciatives per fomentar els ecosistemes del coneixement en zones sensibles científiques i tecnològiques. S'assumeix que els ecosistemes d'innovació crearan xarxes de valor a través de les quals els participants poden desenvolupar i comercialitzar les seves propostions de valor. Les xarxes de valor es refereixen als ecosistemes d'innovació on el producte o servei final és ofert per una constel·lació d'empreses que es complementen entre sí. La literatura de els ecosistemes d'innovació suggereix que els ecosistemes d'innovació condueixen a avantatges competitius per a cadascun dels socis de l'ecosistema, creant valor per a tots els seus actors. Basant-se en un estudi de cas longitudinal del Centre d'Innovació Skolkovo amb més de 3.000 iniciatives innovadores al districte de Moscou a Rússia, aquest estudi explora com es crea valor en els ecosistemes d'innovació en les economies de transició i les funcions de les parts interessades que contribueixen. A través d'un estudi de casos longitudinals i utilitzant el marc Triple Hèlix, aquest estudi conclou que en economies de transició, l'estat tendeix a assumir el paper principal en l'establiment dels pilars dels ecosistemes d'innovació, seguit d'un sòlid suport dels socis de la indústria relacionada amb l'estat, sent les universitats infrarepresentades en les fases inicials del desenvolupament de l'ecosistema. Aquests descobriments perfeccionen l'aplicabilitat del model de triple hèlix en les economies de transició ajustant la ponderació de les diferents parts del model en establir un ecosistema d'innovació.

Paraules clau: Ecosistemes, xarxes de valor, sistemes d'innovació, ecosistemes d'innovació, Rússia, noves iniciatives innovadores, plans de finançament del sector públic, Skolkovo.

La Triple Hélice en economías en transición a través del caso de Skolkovo: un ejemplo de ecosistema de innovación ruso

Resumen

Las administraciones públicas toman iniciativas para fomentar los ecosistemas del conocimiento en zonas sensibles científicas y tecnológicas. Se asume que los sistemas de innovación crearán redes de valor a través de las cuales los participantes puede desarrollar y comercializar sus propuestas de valor. Las redes de valor se refieren a los ecosistemas de innovación en los que el producto o servicio final es ofertado por una constelación de empresas que se complementan entre sí. La literatura de los ecosistemas de innovación sugiere que los ecosistemas de innovación conducen a ventajas competitivas para cada uno de los socios integrantes en el ecosistema, creando así valor para todos sus actores. Basándose en un estudio de caso longitudinal del Centro de Innovación Skolkovo, con más de 3.000 iniciativas innovadoras en el distrito de Moscú en Rusia, este estudio explora cómo se crea valor en los ecosistemas de innovación en las economías de transición, y las funciones de las partes implicadas que contribuyen a los mismos. A través de un estudio de caso longitudinal, y utilizando el marco Triple Hélice, este estudio concluye que en economías de transición el Estado tiende a asumir el papel principal en el establecimiento de los pilares de los ecosistemas de innovación, junto con un sólido apoyo de los socios de la industria relacionada con el Estado, estando las Universidades infrarepresentadas en las fases iniciales del desarrollo del ecosistema. Estas contribuciones del estudio perfeccionan la aplicabilidad del modelo de Triple Hélice en las economías de transición, ajustando la ponderación de las diferentes partes del modelo para establecer un ecosistema de innovación.

Palabras clave: Ecosistemas; redes de valor; sistemas de innovación; ecosistemas de innovación; Rusia; nuevas iniciativas innovadoras; planes de financiación del sector público; Skolkovo.

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Introduction

Entrepreneurs contribute to the development of our society by creating societal wealth and helping others access that wealth. Moreover, the development of successful entrepreneurial hubs in transition economies such as the BRIC countries (Brazil, Russia, India, and China) increasingly contribute to the global wealth, significantly contributing these regions to the global economy and its GDP (Wilson and Purushothaman 2003). Innovation ecosystems or regional innovation systems (RIS) refer to the networks that link together the knowledge-producing institutions of a given location (e.g. universities and public research centers), and the innovative firms operating in the same area. These links ensure knowledge exchange between the different organizations, increasing the region's overall innovation and competitive capacity (Cooke, Uranga, and Etxebarria 1997). Although some common factors on how innovation ecosystems create value have been analyzed (Autio et al. 2014; Bittencourt, Santos and Mignoni 2021; Calza et al. 2021; Jones, Leiponen and Vasudeva 2021), limited attention has been devoted to innovation ecosystems in a transition economy setting.

To address this issue, this article analyzes the Skolkovo Innovation Center ecosystem with more than 3000 innovative startups in the Moscow district in Russia to explore how value is created in such geographical settings. This study is grounded in the innovation ecosystem literature, focusing primarily on the interaction between state, academy, and industry from a Triple Helix framework perspective (Etzkowitz and Leydesdorff 2000).

While technology transfer mechanisms may introduce unnecessary transaction costs by clustering knowledge in patents that instead could freely be transferred to industry (Rosenberg and Nelson 1994), exploring how special grants have been channeled to innovation, and firms formed on campus or within the innovation ecosystem portray a setting where knowledge can



still be successfully transferred to society. Nevertheless, this process requires local adaptation of existing models and strong coordination between all its stakeholders.

The objective of this article is to offer an overview, building on the innovation ecosystems literature, of the development process of innovation ecosystems in transition economies and the role played by the state, industry partners, and startups within such process. First, this article reviews the Triple Helix model (Etzkowitz and Leydesdorff 2000). Next, the manuscript reviews the concept of transition economies and links it with innovation ecosystems. After that, in the empirical part of this manuscript, this study presents the evolution of the Skolkovo ecosystem. Finally, the theoretical work of this paper concludes with the refinement of the Triple Helix Model in the context of innovation ecosystems in transition economies. The last section of this paper is dedicated to implications for practitioners with particular emphasis on policymakers.

The Triple Helix Model

The Triple Helix model (Etzkowitz and Leydesdorff 2000) describes the development of knowledge-based economies, highlighting the synergies between the implicated agents and beyond government sponsorship of innovation initiatives. The three types of agents involved in this model are the universities, the industry, and the state or public administration.

The role of the universities is to aggregate scientific and technological knowledge, develop local talent, and provide support to other stakeholders through their research centers. The industry's role is to provide the scientific and technological community with challenges that could not be solved within the industry, inspiring entrepreneurs to transform knowledge and technology from the labs into solutions that could create economic value for society. Finally,



the role of the state and the public administration is to facilitate this technological, scientific, and business exchange by implementing favorable policies that could support such activities.

The Triple Helix model appeared to reflect the complex dynamics of bi-lateral and tri-lateral relations between its agents in modern economies (Leydesdorff and Meyer 2006). The studies conducted in developed countries indicate that these institutions normally would operate on their own, without much interaction, but in the context of innovation ecosystems they have increasingly been working in close partnerships interacting and establishing links at various stages of the innovation process (Etzkowitz and Leydesdorff 1995). Through these links knowledge is created, used, and diffused, fostering further levels of innovation. The Triple Helix model relies on a recursive system of interaction underlying a knowledge-base economy (David and Foray 2002) reflecting 1) wealth generation by industry; 2) novelty creation in academia; 3) normative control by government (Leydesdorff and Meyer 2006). One of the core ideas of the Triple Helix model is that the university represents the source of new technology and scientific discoveries; the industry represents the connection between new inventions and the customers as they produce goods and services, and the state represents the regulator that provides a reliable and stable framework for interaction and knowledge exchange between the different parties. The goal of these increased interactions among the different actors is the development of new innovative strategies and practices that would translate into the adoption of initiatives that would foster innovation: scientific parks, incubators, accelerators, business angels' networks, and venture capital, among others. Consequently, the Triple Helix model of university-industry-state relations (Etzkowitz 1983; 1998; 2003a; 2003b; 2004; 2008; Ranga and Etzkowitz 2013; Leydesdorff and Etzkowitz 1998 and 1996; Etzkowitz et al. 2000; Piqué, Miralles and Berbegal-Mirabent 2019; Piqué et al. 2021) provides a solid approach for implementing interactive modes of innovation beyond a linear knowledge flow set up.



A number of previous studies used the Triple Helix model to analyze regional innovation system (Leydesdorff and Meyer 2006; Lengyel and Leydesdorff 2011), and nation wide innovation systems (Leydesdorff and Sun 2009; Leydesdorff 2018). The Triple Helix model has also been used to assess bi-lateral relationships between university and industrial partners (Viale and Campodall' Orto 2002; Shinn and Lamy 2006). However, there's little empirical evidence on how the Triple Helix model unfolds in transition economies. Therefore, this manuscript can provide more precise guidance on how to implement this model to achieve the desired innovation results in such settings.

Transition economies

The European Bank for Reconstruction and Development (EBRD 1998) uses the term “transition economies” when referring to those economies that were historically planned and ruled by power relations and bureaucratic controls. In such a setting, the state limited the opportunistic behavior of potential entrepreneurs and allocated the available resources providing little need for formal laws to regulate the exchange relationships between economic actors. Consequently, property rights were protected and held by the state while individuals could use assets but do not own them. The state-owned enterprises (SOEs) were closely linked to the state and public administrations, which granted them direct financial support and preferential treatment. Such planned economies were also characterized by paternalistic, soft budget constraints, and the state actively involved the SOEs in its central planning strategy (Kornai 1986 and 2000; Kornai, Maskin and Roland 2003a and 2003b). After the collapse of Communism in 1989, a set of rapid-growth economies in Central and Eastern Europe (the transition economies) steered towards liberalization, stabilization, and encouragement of privately owned enterprises to sustain the free market mechanisms. Such a move towards

market mechanism generated a set of impediments and challenges that appeared during the transformation process (e.g. lack of strong legal frameworks, limited foreign direct investment) (Estrin and Wright 1999; Devlin, Grafton and Rowlands 1998). Consequently, the setting in which the adoption of the Triple Helix model and the creation of innovation ecosystems takes place requires a more detailed examination to study how value is created in such conditions.

Methodology

For the purpose of this research, the case study method (Yin 1981 and 2014) has been used to analyze the case of Skolkovo Innovation Ecosystem, using this district as the main context of the study. The case study method is suitable when analyzing a case or set of cases that are relevant within the specific context of the study and as is widely used in social science research (Yin 1981). To address the research question of this study, the research setting was required to fulfill several criteria. These criteria allowed to assess whether a given innovation ecosystems was in a country that could be classified to have a “transition economy” or not (EBRD 1998). That is, an economy that was historically planned and ruled by power relations and bureaucratic controls. The countries that could qualify for the study had to be formerly characterized by paternalistic, soft budget constraints; where the state was actively involved in the economy through state-owned enterprises; where a state had a strong central planning strategy (Kornai 1986 and 2000; Kornai, Maskin, and Roland 2003a and 2003b). Consequently, out of the rapid-growth economies in Easter Europe, Russia was selected as the appropriate country for the research setting, and the Skolkovo Innovation Ecosystem was selected as one of the best and most well-documented innovation ecosystem cases (Nikina and Piqué 2016).

This article is empirically grounded on more than 1,100 data points of publicly available information and archival data that were published between 2012 and 2019 and included press



releases, annual reports, quotes, and presentations.¹ Analyzing the content of these data points, the objective was to explore and track the dynamics of three key dimensions identified in the Triple Helix model: government intervention, industry intervention, and university intervention in the development of the innovation ecosystem. Therefore, out of the empirical data illustrating the history of the first seven years of existence of the Skolkovo Innovation Ecosystem, this study looked to outline the most relevant interventions of the three key stakeholders of the Triple Helix model and identified at which evolutionary stage of the ecosystem each of them intervened. Moreover, the composition of the Board of Trustees of the Skolkovo Foundation at its inception and its composition in 2019 is provided to illustrate the weight of the three main stakeholders in the main supervisory and control body of the innovation ecosystem. The key highlights and milestones of the empirical findings are presented in the following section, outlining the most significant interventions of the leading stakeholder during the period covered by this study.

Skolkovo Innovation Ecosystem

In 2009 in his annual speech to the Federal Assembly of the Russian Federation, Russian President Dmitry Medvedev referred to creating a modern and powerful research and development hub in Russia similar to other world's leading hubs such as the Silicon Valley in the USA. According to the President, the goal was to create an attractive environment for leading engineers, scientists, managers, and scholars to contribute to the economic and social development of the Russian Federation and the world. Consequently, in 2009 the President issued an order "On the working group for the development of the project for creating a territorially isolated complex for promoting R&D and commercialization of their results."

¹ Sk Media Center.



Hence, the history of Skolkovo can be traced back to late 2009 and 2010, when a long path started since the Skolkovo Foundation initiated to build from scratch an innovation center with global impact. The primary mission of the Skolkovo district was the creation of an ecosystem that would support the development of entrepreneurship and research.

We cannot delay this any longer. We must embark on modernization and technological reequipping of the industrial sector as a whole. I believe, for our country, it is a matter of survival in the modern world. (Dmitry Medvedev, Russian President, 2009)

In May of 2010, the constitutional assembly of the Nonprofit Organization “The Foundation for Development of the Center for Development and Commercialization of New Technologies” established as managerial bodies the Board of Trustees (the supervisory control body), the Foundation Council (the supreme control body), and the role of the President of the Foundation (the executive body). The Board of Trustees of the Skolkovo Foundation was led directly by the President of the Russian Federation, Dmitry Medvedev. It also included the following members: Ivan Bortnik (Chairman of the Supervisory Board of the Fund for Assistance to Small Innovative Enterprises), Igor Agamirzyan (CEO of Russian Venture Company), Yury Osipov (President of the Russian Academy of Sciences), Vladimir Dmitriev (Head of the State Corporation Bank for Development and Foreign Economic Affairs, Vneshekonombank), Arkady Dvorkovich, (Member of the Skolkovo Foundation Board of Trustees), Andrey Fursenko (Minister of Education and Science of the Russian Federation), Elvira Nabiullina (Minister of Economic Development of the Russian Federation), Vyacheslav Volodin (First Deputy Chief of Staff of the Presidential Executive Office), Sergey Sobyenin (Mayor of Moscow), Vladislav Surkov (Deputy Chairman of Government of the Russian Federation). The Foundation Council was headed by two co-chairmen: Craig Barrett, ex CEO of the Intel Corporation, and Viktor Vekselberg, President of the Skolkovo Foundation and head of the supervisory board of the Renova Group. It also included the following members: Ratan Tata



(Chairman of Tata Sons), John Chambers (Chairman, CEO of Cisco Systems Inc), Esko Aho (Executive Vice President of Nokia Corporation), Vladimir Rashevsky (General Director, Chairman of the Management Board of OAOSUEK), Mikhail Kovalchuk (Director of Russia's Science Center Kurchatov Institute), Martin Bouygues (Co-owner of the Bouygues industrial group), Vagit Alekperov (President of LUKOIL), Alexander Galitsky (Managing Partner of Almaz Capital Partners), Peter Löscher (President and Chairman of the board of Siemens AG), Eric Schmidt (Executive Chairman and CEO of Google Inc.), Anatoly Chubais (CEO of RUSNANO), Anatoly Aleksandrov (Rector of Bauman MSTU).

In June of 2010, Russian President Dmitry Medvedev appointed Viktor Vekselberg as President of the Executive Board of the Skolkovo Foundation. On the 28th of September of 2010, Federal Law No. 244 came into force, initiating the project for the creation of the Skolkovo Innovation Center.

After establishing the managerial bodies, the implementation of Skolkovo's mission required establishing all the necessary procedures for awarding the status of a Skolkovo Project participant to all those technology companies who would qualify to obtain such status. Consequently, in 2011, the Skolkovo Foundation developed and introduced its grant procedure, which allowed 70 companies working in Skolkovo to receive grants to accelerate and implement their innovative projects. As a result, by the end of 2011, the number of innovative companies that received the status of Project participants and could potentially be eligible for obtaining grant support exceeded 330, setting the goal for grant financing in 2012 to 6 billion rubles.²

² Average exchange rate 2012: \$1 ~ 31 Rub.



In parallel to the grant system, in 2011 were also set the leading institutes of the innovation ecosystem including the Skolkovo Institute of Science and Technology (Skoltech); the establishment of the Technopark Skolkovo; The Intellectual Property Center; and the Customs and Finance Company to provide a customs representative's services to the Skolkovo Project participants. To establish the Skolkovo Institute of Science and Technology, the Skolkovo Foundation and the Massachusetts Institute of Technology (MIT) signed a three-year agreement with the goal launch a pilot education program in the fall of 2013 and a full-scale educational and research program in 2014. The agreement was signed by the Skolkovo Foundation's President Viktor Vekselberg and President of the Massachusetts Institute of Technology, Susan Hockfield.

Expansion of cooperation between the Skolkovo Foundation and the MIT will be profitable not to Russia alone. We are convinced that the world's educational, research and innovation community will gain from it, too. (Victor Vekselberg, Skolkovo Foundation's President, 2011)

In terms of funding, in 2011, the Skolkovo Foundation received more than 3.4 billion rubles³ of private funding, dedicating about 2 billion rubles into the development of participants' projects and the rest to the foundation of Skoltech. At the end of the same year, world-leading corporations such as IBM, Microsoft, Nokia, Ericsson, Siemens, EADS, and Cisco (among others) also joined Skolkovo's ecosystem. Furthermore, 13 partnership agreements were signed with Russian and Western companies, who agreed to establish their R&D centers on Skolkovo's territory. In 2011 Skolkovo's ecosystem also attracted 24 venture funds who committed 10 billion rubles and received their accreditation with Skolkovo. All this financial support

³ Average exchange rate 2011 \$1 ~ 29 Rub.



confirmed by the end of 2011 the viability and efficiency of the innovation ecosystem, while Skolkovo's startups gained international presence.

Creating Skolkovo is an important step towards modernization of Russian economy and enhancement of technological innovations. We are proud to be part of this project. (Steve Ballmer, CEO of Microsoft, 2011)

In the period between 2010 and 2014, the goal of the ecosystem was to attract as many innovative projects as possible, increasing the awareness of the Skolkovo Project among the entrepreneurial, tech, and scientific communities. A series of events were organized by the Skolkovo Foundation to attract projects with great potential across all of Russia.

In February 2012, the Skolkovo Foundation visited the United Kingdom to present to the British and international academic and investment communities the capabilities of the Russian innovation center, following up on previously reached Russian-British agreements in September 2011. In addition, in March, the Skolkovo Foundation organized the First International Forum of Russian Specialists in the Field of Science and Technology in Cambridge, United Kingdom, and during the same month, Foundation's President Viktor Vekselberg led a delegation from the Skolkovo Foundation to visit the Silicon Valley supporting United States' interest in cooperating in innovation with Russia. During this visit, a Memorandum on Russian-American cooperation in the field of innovation was signed, followed by an agreement between Skolkovo Foundation and Cisco on the strategies for research and development and an agreement between Skolkovo Foundation and venture capital firm Bessemer Venture Partners on cooperation.



By 2013, the number of startups exceeded 1,000. In 2014 the Skolkovo Foundation awarded more than 1,4 billion rubles⁴ in grants to the most innovative projects. By 2015 the community of Skolkovo startups surpassed the 1400 participants from 65 Russian regions, and the revenue from scientific research of Skolkovo's resident companies increased beyond 43 billion rubles⁵ beating more than eight times the target estimate. By 2015 more than thirteen thousand new jobs were created, 149 participants declared successful sales in 40 countries, and 645 intellectual property applications were filed despite a decrease of private investments in the ecosystem that remained around 4 billion rubles.

During the time of economic downturn, sectoral ministries and agencies increased their search efforts for promising technologies within the Skolkovo ecosystem to incorporate them across national industries, increasing the number of public and private organizations within Russia who either implemented or piloted technological solutions developed within the Skolkovo ecosystem. Among other highlights, a new R&D program was launched in the domain of agriculture seeking to support innovative projects in such areas as microbiology, forestry, horticulture, and animal husbandry. The Skolkovo Foundation also put an increased emphasis on extending its presence in the Asia-Pacific Region, establishing cooperation channels with China and Japan. The Foundation also opened a branch at the campus of the Far Eastern Federal University to bring closer the activity of the Foundation to the ecosystems and countries in the Asia-Pacific Region and organized the 33rd IASP World Conference.

By 2016 Skolkovo became the largest technopark in Eastern Europe after six years of existence, including its laboratories, offices, and common use centers. About 40% of 1,600 received

⁴ Average exchange rate 2014 \$1 ~ 39 Rub.

⁵ Average exchange rate 2015 \$1 ~ 61 Rub.



revenues from their business activities, proving their developments to be commercially successful. Skolkovo also hosted a jazz festival, concerts, and sporting events and accelerated the construction of the Skolkovo Institute of Science and Technology's new campus.

By 2017, Skolkovo exceeded its planned key performance indicators in all areas of its activity, reaching 1,800 startups projects that generated total revenue of 48.3 billion rubles⁶ attracted 7.9 billion rubles of investments, and created more than 30,000 jobs accumulatively. New laboratories and shared knowledge facilities were inaugurated, including the SkBioLab (first Russian medical hackspace and accelerator), where participants could engage in research in the field of biotechnology.

Under the leadership of Viktor Feliksovich Vekselberg, the Skolkovo team has made several quantum leaps. Many Skolkovo startups are already making money, which is the main goal of any business. Many years of day-to-day work of this team allows you to evaluate what is done here. From the very beginning, we understood the risks associated with the transition from the research and development stage to products demanded by the market and consumers. Our goal is to minimize these risks and make the path from the idea to its implementation as short and comfortable as possible. (Arkady Dvorkovich, co-Chairman of the Skolkovo Foundation Council, Chairman of the Board of Trustees of Skoltech 2017)

By 2019, Skolkovo Foundation startups surpassed 100 billion rubles,⁷ attracting 13 billion rubles of investments. Furthermore, since 2019, legislation amendments have allowed any organization conducting research activities in Russia to access the Skolkovo Innovation Center's benefits and services. The Skolkovo Institute of Science and Technology (Skoltech) also entered the Nature Index "Top-100 Young Universities" list. Three new R&D centers belonging to Tatneft, TMK, and Sibur were opened at the Innovation Center.

⁶ Average exchange rate 2017 \$1 ~ 58 Rub.

⁷ Average exchange rate 2019 \$1 ~ 65 Rub.

In 2019, the Skolkovo Foundation board of trustees was formed by: Dmitry Medvedev (Deputy Chairman of the Security Council of the Russian Federation, Chairman of Advisory Board of Skolkovo Foundation); Maxim Akimov (CEO, Russian Post); Andrei Belousov (First Deputy Prime Minister); Ivan Bortnik (Advisor to the General manager, Foundation for innovations assistance); Denis Manturov (Minister of Trade and Industry of the Russian Federation); Maksim Oreshkin (Assistant to the President of Russian Federation); Maksim Reshetnikov (Minister of Economic Development of the Russian Federation); Anton Siluanov (Minister of Finance of the Russian Federation); Alexandr Sergeev (President of the Russian Academy of Sciences); Sergey Sobyenin (Mayor of Moscow); Valery Falkov (Minister of Science and Higher Education of the Russian Federation); Andrey Fursenko (Assistant to the President of the Russian Federation); Maxut Shadayev (Minister of Digital Development, Communications and Mass Media). The summary of this evolutionary process is presented in Table 1.

TABLE 1. Key events in Skolkovo ecosystem evolution and leading Triple Helix Agent intervening

Year	Event	Triple Helix Agent intervening
2009	Announcement of creation of a modern and powerful research and development hub in Russia	State
2010	Creation of managerial bodies: the Board of Trustees (the supervisory control body), the Foundation Council (the supreme control body), and the role of the President of the Foundation (the executive body).	State (Board of Trustees) Industry (Foundation Council)
2010	Appointment of Viktor Vekselberg as President of the Executive Board of the Skolkovo Foundation	State
2011	Creation of the leading institutes of the innovation ecosystem	State
2011	Provision of funding to Skolkovo Foundation	State
2011	World-leading corporations join Skolkovo ecosystem	Industry
2012	Skolkovo Foundation visits to the United Kingdom and US, signature of Russian-British and Russian-American collaboration agreements	State
2013 - 2016	Sectoral ministries and agencies increased their search efforts for promising technologies within the Skolkovo ecosystem to incorporate them across national industries	State

Source: Own elaboration.

Skolkovo innovation clusters and Technopark

One of the drivers that attracted talent and industrial partners to move to Skolkovo is Technopark, Skolkovo's industrial park. The goal of Technopark within the Skolkovo Project is to provide Skolkovo project participants with support to develop their technological initiatives not only within Russia, but also abroad. The Technopark achieves its goal by providing a combination of infrastructures, facilities, administrative and financial resources to its industrial partners, offering a wide range of corporate services to fulfill the needs of the innovation ecosystem. Overall, Skolkovo's Technopark operated as a facilitator and fostered the interaction and knowledge exchange between firms, the public administration and the scientific community. The list of services provided by Technopark included: consulting services; legal support; access to research equipment; access to Skoltech's scientific and technological know-how and to other academic and research partners; facilities to conduct startup incubation activities; interaction with venture funds and international investors; and access to other international industrial parks through its network of "Technopark-Alliance".

The strategic development plan of Skolkovo's innovation ecosystem also included five priority directions of modernization that were identified and divided into clusters: Biomedical Technologies, Nuclear Technology, Information Technologies, Energy Efficient Technologies and Space Technologies. The goal of the Biomedical cluster was to innovate with the goal of improving nation's health and support the development of biomedical technologies. The aim of the Nuclear Technology Cluster was to develop nuclear technologies to consolidate Russian global technological leadership and defence capabilities. The role of the Information Technology Cluster was to establish a network of R&D Centers with universities and key industrial partners (such as Boeing, Microsoft, Cisco, or Intel). The goal of the Energy cluster

was to support innovation and novel technological solutions that could improve energy efficiency of public utilities and infrastructures, and reduce energy consumption among industrial enterprises. The goal of the Space and Telecommunications cluster was to support the space sector to accelerate the modernization of the economy and provide effective scientific and technological progress to improve living standards while also helping to contribute to national security.

Starting from 2012, all the participants of the Skolkovo innovation ecosystem, their business partners, and guests from abroad could meet at the Startup Village. The Startup Village was established as an annual event where startups from Skolkovo's clusters could meet with mentors and investors, large corporations, scientists, and government officials to discuss technology trends, and new ideas. The venue provided the opportunity to scout industrial partners from high-tech sectors, obtaining knowledge about emerging markets and new business models, and find supporting cooperation within the innovation ecosystem and the public administration. From a scientific and educational perspective, the Startup Village provided insights on new, breakthrough technologies while also providing perspective on promising research areas and technological trends. From a governmental perspective, the Startup Village allowed to identify and communicate new technology requests and requirements of the public administration and introduce new governmental support programs to foster innovative activities.

The Triple Helix model in transition economies

The traditional Triple Helix model builds on the idea that the three core roles are represented evenly through the whole development process: the university provides new technology and scientific discoveries; the industry provides the connection between new inventions and the customers as they produce goods and services, and the state provides a reliable and stable



framework for interaction and knowledge exchange between the different parties. Nevertheless, using the theoretical lens of the Triple Helix model (Etzkowitz and Leydesdorff 2000) to analyze the development of the Skolkovo innovation ecosystem, this study reveals that for innovation ecosystem in transition economies, the three types of agents involved in this model, universities, the industry, and the state or public administration are not necessarily introduced simultaneously in the development process of the innovation ecosystem.

The Triple Helix model of university-industry-state relations provides valuable insights on implementing interactive modes of innovation in developed economies (Etzkowitz, 1983, 1998, 2003a, 2003b, 2004, 2008; Ranga and Etzkowitz 2013; Leydesdorff and Etzkowitz 1998; 1996; Henry Etzkowitz et al. 2000). Nevertheless, out of the empirical case of the Skolkovo innovation ecosystem in Russia, a set of insights emerge, refining the Triple Helix. This study reveals some notable differences for the transition economies compared to innovation ecosystems in developed economies. First, despite the transformational efforts, historically planned economies ruled by power relations and bureaucratic controls are still strongly influenced by their legacy. This study shows that at its incipient stages, the state, the state-owned enterprises (SOEs), and public administrations are the ones who provide the initial financial support of such ecosystems. Second, the state appears to undertake the leading role in establishing such innovation ecosystems by undertaking a very active role in attracting private funding (mainly from other state-related industry partners).

This study illustrates that for transition economies, the highest synergies are achieved through significant government implication via sponsorship of innovation initiatives and international diplomacy. Such setup assigns a secondary role to the universities that join the ecosystem at later stages of development. The university remains critical to aggregate scientific and



technological knowledge, develop a local talent pool, and engage other stakeholders through research and development centers. However, in transition economies, the state and the public administration play a leading role in facilitating technological, scientific, and business exchange by implementing favorable policies supporting such activities. Within the innovation ecosystem, scientific parks, incubators, accelerators, business angels' networks, and venture capital funds get established before universities, leading to a more industry-oriented ecosystem.

From a governance perspective, in transition economies, where the state and the public administration have a leading role, the capability of deployment and timely creation of the core urban infrastructure appears to be key to engage the industrial and scientific agents of the Triple Helix. Delaying the construction of key infrastructure (e.g. university campus or research centers) can lead to an unbalanced development of the whole ecosystem. In such scenario, the state would need to undertake increased economical efforts (e.g. additional grant programs and expenses) to mitigate the lack of attractiveness of the ecosystem due to unfinished infrastructure.

From an urbanistic and social perspective, state agents conceived Skolkovo not only as an innovation ecosystem, but also as a prototype for the city of the future that could provide optimal conditions for business and research, increasing its environmental and urban attractiveness for its residents. Skolkovo's example illustrates that from an urban perspective, the development of innovation ecosystems can foster positive spillovers of innovation and entrepreneurship from a business perspective, while also contributing to increase the land value and wellbeing of local citizens. By providing amenities to its residents (e.g. jazz festival, concerts, or sporting events) and quality housing, innovation ecosystems in transition

economies can increase their value proposition to attract not only local but also international talent.

Finally, from an economic perspective, technology clusters' strategy allowed Skolkovo to build on its strengths by focusing and developing further the national pool of talent and expertise while being aligned with nation-wide strategic development interests. Given the increased complexity of creating and developing innovation ecosystems in transition economies, aligning the scope and goals of technological clusters' with the public administration increase the attractiveness for prospective industrial partners and facilitate the alignment of strategic funding requests within the state budget allocation.

Conclusions

The first conclusion emerging from this study is that a series of stages can be observed in the evolution of innovation ecosystems in transition economies: scouting of best practices; conceptualization and adaptation to local needs; core infrastructure deployment; growth and generativity (when ecosystems' dynamics allows to gradually reduce the involvement of state and governmental support). The identification of these stages allow better expectations management when assessing innovation ecosystems in transition economies. Failing to understand these stages might lead to a wrong assessment of the innovation and entrepreneurial outcomes from the ecosystem.

The second conclusion that emerges from this study is that transition economies might still experience legacy inertia when establishing the key governance and administrative bodies of their innovation ecosystem's projects. Such circumstances might still lead to unconscious bias in the decision-making processes and underrepresentation of other stakeholders. One of the most challenging endeavors when establishing ecosystems is to bootstrap them from zero when



the ecosystem is not built on an already existing infrastructure. Even when resources are abundant, careful planning and prioritization are still required. To ensure that the ecosystem engages in favorable dynamics that would allow it to achieve generativity and sustainable growth, government representatives and public administrations should ensure that the first participants of the ecosystem could already benefit from it regardless of whether other participants are already present in the ecosystem or not.

The third conclusion that emerges from this study is that innovation grants offered by the public administration to industrial partners might be an extremely appealing mechanism to achieve the ecosystem's growth targets in the short term. However, in transition economies, the distribution of public funds for grant purposes should be kept on a lower level of priority when compared to the destination of public funds for the deployment of other essential ecosystem infrastructures such as university campuses or research facilities. Missing to timely accomplish the deployment of the critical infrastructure within the ecosystem might delay the achievement of generative growth of the ecosystem, limiting the effectiveness of invested resources.

Innovation ecosystems are attractive while they can maintain their positive dynamics and captivating innovators and entrepreneurs who are willing to join them. Skolkovo is a very young innovation ecosystem that is still in the process of deployment of its infrastructure and further research is required to assess more accurately its trajectory. Nevertheless, its social, economical and scientific impact has already positively contributed to Moscow's region, Russian society, and international scientific community, providing some hints of a promising future.



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