Technological platform - a model of innovative interaction between the state, industry, science and education

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Technological platform - a model of innovative interaction between the state, industry, science and education

Elena V. Shevchenko. [1]
Snitch Viktor Fedorovich 2, *,
[1]kazinnovatsii, JSC, Nur-Sultan, Republic of Kazakhstan.
yelenashevchenko@gmail .com
[2] Omsk State Agrarian University, Omsk, Russia, vic.econ@mail.ru
ORCHID: 0000-0002-9911-6286*
* Corresponding author (vic.econ@mail.ru)

Abstract

The paper explores the development of technology platforms to ensure smart, sustainable and inclusive economy. Technology platforms are considered as the basis for elaboration of the common vision of scientific and technological development based on government-industry-science collaboration. Technology platforms are core element of innovative infrastructure and a way of implementing public-private partnerships. Technology platforms development requires identifying and selecting key sectors or areas of the future economy. The potential for technology platforms development on the country level should be based on special analytical technics including foresight technics and methods, considering the country's position and progress in STI development and existing opportunities for international collaboration.

Comprehensive multivariate analysis can be also applied for identification of new trends and opportunities for high-tech industrial development. Important attributes of progress are new high-tech services, start-ups in breakthrough technological areas where there are competitive advantages.

Keywords. Technology platforms, identification of promising technology areas, industry-science collaboration

Технологическая платформа - модель инновационного взаимодействия

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Шевченко Елена Валериевна.[1],
Стукач Виктор Федорович[2,] ,
[1]КазИнновации, ОАО, Нур-Султан, Республика Казахстан. yel enashevchenko@gmail.com
[2] Омский государственный аграрный университета, Омск, Россия, vic.econ@mail.ru ORCID: 0000-0002-9911-6286*

* Корреспондирующий автор (vic.econ@mail.ru)

Аннотация

Технологические платформы рассматриваются в качестве основы для разработки общего видения научно-технического развития на основе государственно-промышленно-научного сотрудничества. Технологические платформы являются ключевым элементом инновационной инфраструктуры и способом реализации государственно-частного партнерства. Разработка технологических платформ требует выявления и выбора ключевых секторов или областей будущей экономики. Потенциал развития технологических платформ на страновом уровне должен основываться на специальной аналитической технике, включая дальновидность и методы, с учетом позиций и прогресса страны в сложный инструмент реализации научнотехнологической и инновационной политики (далее - И1ПП1), и существующих возможностей для международного сотрудничества.

Для выявления новых тенденций и возможностей для высокотехнологичного промышленного развития можно также применять комплексный многовариантный анализ.

Ключевые слова: Технологические платформы, выявление перспективных технологических направлений, отраслево-научное сотрудничество

Introduction

Technology platforms development is a methodological and resource basis to link government, business, science and education to implement a common vision of scientific and technological development and common approaches to the development of appropriate technologies. Technological platforms allow mobilize efforts, competences and resources of all stakeholders for the development of innovative technologies in certain strategic areas. Technology platforms are the core element of innovative infrastructure that is based on a mechanism of publicprivate partnerships.

Among the prerequisites for the efficient development of technology platforms, the authors highlighted: strategic technological challenges; the necessity of improving collaboration between core actors of innovation ecosystem; low efficiency and poor coordination of state support instruments for R&D and innovation development; fragmentation of scientific activities and low level of science - industry collaboration.

Digital economy requires implementation of digital solutions for technology platforms development. Stimulating demand for innovation and increasing the efficiency of commercialization processes, introducing innovative ideas into the real sector of the economy is significant for innovative economy development.

In Kazakhstan technology platforms are viewed as a methodological basis for connecting representatives of the government, business, science and education to implement a shared vision of scientific and technological development and common approaches for advanced technological development. Technology platforms allow mobilize efforts, competences and resources of all stakeholders to develop innovative technologies in certain strategic areas.

Countries with developed science and technology are using technology platforms (hereinafter - TP) as a tool for the developing a competitive and high-tech economy. According to the internationally accepted definition of TP are objects of innovative infrastructure that allow effective communication and development of advanced technologies, high-tech, innovative and competitive products based on the participation of all actors (government, industry, science, education, public organizations). In the EU, technology platforms are a demand-driven innovation policy tool (Rudnik, 2011)

One of the problems hindering the technological development of Kazakhstan is a low level of collaboration between government, industry, research and education, which lowering technological and innovative development. The process of identification of key areas for the development of technology platforms, as well as the further implementation of TPs requires appropriate methodological support. In this regard, it is necessary to develop a methodology for evaluation and selecting priority areas for the National TPs development.

TPs are considered as:

1) an object of innovation infrastructure;

2) a way to mobilize efforts and resources of all interested parties - various ministries and agencies, business, scientific community to create innovative technologies in certain strategic areas;

3) a mechanism for coordination activities of all stakeholders, involved in the process of the national scientific and technological policy implementation;

4) the way to develop public-private partnership.

At the same time multisectoral development of TPs has critical importance for the development of network structures that represent a characteristic feature of the new economy (Akberdina, Smirnova, 2018).

In this regard authors focus on theoretical and methodological foundations of the formation of technological platforms as a tool for integration of interests of all groups of stakeholders (government, industry, science and education) on the implementation of common vision and strategy for technological development.

The main feature of TPs is that they are developing in the areas with high technical complexity and high export orientation.

An important issue that needs to be resolved within the framework of this work is the development of a methodology for assessing the prospects and selection of priority areas for the development of technological platforms.

EU, Russia, Great Britain, Singapore are designing of TPs as a complex instrument of science, technology and innovation policy (further - STI) implementation that require a strong methodological support at the stages of TPs designing and implementation.

At the same time, many researchers believe that TPs could be developed based on the positive experience of the EU countries. Zlyvko O.V. and Lisitsyn E.M. (Zlyvko, Lisitsyn, 2012) based on the experience of Russia in the implementation of TPs highlighted importance of methodological support for TPs development.

Foresight on the national level (foresight research) is a multi-stage interactive process that includes a set of various methods, such as expert methods, economic and mathematical forecasting models (trend extrapolation, econometric modeling). However, mathematical forecasting methods have a rather significant limitation for application in complex systems - they are most effective for systems with a stable development trend, not for the situations of high volatility and uncertainty.

In turbulent times, the pace of change accelerates, global competition intensifies in many sectors and new players come to force. To avoid the disorientation associated with the pace of economic globalization, governments should concentrate on the long-term development of the most important sectors of the national economy (International Labor Office, 2014).

An important advantage of econometric modeling is the ability to consider the influence of external economic factors. Econometric models allow solving a wide range of research tasks: analysis of cause-and-effect relationships between economic variables; forecasting the values of economic variables; scenarios elaboration based on simulation experiments with the model. Modeling and forecasting macroeconomic processes are undoubtedly an urgent problem of the economy.

However, among the weaknesses of econometric modeling is that the method requires comprehensive databases (statistical, economic, sectoral data, etc.) and is more suitable for extrapolating existing trends than for recognizing weak signals of change.

The objective of the paper is to explore methodological approaches to the development of TPs, based on the STI development priorities.

The scientific novelty and significance of the paper consists of the development of a approaches for TPs designing and implementation based on a combination of several advanced techniques that make it possible to implement the basic criteria for assessing and selecting priority areas, including the use of foresight in combination with multifactorial analysis and mathematical modeling.

Materials and Methods

Among the methods for identification of priority sectors for TPs development that can significantly influence the development of the whole industry, can be mentioned such methods as patent and bibliometric analysis, analysis of "weak signals", horizon scanning, etc. The above methods allow early detection of technological trends in the development of groups of technologies within certain areas that have the potential for explosive development in the future. These methods should be considered in developing methodology for assessing priorities for TPs development. To collect the data different data sources should be used, such as statistical databases, results of foresight exercises, analytical reviews, etc. It is important to combine datasets from different data sources to increase objectivity and credibility.

Development of a methodology for identification of priorities for the development of TPs on the national level should be based on a set of tools and techniques described below.

Basic methods of foresight can be applied on the stage of identification priority areas and key sectors for TPs development, such as horizon scanning, emerging trends analysis, weak signals, wild card, STEEPV, BMO analysis, etc. In order to effectively anticipate or scan possible futures, it is important to clearly understand key parameters and basic elements to define future priorities in situations of uncertainty and volatility.

Horizon scanning allows capturing weak signals as an indicator of a potentially emerging issue, that may become significant in the future. Such approaches as traditional planning based on trends extrapolation can be successfully used under relatively stable external conditions. However, given the acceleration of historical time, these techniques lose their effectiveness and can provide misleading results. The same time horizon scanning allows to identify possible threats or emerging opportunities at an early stage and to use this information as a competitive advantage.

In identifying global technological trends, the patent analysis plays a significant role in exploring new trends and emerging market niches.

Foresight plays an important role at the stage TPs designing by providing instruments for priority areas identification. Foresight provides mechanisms for mobilizing all

stakeholders on the initial stage of TPs development. On this stage a common strategic vision is formed with further gradual detailing by involving expert groups, conducting in-depth interviews, developing roadmaps and identifying multisectoral intersections, in order to identify tasks that can be most effectively solved by combining efforts, resources and technologies of all actors to ensure synergistic effect.

Foresight results will provide understanding which areas (sectors) will have a leading position on a global scale and which countries can be at the forefront of their development and what competencies should be developed to ensure a qualitative breakthrough in the selected priority sectors of the future.

Results

TPs can be formed on a basis of foresight results, considering the importance of the economic sector in terms of implementing the priorities of the country's socio-economic development, for solving such problems as:

1) Linking needs of business and society for implementation of the most important areas of scientific and technological development;

2) Identification of new scientific and technological achievements for the modernization of existing sectors and the formation of new sectors of the economy;

3) Determination of the principal directions for improving industry regulation for the rapid spread of promising technologies;

4) Stimulation of innovation, support of scientific and technical activities and processes of modernization of enterprises, considering the specifics and prospects for the development of industries and sectors of the economy;

5) Expansion of scientific and industrial collaboration and the formation of public-partnerships in the innovation sphere;

6) Improvement of legal regulation in the field of scientific, scientific-technical and innovative development.

In EU countries TPs are considered as a tool for cooperation and coordination of the implementation of innovation policy, increasing openness and interaction of all participants to achieve a common goal. In this regard TP are viewed as a tool for increasing industry-science collaboration (Zhogova, 2019).

Discussion

In the process of priority sectors identification for the development of TPs fulfillment of the following conditions is important: 1) the formation of platforms should be

based on implementation of digital technologies, 2) scalability from the standpoint of economic effect and 3) the development of an innovative component, the development of multisectoral cooperation and obtaining a synergistic effect.

In the context of a new technological paradigm and the transition to a digital industry that caused transformation in production, sales, logistic chains, natural resources are no longer a competitive advantage and country's competitiveness is increasingly dependent on the introduction of science-intensive technologies, formation of creative economy and development of advanced competencies. Currently we can observe trend of arising technologies of the Industry 5.0 that focus on the interaction between humans and machines. This trend is developing in parallel with the Industry 4.0 (Golov, Mylnik, Palamarchuk, 2018). Society is moving to a new stage of reindustrialization, the development of production in a qualitatively new environment based on networking technologies. In this direction, the development of technological platforms is seen as a promising tool for ensuring sustainable development based on the principles of openness, involvement, collaboration and a wide application of the achievements of digitalization and project management.

In the EU countries development of TPs was carried out using complex schemes for supporting scientific and technological sphere, using the possibilities of such large research funding programs as "Horizon 2020". It aims to improve conditions and access to finance for research and innovation in Europe, to ensure that innovative ideas can be turned into products and services that create growth and jobs. TPs aims to involve all actors and all regions in the innovation cycle by revolutionizing the way of public and private sectors collaboration.

However, in the circumstances of Kazakhstan, elements innovation ecosystem as well as instruments of state support of science, technology and innovation development require more efficient inter-ministerial coordination. In this regard targeted long-term mechanisms to support the country's innovative development should be implemented on the national level, including implementation of technology platforms.

In the Russian Federation, the implementation of TPs is aimed at bridging the gap between science and business, as well as forcing big national companies with state participation to increase R&D collaboration and to implement advanced technologies into production process through participation in TPs. TPs should help to introduce long-term interaction mechanisms and consolidated STI policy of all participants in relation to the prospects for scientific and technological development, forming (Protocol of the State Commission of the Russian Federation, 2010).

Analyzing the experience of Russia and the EU countries in the development of technological platforms, we can conclude that the basis of their formation lies in solving the strategic tasks of scientific, technological and innovative

development, and they are considered as one of the mechanisms for the effective promotion of priority scientific and technological areas identified within the framework of long-term scientific and technological forecast using the foresight method.

Conclusion

1. Among the main methods for priority areas identification that can have a decisive influence on the development of the industry, should be highlighted such methods as patent and bibliometric analysis, weak signals, horizon scanning, etc. These methods allow early detection of emerging technological trends within certain areas that have the potential for explosive development in the future. The assessment of national technology platforms should be carried out on a competitive basis within the framework of national priorities identified based on technology foresight methods.

2. In the process of selection priority areas for technology platforms development, it is necessary to identify key technologies based on attractiveness and feasibility criteria. Identification of priority areas of TPs development will allow concentration of limited resources on strategic fields and key technologies (Shevchenko, Stukach, 2019).

3. It is advisable to analyze the multiplicative effect on the development of related sectors and fields. In addition, internal competency level that include technological readiness, technology life cycle, the country's position in STI development in comparison to the leading countries, as well as potential for international collaboration should be evaluated. This comprehensive multivariate analysis will become the basis for determining strategies for high-tech industrial development, as well as the development of startups in promising technological fields in which the country has competitive advantages.

4. The following main stages for TPs priority areas identification are proposed:

- assessment of strategic prospects based on the selection and analysis of complex full cycle projects;

- analysis of value-chains inside TPs based on intersectoral approach;

- identification of the prospects for the development of the scientific and innovative component by linking needs of business with competences of research.

- assessment of the needs for digitalization of the technology platforms to enhance the overall effect of TPs development. 4. Technology platforms facilitating performance of the priority sectors based on a network structure that supports an innovation activity of all actors of the national innovation ecosystem. At the same time, in the digital economy, digital platforms provide solutions that become a basis

for the formation of business ecosystems with high level of communication among all stakeholders

and accumulation of limited resources for production of technologically advanced products and services (Boyev, Ponomaryeva, Haibullin 2019).

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