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A POLICY PERSPECTIVE ON THE RUSSIAN TECHNOLOGY PLATFORMS

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The paper offers a taxonomy of the technology platforms (TPs) to help assess a platform's risk level. TPs are seen as a valuable policy instrument that assists a multi-stakeholder formulation and implementation of long-term R&D programs in specific technology areas at economy or industry level. The TPs analysis and the taxonomy are based on the industrial economic perspective and contribute to defining and implementing technology platforms above the company level. In practical terms the results of the study may be used by policy-makers in designing the R&D support measures.

Moreover, the paper clarifies the role of TPs in the science, technology and innovation policy mix. The authors trace the evolution of the 'technology platform' concept from an instrument used by companies for R&D and innovation management towards a policy instrument used for technology and economic development at national and international levels. The authors propose a theoretical approach to TPs as a science, technology and innovation policy concept. Furthermore the paper offers a case-study of Russia's newly established Technology Platforms

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Keywords: technology platform, science and technology policy, innovation policy, regional development, economic development, public private partnerships

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Introduction

During the last 15 years Technology platforms (TPs) have evolved into a research and innovation policy concept, which so far hasn't received much attention in the scientific discussion. The history of TPs can be traced back to the restructuring of industrial R&D activities in the 1990s and early 2000s when industrial TP (iTP) emerged. These years witnessed a major shift in the organization of industrial R&D (including engineering) which was increasingly challenged to serve multiple business applications. Industrial R&D organizations were supposed to generate budgets from company internal resources on a more competitive basis than before. This eventually caused a paradigm shift from multiple new R&D projects towards multiple applications of a single project's results. To this end technologies were disassembled and the core features were used for various more sophisticated solutions. Thus iTPs emerged and up to date remain the core of industrial research.

It can be concluded that iTPs are considered clusters of technologies and competencies that can be developed and applied to a large variety of products, processes and service applications. The required competencies are demanding and may be developed relatively slowly, although they represent a tremendous competitive advantage for an organisation that can deploy them. Competencies can include scientific skills, as well as application know-how, systems know-how and a vision of how the platform will evolve and open up new opportunities in the future. Consequently the iTP concept was considered a tool for developing innovation roadmaps and involving innovation actors from different spheres. Therefore platforms are considered to be a strategic asset of the organisations that possess them. The iTP concept has received increasing attention from public authorities responsible for priority-setting in research and innovation funding in particular due to its role in strengthening the links between research and innovation. The latter is frequently discussed as technology transfer and industry-science linkages and various policy measures were developed to support these linkages. The development of such STI policy measures leads to the adaption of the iTP concept as an STI policy instrument. Consequently the notion of 'technology platforms' (TPs) appeared which signifies a venue for joint discussion and R&D priority-setting for a variety of stakeholders: companies, research organizations, NGOs and government agencies. TPs like iTPs aim at developing a strategic focus and the joint identification of applications for research outcomes by multiple stakeholders at the very early stages of research and innovation. This leads to the development of roadmaps which cover the competences of different actors. Baldwin and Woodcard (2009) find that TPs exist in three separate, but interrelated fields: product development, technology strategy and industrial economics and all of them share the same common approach of developing or reusing existing core components to multiple applications which bring economies of scale for research, development and innovation and leverage synergies by cost reduction which results from the development of complimentary components.

Given the history of business interest and the involvement of multiple stakeholders technology platforms have the potential to become a significant STI policy tool. Consequently the following research questions arise:

- What is the role of TPs in the science, technology and innovation policy mix and how can this policy tool be applied?
- What TPs as an STI policy instrument can learn from iTPs?

The paper shows how the iTP concept has been further developed for the purpose of regional and national STI and economic development. A taxonomy of TPs is introduced and platforms are compared with some of the commonly used STI policy measures. The theoretical findings are illustrated with a case-study of the three year performance of TPs in Russia.

The scope and methodology

Previous research analysed TPs in the context of innovation, in particular focusing on various strategies for opening up platforms (Boudreau, 2010) and marketing high-technology products (Mohr et al., 2010). Several in-depth studies have provided a comprehensive overview of platforms, enriched with case-studies, taking up issues of governance, management, design and knowledge (Gawer, 2009). Therefore, methodologies to define and implement iTPs have been developed and successfully implemented. However defining and implementing technology platforms above the company level is challenging. In this paper we look at platforms from the industrial economics' perspective - as products, services, firms and institutions that mediate transactions between two or more groups of agents, and these agents vary accordingly. The paper applies policy analysis methods to determine the meaning of TPs in the STI policy mix. In this regard the main TP features and characteristics are outlined to develop a taxonomy of TPs. The indicators and criteria underlying this taxonomy are mainly taken from the experiences with iTPs. Furthermore the level of risk to public funding at various stages of TPs' development is taken into account. Based on the theoretical deliberations the meaning of Russian TPs in the overall STI policy mix is analyzed. Furthermore a typology of Russian platforms that links theoretical considerations with practice is developed. The methodology of the case-study of Russian platforms is based on triangulation of data. First, TP-related official documents placed on their web-sites and official data provided by the Russian government are analyzed. Second, analytical and media publications on TPs made by authors outside the platforms and the government are reviewed. Third, 18 interviews on the conditions of anonymity were made with government officials (3), university representatives (8), industry partners (3) and TP representatives (4). Interviews followed a structured interview guideline. Complementing this analysis the European Technology Platforms were analysed and lessons learned from these were matched with the Russian Technology Platforms.

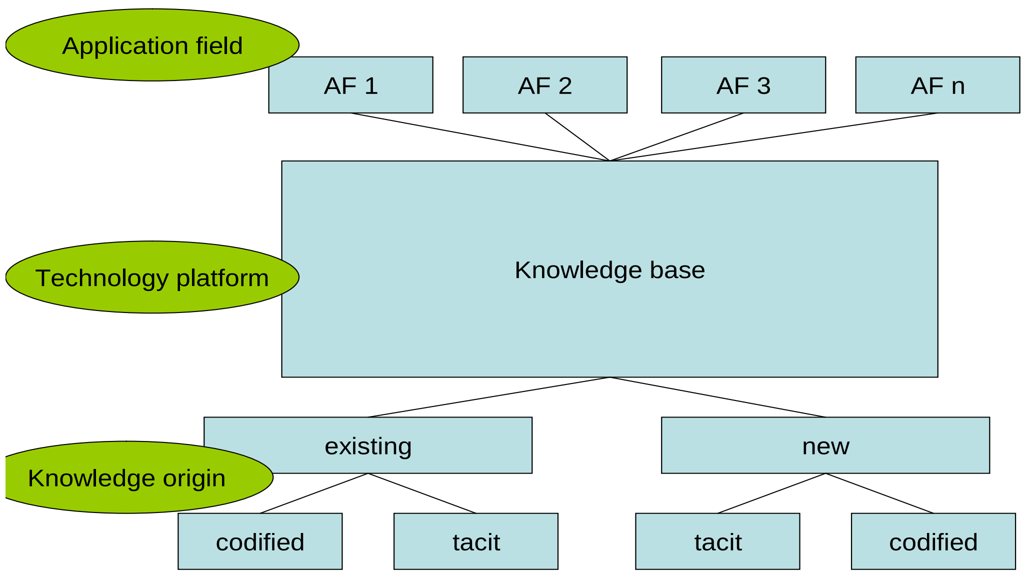
Characteristics of 'technology platform' concept

As outlined in the introduction iTP is an interdisciplinary concept, which is considered essential in R&D and innovation management of companies, affecting sensitive areas of companies' operations. The sensitivity related to internal communication on matters related to companies' stock of information, knowledge and competences which requires the involvement of multiple stakeholders. Given the broader nature of TPs in STI and economic development policy this communication has to be extended beyond a company's boundaries, which requires careful selection of information that will be disclosed. As different actors are involved, there should be a unifying common technology interest. In addition companies need to be clear about the potential of TPs they are willing to join, as well as the relations with external partners. It might occur that the different strategic intensions of companies engaged in a TP may cause a conflict of interest. Eventually this may pose additional challenges for TP management.

In structural terms TPs are closely affiliated with knowledge infrastructures. Hirschman (1958) approached the respective infrastructure as 'social overhead capital' nearly fifty years ago. The concept of 'technology infrastructure', more recently put forward by researchers (Tassey, 1991; Justman and Teubal 1995), was narrowed down and related to those producers that primarily input scientific and technological knowledge in their production processes. Tassey

(1991) defines technology infrastructure as "science, engineering, and technical knowledge available to private industry". The development of the respective infrastructures is suggested at the local (O'Dubhchair et al., 2001) and the regional (Goldstein, 2005) level. Figure 1 shows the different technology components and dimensions incorporated and enhanced in a technology platform.

Figure 1. Composition of a technology platform



A TP is considered a knowledge base combining knowledge and competences from different sources with the requirements of different applications fields. Underlying the knowledge origin are strategic considerations, which are primarily related to the question how to best access knowledge. Also a TP may be looked at as a tool which matches requirements for technologies (and knowledge), induced by the applications with the knowledge base. Thus a TP focuses on establishing, maintaining and exploiting a knowledge base which is intended to serve multiple application fields. The knowledge base draws both on existing codified and documented, as well as tacit knowledge which is developed due to the technology infrastructure competence. Thus, one of the purposes of a TP is to systematically identify and document knowledge and competence gaps which are essential for meeting the requirements of previously defined application fields. In addition considering the codified and tacit dimensions of technologies and their respective weight and importance for different application fields, policy-makers may identify STI policy measures which go beyond the initial focus of a TP. Thus TPs are not a direct STI policy instrument but rather a concept suitable for describing and formulating the needs for technology generation, e.g. either through new knowledge generation, or a mixed approach. Given the involvement of public and private actors and the long-term nature of technology platforms they may be shaped as public-private partnerships (PPPs), which have become a cornerstone of STI policies in developed countries.

TPs may also be understood as a tool for structuring research needs arising from large scale challenges (European Commission, 2004). Assuming this understanding of TPs it becomes obvious that the involvement of numerous stakeholders with a variety of backgrounds, ambitions, expectations, experiences and competences is required for designing TPs. These stakeholders involve private sector organizations, embracing the whole production and supply chain, as well as public sector organizations in their capacity of policy-makers and funding agencies, promoters and consumers of technology and knowledge and technology generators, (e.g. research institutes and academic community). Moreover TPs involve the financial community (e.g. private banks, public banks, venture capital companies) and civil society, including users and consumers (European Commission, 2004). Thus the creation of a TP at national and international level is an ambitious and challenging undertaking given the diverging interests of the parties involved in the design process and the complexity of underlying procedures. In most cases TPs are organized around an economic challenge, trying to find technological solutions that will have multiple applications in companies' products at the market. At the same time, grand challenges to society may also be addressed through TPs (European Commission, 2004).

Herva´s and Mulatero (2011) assume that TPs are always being designed and implemented with the involvement of private sector actors. Such underlying assumption might hold true for technology fields which are close to application, but not necessarily for early stage (basic) research projects. Hence the nature of technology and related research fields becomes a decisive factor for the practical design and implementation of a technology platform.

TP as an STI policy tool has implications for research policy, industrial policy, regional development policy, environmental policy and impacts on societal benefits and sustainability (European Commission, 2004). Since TPs and their respective strategic research agendas involve numerous actors from different fields and different locations, they eventually appear to be measures of active research and innovation cluster stimulation within and across regions (see, for example, European Commission, 2010a; European Commission, 2007). However the sustainability of such clusters strongly depends on the structure and the location of actors and the research agenda in the respective innovation system. The closer a TP research agenda is to the market application, the less likely a sustainable cluster effect seems, although it can be a vehicle to leverage already existing manifold competences. In this regard an evaluation of 36 European Technology Platforms (ETP) convened by Directorate General for Research of the European Commission in early 2009, proposed that in future all ETPs should be directed towards clusters organizations which have the flexibility to react and adjust to key societal challenges facing Europe. More specifically, "the clusters should involve all relevant stakeholders, work across all aspects of the knowledge triangle, and be responsible for implementing potential solutions. ETPs will be able to contribute more to focused research programmes towards the challenges faced by European society and also to bring the results of that research to the global marketplace" (European Commission, 2010a: 2).

In the first step, platforms should serve as an instrument to bundle research needs, and, in a second step, different STI policy support measures, either existing or new ones, are designed and applied to meet the identified research challenge (European Commission, 2004). The design and selection of policy measures to implement TPs can be structured along two lines of TP characteristics (Table 1):

- *Policy priority characteristics* involve the national and international policy agenda. TPs are in some cases initiated for implementing policy priorities, but they are also considered to generate new knowledge which might impact the future priority setting;

- *knowledge related characteristics* describing the complexity of a TP, the ratio of existing knowledge vs. the need for new knowledge generation, the level of competition in national research and application landscape, the willingness to meet government's research and technological priorities; and

- *application characteristics*, which include the degree to which application fields can be defined and described in a clear and comprehensive way, the proximity of a TP to application and the underlying degree of technical feasibility, the feasibility to reach the set goals.

Table 1. TP features

	Feature	**Characteristic**		
Policy priority characteristics	Meet the national (supranational) RTD priorities	Low	Medium	High
	Meet national (supranational) industrial competitiveness goals	Low	Medium	High
Knowledge related characteristics	Complexity of a TP	Low	Medium	High
	Ratio of existing knowledge vs. the need of new knowledge generation	Knowledge combination dominant	Balanced	Knowledge generation dominant
	Competitive situation of national research and application landscapes	Very strong internationally	Competitive	Weak
Application characteristics	Degree to which application fields can be defined and described	Precise	Illustrative	Vague
	Proximity of a TP to application	Short term	Mid term	Long term
	Underlying degree of technical feasibility and feasibility to reach the set goals	Predictable	Risky	Highly uncertain
		Type 1 – low risk TP	**Type 2 – moderate risk TP**	**Type 3 - high risk TP**

TPs typically involve a number of different R&D projects with different aims and ambitions, as well as diverse characteristics. Thus a platform's features are, to a large degree, determined by these projects features that can be expressed in different forms. For instance, the complexity of a TP might vary from narrowly defined / low complexity to broadly defined / high complexity; the nature of underlying knowledge varies accordingly. In some TPs the combination and exploitation of existing knowledge is dominant, while other TPs require a larger proportion of newly generated knowledge. In that context the position of the respective research (and also innovation) landscape in the global perspective should be considered. The application fields identified and assigned to a TP are also crucial when it comes to its functioning. Firstly the level of precision in defining the application fields and the proximity of a TP's research agenda to application are important parameters which determine the potential outcome and impact generated. Secondly, the technological feasibility is to be taken into consideration. Based on these features and characteristics we identify three types of platforms:

- Type 1. *Low risk TPs* are likely to fulfil the set goals and perform the planned research work which will eventually lead to market application. Risks for all stakeholders involved are rather modest and outlooks of this type of TPs are promising. TPs which fall into this group do not require significant public funding. As risks appear manageable only a moderate public sector involvement for risk sharing seems reasonable.
- Type 2. Other TPs show a *Moderate risk* profile -, which makes them unlikely to produce applicable outcomes in the short run. At the same time they are expected to deliver substantial outputs in the midterm with respective application potential. Typically the impact and range of potential applications is significantly broader than that of *Low risk TPs*. However the inherent uncertainties justify different forms of public intervention and support.
- Type 3. *High risk TPs* require a different organizational set up and management approaches for achieving the ultimate ambitious goals, as well as well-thought financial solutions. For such TPs a larger share of public funding is justifiable only if a TP focus area is a national priority, since the agendas of these TPs are usually far from commercial application.

However in the course of implementation of research agendas TP’s characteristics may change, e. g. a TP that has recently shown high risk profile tends to lower the risks and make several important achievements towards market application of its outcomes. Thus it is important to constantly monitor, assess and fine-tune various STI policy measures targeted at supporting a TP and its research agenda. Table 2 shows a variety of policy measures that may be applied to the three types of platforms, given the limitations described above.

Table 2. Suitability of STI policy measures and funding sources for TPs

		Type of TP		
		Low risk (type 1)	Moderate risk (type 2)	High risk (type 3)
Suitability of implementation channel / tool	Public Private Partnership instruments	↑	↑	↑
	Joint projects	→	↑	→
	Contracted research	↑	↑	→
	Consortia	→	↑	↑
	Joint undertakings	↓	→	↑
Funding sources	Private sector TP actors	↑	→	→
	National public funding	→	↑	↑
	Mixed (actors + public)	→	↑	↑
	Financial institutions	→	→	↑

Note:
Suitability: ↑ very suitable → suitable ↓ - not suitable
Role of funding source: ↑ strong → medium ↓- weak

STI policy measures to support TP research agendas need to take into account the involvement of multiple stakeholders, as well as significant financial and human resources. At the same time policy-makers have to bear in mind the high uncertainty and risk associated with implementation of TP's research agenda (European Commission, 2010b). Moreover, due attention should be given to inherent conflicts of interest between the attitudes and the established routines of different TP actors and stakeholders. In some cases an adaption and adjustment of public research and innovation support measures is essential with regard to the complexity of a TP research agenda and associated greater risk, requiring flexibility of budgetary means.

Case-study of the Russian technology platforms

In April 2011 a number of TPs were created in Russia. The governmental Commission on High Technology and Innovation approved a list of 22 TPs and seven more were placed in a pipeline for merger and further engineering (Russian Ministry of Economic Development, 2012).

By 2013 the number of established TPs rose to 34 with a few still in pipeline[5]. TPs are spread across a range of thematic areas:

1. Medicine and biotechnology (3 TPs);
2. Information and communication technologies (3 TPs);
3. Photonics (2 TPs);
4. Aviation and space technologies (3 TPs);
5. Nuclear and radiological technologies (3 TPs);
6. Energy technologies (4 TPs);
7. Transport technologies (3 TPs);
8. Technologies of the metal industry and new materials (3 TPs);
9. Extraction of minerals and oil/gas processing (3 TPs);
10. Electronics and mechanic engineering technologies (3 TPs);
11. Environmental development technologies (1 TP);
12. Industrial technologies (3 TPs);
13. Agriculture and food industry technologies (1 TP).

The methodological recommendations for organizations willing to form a platform and obtain public funding provide a self-explanatory definition of a TP:

> *A communication instrument, destined to trigger the creation of prospective commercial technologies, new products (services), to attract additional resources to R&D performed with the participation of all stakeholders (business, science, government, and civil society), advancing legal framework in the sphere of science, technology and innovation-based development.* (Working group on PPP in the innovation sphere, 2010: 3).

Following this definition a number of criteria were outlined for TPs applying for public funding, among which are:

- a strategic research focus that matches government priorities,
- long-term business or social requirements;
- development of educational programs and advancement of educational standards;
- consideration of a variety of alternative technological solutions;

[5] http://www.hse.ru/org/hse/tp/catalogue

- attraction of co- funding from different sources;
- transparent rules for participation and
- openness of entry for new members, clarity and disclosure of research results.

The established TPs received initial financial support by the Russian Ministry for Economic Development (MED) to set up their roadmaps and strategic research programmes. During the three years of existence each TP

- agreed on long-term development perspectives for selected S&T areas;
- established a system for expert assessment and selection of (priority) projects;
- established a system of sector expert assessment (i.e. performed at the request of various government agencies) and
- launched a number of large joint projects at the pre-competitive stage of R&D.

The platforms formed a pipeline of projects, which amounts to RUB 362,2 bln in funding volume in 2013-2017. The Russian TPs started the development of strategic research programs in the fall of 2011, in line with the *2011 Plan of Measures for the Development of TPs* (approved by the Governmental Commission on High Technologies and Innovation earlier that year). However by the end of 2011 only 17 TPs provided the three required documents to MED: their strategic research program, the report for 2011 and an action plan for 2012[6].

As of December 2013, 26 of 34 TPs developed strategic research programs, of which 11 programs were of high quality, 9 programs are average and 6 programs require further attention. Moreover 7 platforms have developed roadmaps for the implementation of their research programs (MED, 2013)[7].

Since their inception the Russian TP have passed the following steps:

1. TP participants have agreed on long-term development perspectives in selected research and development areas, established the system for project evaluation and selection (priority-setting) within their platforms.

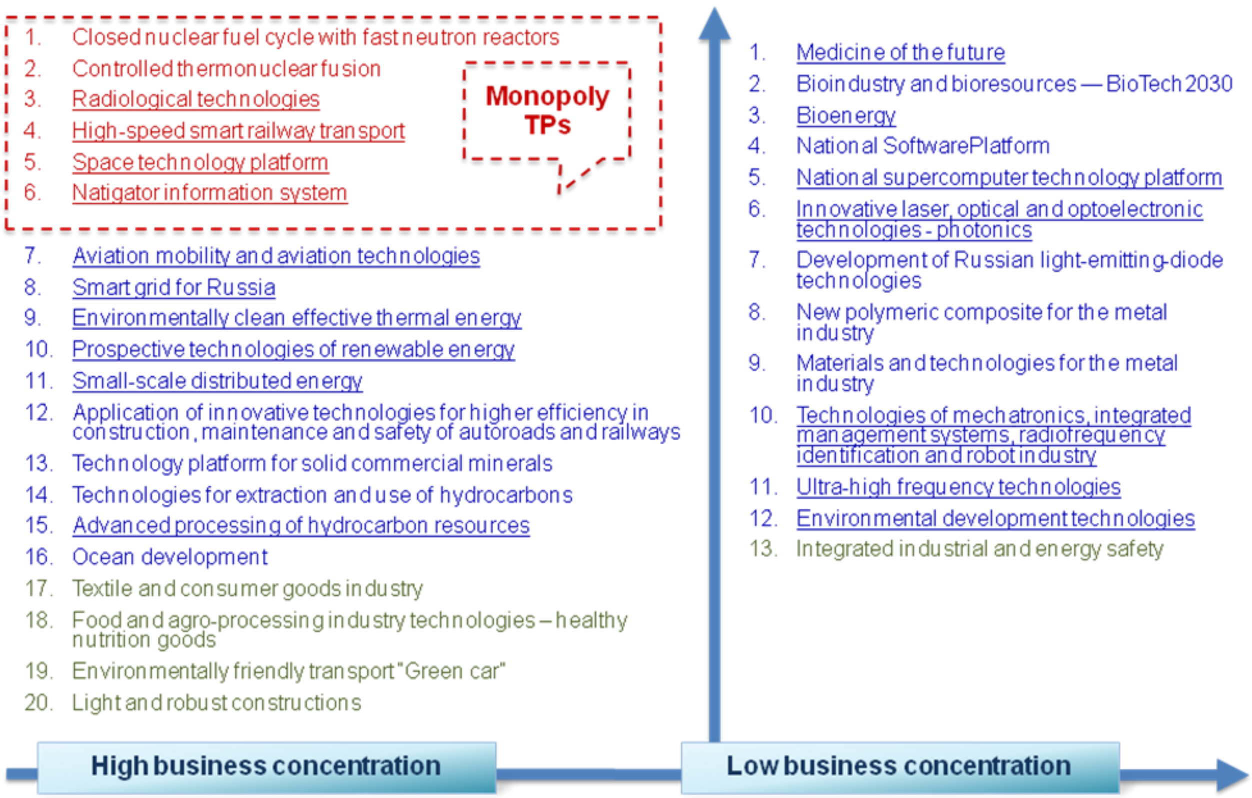
[6] The respective TPs are highlighted in Figure 4.
[7] Roadmaps were developed by the platforms “Medicine of the future”, “Innovative laser, optical and optoelectronic technologies - photonics, “Environmentally clean effective thermal energy”, “Radiological technology”, Aviation mobility and aviation technologies, “Ocean development”, “Textile and consumer goods industry”.

2. A sectoral expert evaluation system was launched (i.e. expert support to the development of sectoral roadmaps).
3. A number of large-scale joint projects (pre-competitive stage of R&D) were launched by the platforms.

The overall number of participants of the Russian TPs is over 3000, 18% are universities and 21% research organizations, 38% are industrial enterprises and SOE (2-3 on average in each TP). All platforms are open for new members (with the exception of monopoly TPs), which makes the membership constantly grow. TPs keep negotiating cooperation agreements with other platforms that develop similar or complimentary technologies, with various government bodies, as well as with end users, e.g. companies and enterprises (Russian Ministry of Economic Development, 2014).

Figure 2 shows a taxonomy of the 34 Russian platforms (established as of May 2012) following the classification in Table 3. We note that 6 platforms hold a monopoly position in their area of research with SOE dominating the picture due to government regulation of the market for security (i.e. nuclear fuel cycle) and/or social (railway transport) reasons. The TPs marked in green color are those that were created later than others (i.e. in 2012) and for this reason did not submit their 2011 activity reports and 2012 action plans.

Figure 2. Russian TPs grouped by business concentration



TPs shown in figure 2 are often those with high business concentration where private sector participants constitute nearly half or more. Consequently TPs with low business concentration are those in which companies and enterprises form an absolute minority. In our view TPs with low business concentration bare higher risks, as they overwhelmingly depend on state support for their research activities and commonly provide less evidence of potential demand for the planned outcomes.

The overall number of participants is highest in platforms “BioTech-2030”, “Innovative laser, optical and optoelectronic technologies – photonics”, “Smart grid for Russia”, “Small-scale distributed energy”, “Medicine of the future”, “National supercomputer technology” and “Environmental development technologies” – all with more than 140 members. The smallest number of participants is found in the TPs “Controlled thermonuclear fusion”, “Development of Russian light-emitting-diode technologies” and “Closed nuclear fuel cycle” – with less than 13. The number of participants clearly has consequences for the decision-making process of a TP, including priority setting and project implementation. The most representative platforms with highest number of participants are likely to face difficulties with agreement of various interests.

It is most probable that the monopoly TPs, due to the nature of their studies and the business processes of founding institutions, ultimately will not release their findings to the public. Furthermore their membership will remain limited.

The first steps to identifying the sources of funding for the Russian TPs were taken with the allocation of funds to TPs within the federal program "Research and Development in priority areas of S&T development in Russia for the years 2007-2013" (Head of Government of the Russian Federation, 2013) and the adoption of the subsequent federal program for the years 2014-2020. In this program with a budget of RUB 239023,77 mln TPs are listed among the main instruments of S&T policy implementation for the next 5-7 years. For instance, the most important principle of the Program is the "active involvement of business and technology platforms to making a substantial R&D input by performing applied research in suggested topics (bottom-up approach), including those in the form of public-private partnership, as well as top-down pre-defined research topics in the interests of various sectors, business and technology platforms, including those identified through prior agreement of key stakeholders" (Ibid: 11).

There are other thematic federal programs that support R&D in the thematic areas in which TPs function, for example, "New generation of nuclear energy technologies for 2010-2015 and until 2020". Some financial support to TPs may be expected from the Russian development institutions, e.g. RUSNANO Corporation and Russian Venture Company (at the stage of commercialization) and the Russian Foundation for Technological Development[8] among others. These are the direct competition-based support instruments. Other instruments of indirect support include methodological recommendations and consultations by MED and other institutions, organizations of events (i.e. exhibitions) and discussion platforms (i.e. conferences), preparing information/promotion materials, etc. In addition support is given by aligning the research programs of the Russian Academies of Science and the national research and federal universities

[8] The Foundation organizes and conducts the competitive selection of the innovative projects, included into the Road Maps and Strategic Research Programmes. As of October 2012, 10 projects presented by seven Technology Platforms have been financed for a total amount of 1,134 million rubles (one billion one hundred thirty-four million). URL: ftp://ftp.cordis.europa.eu/pub/etp/docs/technology-platforms-rf_en.pdf (last access 21 January 2014). According to the Foundation it received 143 applications from TPs which amount to RUB 15,5 bln in 2012. Loans were provided to 17 applications only in the amount of RUB 1,6 bln, inter alia, of the following platforms: "Photonics", Materials and technologies for the metal industry", "Bioenergy", "Biotech-2030" and other.

with the goals and tasks of TPs, which will allow for support by the key research actors of the Russian science and innovation system. Innovation development programs of the largest state owned companies (SOE)[9] will have to undergo an evaluation of the MED working group on public-private partnership in innovation, which will consider the planned participation of SOE in the TPs. As a result by 2014 33 SOE out of 60 that have established innovation development programs use TPs as cooperation platforms, including 11 companies that participate in TPs very actively. The volume of SOE funding of extramural R&D that are in line with the TP priorities amounted to RUB 4,8 bln in 2012.

Moreover, representatives of TPs are invited to join advisory bodies of the federal government agencies that are responsible for the distribution of R&D funding and advisory bodies of development institutions (i.e. Russian Venture Company and RUSNANO Corp.). Following the federal model, Russian regions also started creating TPs. For instance by 2013 the Krasnoyarsk region and its Innovation Council established four TPs in wood processing, energy, agriculture, ICT and space technology. By 2020 the region plans to establish 11 TPs for coordinating the activity of business, science and government for the technological development of priority sectors and industries.

Thus TPs are viewed as an effective policy instrument at federal and regional levels. However its actual implementation and effectiveness is to a large extent dependent on its position in the existing policy mix, as well as on efficiency of other tools in this mix. For this purpose the main STI policy tools are briefly reviewed.

The governance of the Russian S&T system is performed predominantly at the national level. Several revisions of national S&T priorities took place as of 2011 and resulted in formulating S&T priority areas and lists of priority (critical) technologies, with allocation of funding in line with these priorities (for the latest published lists see President of the Russian Federation, 2011). Planning for the S&T sector is done the Ministry of Education and Science (MED), which develops the Federal Strategy for the Scientific and Technological Development. The documents currently in force are the *Strategy for the development of science and innovation in the Russian Federation for the period up to 2015* and the *Strategy for Innovation Development of the Russian Federation until the year 2020*. MED also implements the main competitive S&T funding

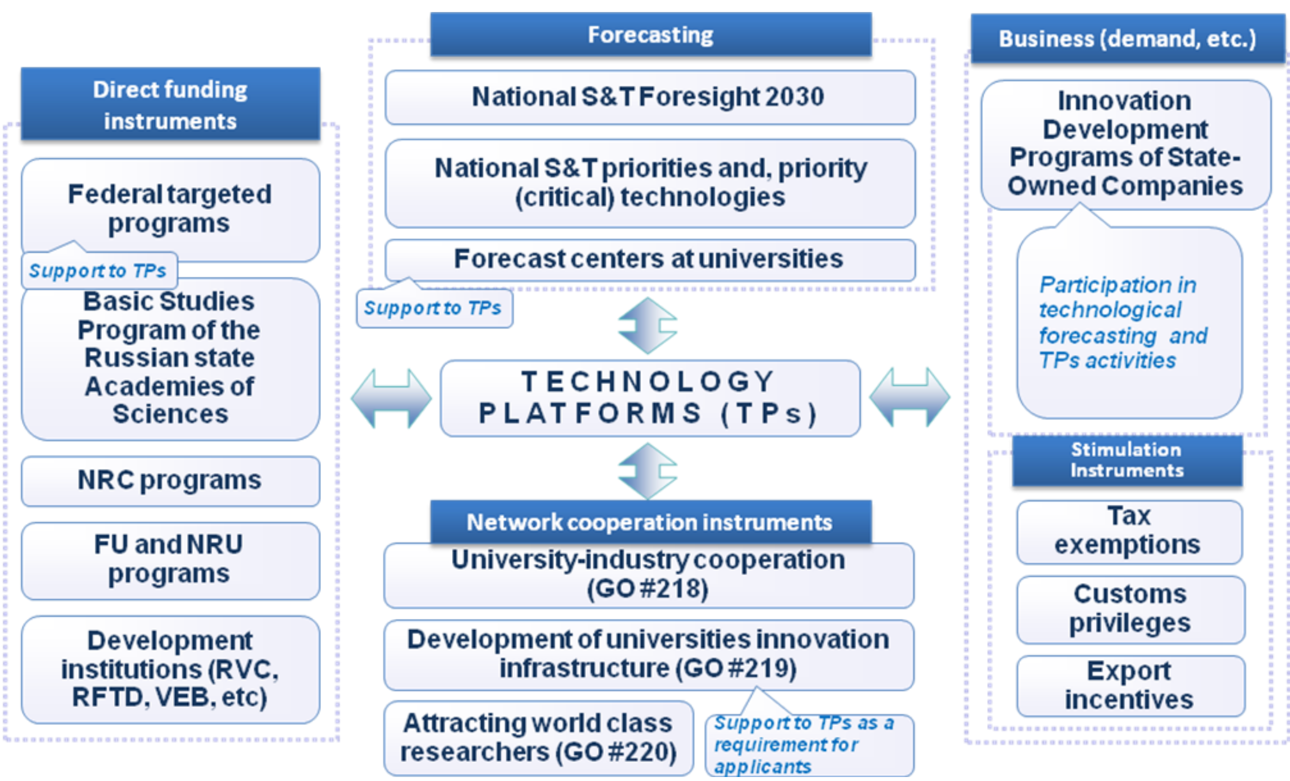
[9] 60 SOE have been implementing such programs starting in 2011 and 2012.

programme - the Federal Targeted Programme "Research and Development in priority areas of S&T development in Russia" (for the years 2007-2013 and 2014-2020).

For years the Russian Academies of Science has remained the main recipient of budget funding for civilian R&D. To diversify R&D performers several recent initiatives were adopted aiming at the promotion of R&D at universities, among them support to university–industry collaboration, support to university innovation infrastructure, support to development programmes of the leading universities that were assigned the status of "National Research Universities" and the merger of several smaller universities in Russia's regions into seven Federal Universities. In addition the first National Research Center – Kurchatov Institute – was established, and more remain to be named, with a view to cluster research in a particular priority area. Multiple legislative changes introduced after the year 2000 were aimed at facilitating R&D and innovation, including tax exemptions, commercialization of R&D by universities, obligation for large public companies to put up innovation strategies, etc.

The newly established Russian TPs were well placed to fill in the existing gap in engaging business in long-term R&D forecasting, network cooperation and funding. Figure 3 shows the position of TPs within the array of policy tools described above.

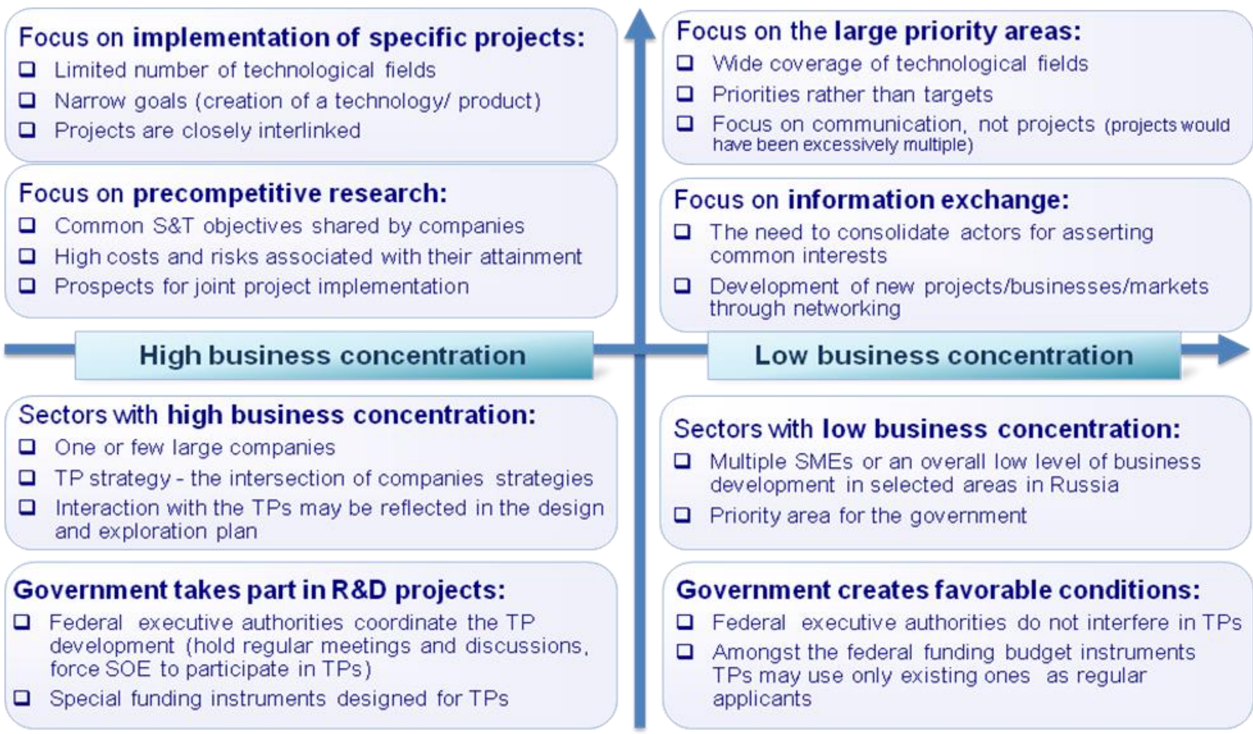
Figure 3. Russian Technology platforms in the STI policy mix



Notes: FU – federal universities; NRU – National Research Universities; NRC – National Research Centers; RVC – Russian Venture Company; RFTD – Russian Foundation for Technological Development; VEB – Russian Bank for Development "Vnesheconombank"; GO – Government Order.

Further we attempt to categorize the Russian platforms by a number of features, such as their focus, sector and the role the Government plays in their support (Figure 4).

Figure 4. The main types of Russian technology platforms



The proposed classification of the Russian TPs broadly reflects the knowledge-related and application characteristics, described in the theoretical part. For instance, the closeness of a TP to application may be accessed through the declared goals: - narrow goals (creation of a technology/project) vs. working towards broader priorities. The underlying degree of technical feasibility and uncertainty of reaching the intended goals may be assessed though a platform's focus on precompetitive research vs. information exchange.

The newly established Russian platforms broadly follow the European Technology Platforms (ETP) model. Russian TPs and the Ministry of Economic Development responsible for their creation and development considered the formal evaluations of ETPs, which outline quite a few deficiencies of this instrument. Among the positive effects it's worthwhile to mention that Russia is already integrated in the European Research Area due to its active participation in the European Framework Programs (FP) for Research and Technological Development and other European and EU-Russia research and innovation related initiatives. Consequently Russian TP initiate ad-hoc meetings with their European counterparts and benefit from the activities of the FP7 project BILAT-RUS [10]: Enhancing the bilateral S&T Partnership with the Russian Federation, whereby Higher School of Economics and German ZENIT GmbH provide support to contacts between Russian and European platforms. This Russian-European interaction deals with the following issues:

- Exchange of experience in TP organization and management;
- Joint research in the sphere of long-term technology forecasting and Foresight;
- Identification of opportunities for joint project funding;
- Joint use of infrastructure and equipment;
- Exchange of information and development of mechanisms for this (joint databases, communication systems and portals);
- Organization of joint events;
- Participation of invited experts in TP meetings;
- Joint R&D project work;
- Development of recommendations on advancing regulatory and legal framework in science, technology and innovation, inter alia, when it comes to international standards, technology transfer management and international technology cooperation.

Perhaps the most important lessons that Russian platforms may learn from the European experience are found in ETPs evaluation reports. As cited earlier, the ETPs evaluators suggest

[10] For more information see: http://www.bilat-rus.eu/en/94.php (last accessed 12.02.2014).

that in future all platforms should work in flexible clusters, which focus on key societal challenges, and should involve all relevant stakeholders. Following the evaluation it became clear that certain re-adjustment of the TP policy support mix in Russia was necessary, inter alia, to speed up the implementation of research plans, boost the research performance and open up platforms and their outcomes to the public. The earlier evidence on the interlink between a TP research agenda (how close its research is to the application) and its capacity to impact upon the creation of a sustainable cluster was not given sufficient attention in the process of innovation clusters creation in Russia[11].

There are two more important issues to be noted by the Russian platforms. First of all, ETPs offer space for dialogue that is suitable for various actors and stakeholders in the innovation process. This may be cumbersome for TPs not only because scientists and businessmen often face difficulties to come to terms, but also because business competitors will be required to cooperate to advance mutual research interests. Nevertheless active contribution of a variety of stakeholders is necessary for the success of this policy tool, as underlined by OECD (OECD, 2011: 23):

> *"The government should … establish stakeholder forums to achieve greater coherence and to draw upon the wide range of knowledge distributed across the innovation system. These should draw together the relevant ministries and agencies, the state owned enterprises (SOEs) and state corporations, the academies and HEIs, and, of course, the private sector, in order to formulate strategic goals and action plans. Without full and meaningful involvement of the main actors from across the distributed landscape of the national innovation system, top-down plans and strategies risk being ignored, even in a relatively centralised governance system like Russia's. In this regard, the recent announcement to launch a number of technology platforms, inspired by European Union experience, would seem to be a move in the right direction".*

Secondly, European enterprises, driven by their long-term but also short-term business interests, usually initiate the creation of TPs and/or play a leading role in this activity. This is a difficult business decision, as this initiative may again stumble over competitors' business ambitions, or prevent them from investing in bigger research initiatives.

[11] In March 2012 25 clusters were selected by MED to receive various types of government support, including 14 that were granted financial support.

Both of these features are less applicable to Russian TPs. First, business councils and chambers, sectoral business associations serve as either ad hoc dialogue platforms or make a minor impact on the Russian decision-making process. Second, Russian companies rarely pursue long-term planning. A typical Russian company has a planning horizon that does not exceed two or three years (BDO, Russian Managers Association, 2013[12]). Moreover, it was not Russian companies that came forward with an initiative to establish TPs, but the Government who kicked off the process by designing and fine-tuning this STI policy tool. This process is still ongoing, i.e. currently the financial means to support the Russian technology platforms have not yet been fully identified.

In 2013 the Russian platforms were evaluated by MED on the parameters summarized in Table 3.

Table 3. Criteria for the evaluation of Russian TP after three years of performance.

	Evaluation parameter	Indicators/criteria
1	A functioning organizational structure of platform was established, a legal person was registered to perform platform's activity	The role of Executive Director or similar body of a platform; The level of participants' activity (as per the 2012 survey); Activity of working groups, research and technology board and other platform's bodies.
		Legal form of a TP (non-commercial partnership, autonomous non-commercial organization, consortium, etc.)
2	Web-portal of a platform was created	Web-site traffic, completeness and relevance of information, existence of forum and other options for participants' communication
3	Development and adoption of a "Strategic research program" and its open access in the Internet	Being in line with methodological recommendations; No. of participants, who took part in the program development; No. of amendments; Development of corresponding roadmaps; Degree of readiness (adopted / not adopted, to be signed, iterative discussion, etc.); Open access to the program in the Internet
4	Activity reporting of a TP for all years of its existence	Being in line with the methodological recommendations for 2011 reports (application), 2012 and 2013 reports
5	Action plan for the future	Being in line with the methodological recommendations; Existence and quality of information: responsible persons,

[12] According to the 2013 joint study of BDO company and Russian Managers Association, short term business strategies (1-3 years or 3-5 years) are the most implemented type of strategies.
In the innovation development programs developed by the 60 SOE the planning horizon averaged 5-7 years, while the MED recommended it to be 10-15 years.

	Evaluation parameter	Indicators/criteria
		timelines, relevancy (rationale)
6	Advancing S&T communications	Participation in international platforms and clusters; Participation in international events: conferences, seminars, fora, symposia, etc.; No. of foreign participants of a TP; Participation in projects with foreign funding; No. of signed international agreements, contracts, etc.; Existence of inter-platform projects with the Russian TPs
7	Interaction of a platform's participants with other organizations	Interaction with the federal executive authorities; Suggestions formed to the research agenda of the federal programs for funding R&D; Interaction with the development institutions; Participation of large companies in a TP; Feedback to the platform coordinator.
8	Interaction with the Russian Foundation for Technological Development (R&D funding)	The only development institution so far which funds projects at R&D stage. Russian Foundation for Technological Development information about loans, applications, etc from TPs.
9	Development of information materials	Russian Foundation for Technological Development information
10	Promotion of a TP	Russian Foundation for Technological Development information

According to this evaluation the best performing TPs are 'Medicine of the future', 'Innovative lazer, optical and optoelectronic technologies – photonics' and 'Light and robust constructions'. The platforms that are performing above the average level are 'Advanced processing of hydrocarbon resources', 'Technologies of mechatronics, integrated management systems, radiofrequency identification and robot industry', 'Prospective technologies of renewable energy', 'Environmentally clean effective thermal energy', 'Radiological technologies', 'Navigator information system', 'Aviation mobility and aviation technologies', 'National software platform', 'Bioenergy' and 'Biotech-2030'.

Conclusion

The Russian TPs were created in a wide array of research fields and the Russian government will face the challenge to make a decision about which of platforms (or projects) to support financially. Intermediate results of TPs performance testify a considerable divergence in platforms' activity level and performance quality. While some platforms mostly perform communication functions for their diverse membership, others are advancing large-scale R&D projects. It may happen that the least performing TPs will lose their status and support from MED, evolving into different types of structures and networks. Some of the remaining ones will have to be aided to advance better.

Having reviewed the STI support instruments for the Russian platforms, we observe that both may be grouped into direct (i.e. funding) and indirect support instruments depending on the feasibility of outcomes in the form of a new technology or product.

SOE are often spending own resources for R&D projects identified by TPs to which they belong. It remains to be seen to what extent SOE are eligible for extra public funding. At the same time the very fact of establishing platforms in such sensitive areas as space or nuclear technology, will allow the monopoly companies to tap on tacit and codified knowledge offered by external sources.

As noted, the financial instruments for public support of platforms are still being fine-tuned and the proposed categorization of platforms by the risk level may be a first step in this direction. Special funding options are projected in Russia (similarly, they are made available in Europe) for research programs of those technology platforms that are ready to deliver a technology/product in a short to medium term perspective. Like in Europe, the Russian government actors are supportive of platforms with high business involvement, but only at the stage of strategy-making, and step down when it comes to implementation.

Creation of TPs in today's Russia is widely debated among policy-makers and innovation stakeholders (see for ex. Gorbatova, 2013; Schraer, 2011; Goland, 2013). Arguably, TPs are seen by Russian policy-makers as an important mechanism of a well-functioning innovation system. Although policy-makers initiated the creation of platforms, much hope is attributed to interest and the support from private sector organizations involved (TPs with high business intensity). It is also dependent on the structure and operating mode of the platforms. How smoothly will platforms fit in the STI policy framework in the mid-term perspective? Will the platforms allow for all stakeholders to be involved and contribute? How fast will TPs membership grow and how will those with large membership organize the decision-making process? Responses to these questions remain to be identified in future research.

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