

Could Russia become innovative? Coordinating key actors of the innovation system

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Since the beginning of the 2000's, policymakers in Russia have emphasized the need for modernisation of the economy. Within the large scope of this notion, technological upgrading occupies a prominent place: it is assumed that without a breakthrough in some key technologies, the ability of the Russian economy to raise decisively its productivity level will not be sustained.

In November 2008, the government of the Russian Federation issued a long-term programme of economic and social development policies coined "2020 strategy". This programme set up the framework for discussions that have been held since then among top political leaders and scholars about the measures needed to re-shape the Russian economic structure and diminish its oil and gas dependency. In the "2020 Strategy", research and development (R&D) and innovation are given top priority. For the authors, that the economy won't be able to experience again the 1999-2008 rates of growth (7,5% a year) without shifting from a low-tech, resource-intensive economic model to a resource-sparing, innovative one (Mau, 2011).

An interesting, albeit puzzling question is whether this aim is achievable given the current institutional framework of Russia. In this article we intend to focus on some key parts of the Russian innovation system. Our approach of the innovation system is derived from the National Innovation System (NIS) theoretical framework developed by Lundvall (2010), Nelson (1993) and Freeman (1995) within an evolutionary perspective. According to their definition, a NIS is constituted by five types of elements and their interactions: the public sector, private firms and their organisational structure, inter-firms relationships, institutional set-up of the financial sector, and the intensity and organisation of R&D activities (Lundvall, 2010, p. 14). We intend to focus on the relationships between the state and industrial enterprises, from the research to the commercialization phases of the innovation process. How did Russian firms adapt their R&D activity during the past decades? What kind of relationships emerged between private and public sectors regarding innovation? What was the outcome, in terms of organisation and results, of these relations? What are the means chosen by Russian authorities to improve the efficiency of the current innovation system in Russia? In tackling these questions, we will support the view that, beyond top-down planning, subsidies and fiscal incentives, an important – and so far overlooked - task of the State is to build up coordinating devices that can be used as public goods by all the actors of the innovation system to elaborate long-term cooperation projects.

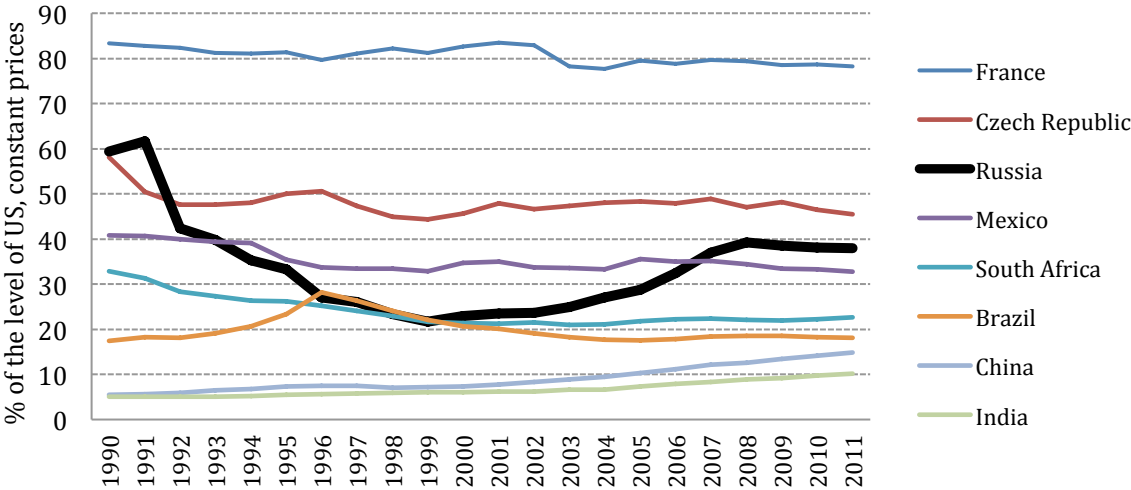
The first section underlines the institutional set-up and the main resources available for innovation in the Russian industrial sector. The second section scrutinizes the way actors of the innovation system use these resources to innovate. The third section sums

up the results of R&D activities at the level of industrial enterprises in Russia. The fourth section provides an assessment of the coordination tasks performed by the State.

1. Innovation in Russia: main resources and institutional framework

The 2009 crisis has ended an exceptional period of growth for Russia. During the 1999-2008 period, after having suffered an economic collapse following the “shock therapy” that culminated with a financial crisis in 1998, the Russian economy enjoyed the briskest recovery in its history. Productivity, measured as GDP per worker, increased to reach a level of approximately 40% of the United States. But the international financial crisis hit badly the Russian economy, breaking the catching up dynamics (Graph 1).

Graph 1. Evolution of apparent labour productivity in selected countries (1990-2011, in % of the level of the United States)



Source: author’s calculations based on PennWorld database N°8/2012

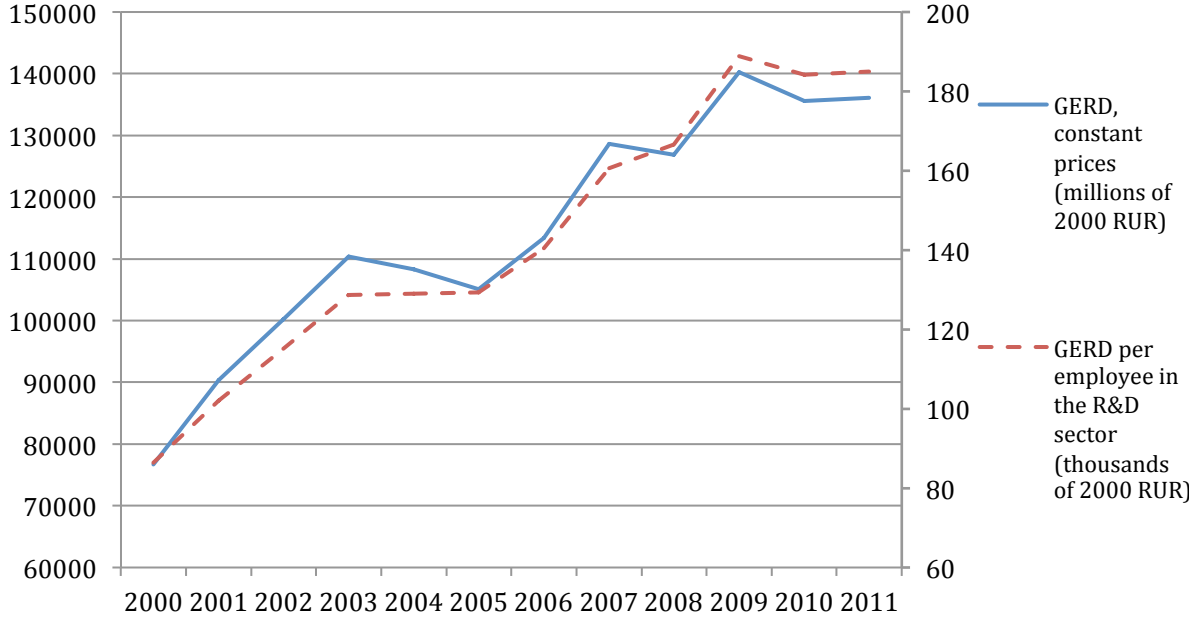
Economic links between innovation and productivity have long been documented. In Russia, empirical studies show that innovative enterprises are significantly more productive than the others (Kuznetsov *et alii*, 2011). As for the rest of the economy, the Russian R&D network experienced an unprecedented turmoil during the first decade of systemic transition (1991-1999). Public funding for education, science and technology plummeted, without being relayed by private funds. Only foreign NGOs, private enterprises and foundations step up in Russia to sustain the R&D effort at this time. During 1991-1994, the drop of R&D expenses reached 80% (Graham, 2008, p. 19). At the same time, a brain drain occurred at the expense of research centres and universities: some of the best researchers were hired by western universities, and the vast majority of those who left laboratories turned to business activities in a context of dwindling real wages of civil servants. The number of scientific researchers officially registered in Russia fell by 65% between 1991 and 1994. It continued to decrease till 1999.

Resources: lots of people, but not much capital

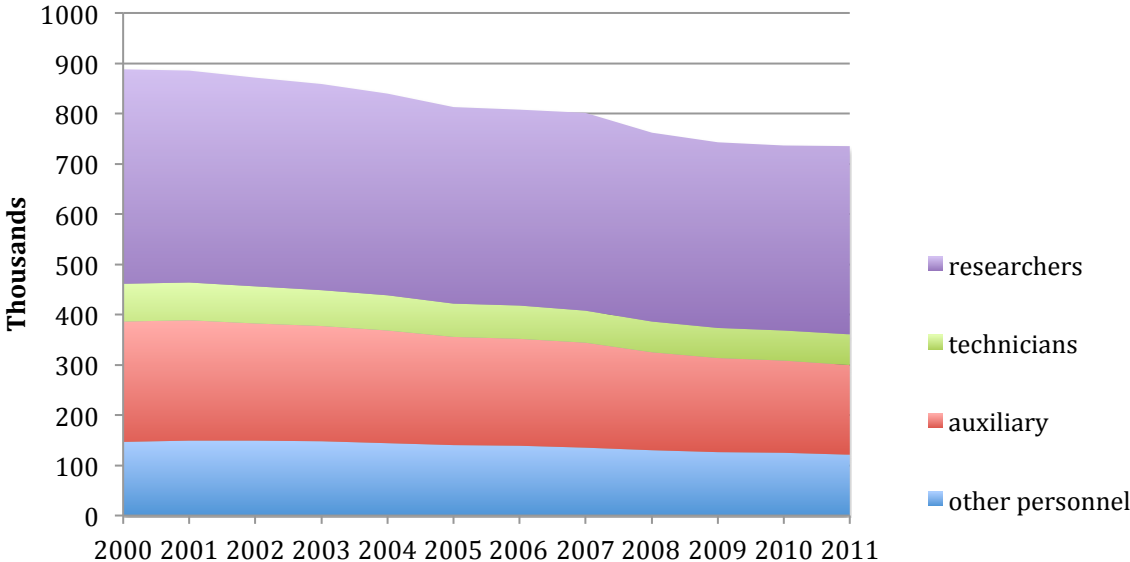
From 1999 onwards, the free fall of financial resources to public laboratories and universities came to an end, thanks to economic recovery. The share of public financing

in Gross domestic Expenditures in Research and Development (GERD) increased anew – but not the number of employees in the R&D sector (Graphs 2 & 3). One of the main drivers of growth was the military budget.

Graph 2. Gross Expenditures in the R&D sector (GERD), constant prices, 2000-2011



Graph 3. Number of employees in the R&D sector, 2000-2011



During the 2000's, Russia has not done so badly in international comparison. With more than 375,000 people in 2008, the number of researchers per million inhabitants is still more than three times more elevated than in China, Brazil, Turkey or South Africa and

remains at the level of many OCDE countries. R&D expenditures relative to GDP are not much smaller than in these countries, standing at the level of Italy (OECD, 2011). However, their absolute amount still represents only 8,4% of the US, 17% of China, 24% of Japan and 59% of South Korea in 2011 (OECD, 2013). More than the public/private balance in the funding of R&D, clearly in the favour of the former due to the soviet legacy, two distinctive characters of the Russian system are worthwhile to be noted: first, the contribution of industry to R&D is only of 0,3% of the GDP, against 1,4% for the average OECD countries (OECD, 2013); second, the affectation by type of costs of GERD in Russia is distorted toward salaries and current expenses, to the detriment of investments. The latters represent less than 5% of the total expenditures (9% in France and Japan, 21% in China) (OECD, 2011, p. 106-107). This structural distortion of expenditures is not favourable to a catching-up dynamics.

R&D's changing formal institutional framework

Since 2000, the institutional framework surrounding R&D activity in Russia has changed significantly. Spontaneous transformations as well as policies reshaped the landscape of R&D. As regards only public regulation, about thirty initiatives were undertaken, aiming at making the environment more conducive to innovation (see Box1). Alongside long-term projects, trying to plan favourable conditions for innovation in targeted sectors (Box1: 2002a, 2003c, 2007a, 2008a, 2011a, 2011c, 2012a, 2012b), Russian authorities created public institutions designed to channel specific funding or implementation tasks (Box1: 2000, 2002b, 2004, 2006b, 2006c, 2006d, 2007b, 2009d, 2010b, 2010c, 2010e).

Meanwhile, the legislative corpus was reformed in order to streamline the regulation environment of R&D and intellectual property rights. Some of these changes followed suggestions from international organizations that Russian authorities wish to enter (WTO and OECD. Box1, 2008b): for instance, since 2009 the exclusive rights of intellectual property, including scientific research, created under a state contract, belong to the performer if not stated diversely (Vaziakova *et alii*, 2011). The reform of IPR regulation has been hailed by international organizations, notably EBRD (EBRD, 2012).

Box 1. Institutional building and Policies in the R&D field, 2000-2010

- 2000: creation of the “Science City” status
- 2002a: First Federal Target Programme (2002-2006); “Science and Technology Development Guidelines until 2010 and beyond”
- 2002b: Creation of the Russian Technology Transfer Network (2002-2006)
- 2003a: Fasie (Foundation for Assistance to Small Innovative Enterprises) Start programme
- 2003b: Innovative Mega Projects
- 2003c: “Main Guidelines of the Public Policy in Science and Technology”
- 2004: Restructuring plan of R&D public organisations (2004-2008)
- 2006a: Presidential priorities for innovation and critical technologies list
- 2006b: Federal programme for high-tech clusters (“Teknoparks”)
- 2006c: Creation of the Russian Venture Company and 19 Regional Venture Funds
- 2006d: Creation of the OJSC “SEZ” to develop Special Economic Zones
- 2007a: Second Federal Target Programme (2007-2012): innovation initiatives in higher education
- 2007b: Creation of State corporations: in high tech sectors, *Rosnano, Rostekhnologii, Rosatom*
- 2008a: Publication of the *Long Term Economic Development Plan (“Strategy 2020”)*
- 2008b: Restructuring of IPR Legislation and Tax treatment of R&D, Patenting activities
- 2008c: Creation of the status of National Research Center
- 2009a: Presidential Commission for Modernization and Technological Development
- 2009b: Creation of the status of Regional University (7 universities granted) and National Research University (14 universities granted)
- 2009c: Restructuring of the financing of the Russian Academy of Science
- 2009d: Launching of the high-tech compartment of MICEX
- 2010a: 15 new universities are labelled National Research University
- 2010b: Creation of “Technology Platforms”
- 2010c: Launching of the Skolkovo Project
- 2010d: Restructuring of the Governmental Commission on High Technology and Innovation
- 2010e: Creation of the Russian Defence Innovative Projects Agency
- 2011a: *Program of development of innovation in the machine-building sector*
- 2011b: Publication of the *Governmental Development Scenario for the Russian Economy until 2030*
- 2011c: Publication of the *Governmental Strategy for the Development of Innovation in Russia until 2020*
- 2012a: Government’s long term *Program for Shipbuilding development*
- 2012b: Government’s approbation of environmental program until 2020

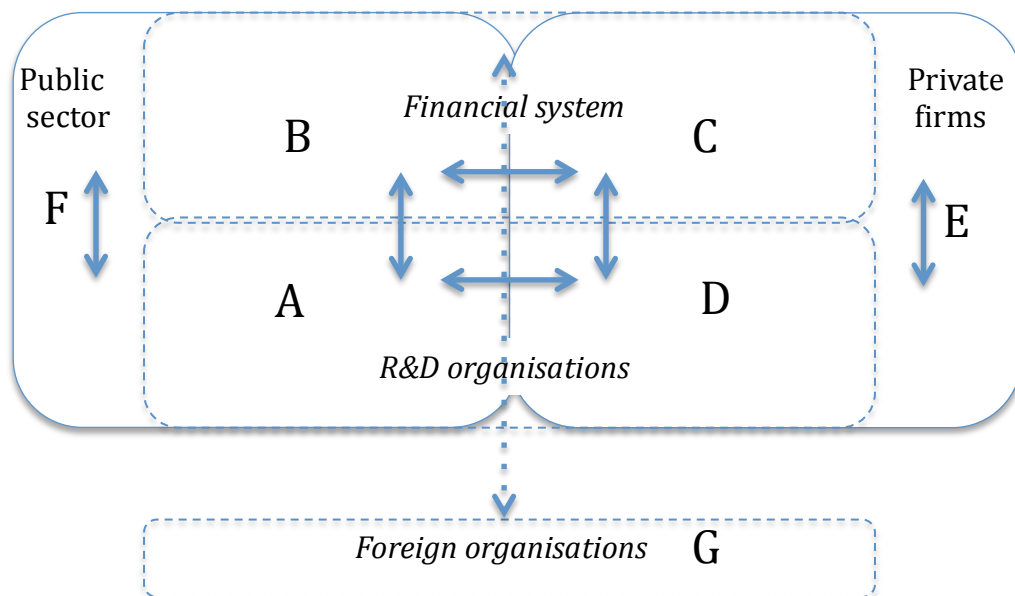
Sources: Bofit (2010-2013), OECD (2011), Government of the Russian Federation (2011).

In the research side of the innovation system, institutional reforms targeted academic institutions that developed awkwardly during the 1990’s. In March 2004 the Russian Academy of Science, former industrial branches research laboratories and universities were gathered under a unique ministerial authority - the Ministry of Education and Science. In 2008 the government launched a profound re-organization of the public universities by granting special status to a small number of them considered as the most efficient (Box1: 2009b), with the implicit threat, for the others, that subsidies could dwindle and accreditations could cease if their wouldn’t improve their performances (Kastoueva-Jean, 2012).

2. Key actors of the current innovation system in Russia

How innovation actors reacted to changes introduced in their environment? Following the Lundvall-Freeman-Nelson approach, we will distinguish public R&D institutions (Fig.1, A), financing networks (B & C) and industrial organizations (D & E). However, we will add to their conceptual framework the linkages established with foreign organizations (G), be there in the scientific, financial or productive sphere.

Fig. 1. A Lundvall-type Model of Innovation System



Source: author's elaboration based on Lundvall (2010), p. 14.

Research and higher education institutions (Fig. 1a - A, D)

An exhaustive inventory of organizations of the scientific and technological complex was conducted between 2006 and 2008, studying over 3666 organizations performing R&D activities. Among them, 45% were public, accounting for 28,7% of total employees and 34,7% of researchers (Kitova, 2010, p. 44).



**Table 1. Age structure of the personnel of the R&D sphere
(% of total)**

Age (years)	<29	30-39	40-49	50-59	60-69	>70
All Russia	17,7	13,6	17,5	26,7	17,1	7,2
Public (Federal) institutions	14	15,4	17,5	25	18,2	9,9
Enterprises	18,8	11,3	16,9	28,2	18,1	6,7

Source: Kitova (2010), p. 47

**Table 2. Age structure of the scientific equipment
in public R&D organizations (% of total)**

Age (years)	<1	1-2	3-5	6-10	11-20	>20
All equipment	12,1	16,5	28,6	17,7	13	12,1
Information and communication equipment	11,9	20,1	32,7	21,6	9,2	4,5

Source: Kitova, (2010), p. 48

During the first decade of transition in Russia, vocations for scientific careers in public institutions have been discouraged by the disarray of the scientific and technical complex. The situation has improved somewhat after 2000, thanks to an effort in recruitment. But the age pyramid remains distorted: 51% of the R&D personnel are more than 50 years old (Table 1). Another characteristic of public laboratories is their lack of modern equipment. This situation contributes to explain why young, talented scientists have long preferred to escape from a career in the public research system (Table 2). In addition, some scholars insist on the permanence of some inherited behaviours within public research institutions: at the local level, chiefs of laboratories continue, as in soviet times, to allocate resources without any regard to the performances of the research teams (Milard, 2008). The poor governance of certain laboratories may also nurture incentives for young talent to emigrate and contributes to explain the difficulties for Russian laboratories to hire skilled personnel from abroad (EBRD, 2012).

Financing system (Fig. 1 - B, C)

In 2007, the Russian Government established two financing institutions designed to foster innovation, notably through new enterprises: the *Russian Venture Company (RVC)*, a fund of funds, and *Rosnano*. These two funds invested mainly in manufacturing (nanomaterials, nanomedicine, nanophotonics), infrastructure (Kazan, Zelenograd, Ulyanovsk, Troitsk, Tomsk, Novosibirsk, Yekaterinburg), educational programmes (among which for training), and joint ventures (EBRD, 2012, p. 86).

Relevant financing schemes vary with the enterprise's size and the stage of the activity in the innovation process. In large companies, where innovation adopts a routine form, internal funds remain the main financing source. By contrast, in the early stages of technological development of small enterprises, when invention is becoming innovation, - the "seed" and "start-up" stages -, banks cannot play a decisive role since they are not able to monitor effectively the risks and rewards associated with these stages and can be hampered by their equity holding limitations. Therefore, main funding can be found

in government and foundation grants, angel investors alongside with internal resources (Vazyakova *et alii*, 2011, p. 31, EBRD, 2012, p. 80). In Russia, as far as grants are concerned, 133 millions of US \$ were distributed in 2012 for 655 projects, mainly by *Skolkovo* and *Bortnik* foundations¹ (PricewaterhouseCoopers, 2012). In developing countries, due to the lack of private investors, the problem of funding encountered by firms is more acute than in developed economies. Consequently, public funding is essential in order to buttress the take-off of the innovative sector.

Venture capital is also considered as appropriate in early stages of innovation activity since venture firms are used to invest in monitoring and information gathering, which are both essential to keep projects on tracks. In most emerging countries, equity markets are too narrow to offer clear exit possibilities for investors. In Russia, even if the venture capital market is growing fast, it is still expecting the first “big exit”, paving the way for future IPOs.

Consequently, public investment in privately managed funds can be seen as a useful mean to grow a local venture capital industry (Lenshuk and Vlaskin, 2006, EBRD 2012). In Russia, several private corporations created their venture capital fund in the early 2000's². In 2012, more than 200 publicly disclosed financing operations were conducted with the help of venture funds, totalling more than 900 millions US \$ (RVC, 2013) (Table 5). Key investors are *RVC Seed Investment Funds* (18 project financed, 17 Mns US \$) and the Foundation for the Promotion of Small Enterprises in Science and Technology (*FASIE*). Entitled with a budget of 1,5% of the total R&D public budget, *FASIE* is currently accompanying 2500 innovation companies and 2000 individual scientists, supporting to the creation of 500-550 companies a year, with a survival rate of 5%. Its results have been considered as fairly positive by international observers so far (EBRD, 2012, RVC, 2013). According to a survey of 100 large companies conducted in may 2010, 87% of respondents funded their research from own sources, 18% used funds provided by state (*RVC, Rosnano*), 10% foreign investment (PricewaterhouseCoopers, 2010, p. 19). There is a debate about the necessity for the state to commit itself to sell its participations in RVC and FASIE – an EBRD recommendation (EBRD, 2012, p. 88).

¹ The corresponding amounts were 24,4 millions US \$ in 556 grants and 108,3 millions US \$ in 87 grants, respectively.

² *Alfa-Group* - 20-million dollar venture fund, 2003; *Leading, Technsnabexport* and *VCIF* - 11-million venture fun, 2003; *Optima* - 7,5 millions investment fund, 2003; *Aerospace Equipment Corporation* and *VCIF* - 10 millions \$ fund dedicated to the Aerospace and Defence Industry, 2004.

Table 5. Venture capital market in Russia in 2012

	Seed	Start-up	Early growth	Expansion
Description of the stage	A concept, but no product, work in progress for a prototype	Pilot version for the product, testing under way	Product ready - demand is being tested	Product available on the market - demand growth is being measured
Total funding (Mns \$)	37,5	100	255,4	517,7
Average funding by deal (Mn \$)	0,4	1,4	8,0	37,0

Sources: RVC (2013), PricewaterhouseCoopers (2012)

From what precedes, it appears that the first stages of technological development in Russian begin to be addressed by existing financing schemes, be they public (grants) or private (venture capital). It remains to be seen how the following stages (commercialization and development) could benefit from both financial and institutional favourable conditions. An insight into the Russian industrial network provides an answer to this question.

Industrial enterprises (Fig. 1 - E)

Technological innovation in industry differs significantly between advanced and transition countries along one dimension: the share of intramural R&D activities in total R&D expenditures. In general, intramural and acquisition of machinery and equipment appears to be more substitutable than complementary in industrial R&D expenditures, explaining the emergence of two models of behaviour in innovative firms:

- In the first model (France, Germany, Austria, Netherland), expenses are predominantly intramural: no less than 50% of total R&D budget serves to financing inner R&D tasks, purchase of equipment doesn't represent more than 35% of the total.
- In the second model, R&D is conducted mainly by importing from other firms (being either national or foreign) ready-made equipment and machinery. Russia belongs to this group. In Lithuania, Czech Republic, Poland and Russia, not less than 50 % of this budget is devoted to the purchase of equipment and machinery (Russia: around 55 %) whereas intramural R&D doesn't represent more than 22% of the R&D budget (in Russia, around 15%).
- Italy is somewhere between these two models: intramural expenditures represent 41% of total R&D, while acquisition of machinery and equipment absorbs 47% (Gokhberg and Roudy, 2012).

Russian observers regret that Russian private businesses tend to buy foreign technologies rather than investing in intra-mural R&D (Varshavskiy *et alii*, 2006, p. 11). According to Gokhberg *and alii* (2008, p. 52), only 8% of Russian enterprises undertake

mainly intramural R&D, accounting for 3,5 % of total employment and 8,4% of total exports. The 2011-2012 BEEPS survey confirms this picture of a lagging private sector in terms of innovation: 20% of manufacturing firms carry some form of R&D. According to OCDE estimates, innovative SMEs in Russia account for a mere 2 % of the total SME population (OCDE, 2011). In addition, private enterprises rarely formalize their innovation strategy: on a random sample of 250 Russian enterprises, 24% do not mention having any innovation strategy and 51% state that innovation strategy exists only in top manager's mind. Only 25% of them formally document their innovation strategy (Prazdnichnykh and Liutho, 2010, p. 6-7).

Russia displays specific structural characteristics, arising from its soviet legacy: the vast majority of R&D expenditures of business enterprises are financed by government sources, whereas in western developed countries this source is considerably smaller. During soviet times, industrial branch research institutes operated separately from the production segments of their branches. During the nineties, they were split in smaller research centres, but not privatised. Therefore, in 2008 almost 75% of R&D institutes were state owned – more than half of them being linked to the defence sector -, owing 88% of R&D fixed assets, and realizing the bulk of enterprises' R&D without depending organically on them (OECD, 2011, p. 56 and 104-105). Government agencies conduct in reality much of the R&D activities of the business sector and company level spending on R&D represents less than 9% of the total (EBRD, 2012).

With an industrial structure characterized by the domination of domestic markets by large firms, the Russian economy does not appear to be well prepared for the development of a vibrant ecosystem of small, innovative enterprises. In 2004, 15 to 30% of large and medium size companies were considered as innovative (Gurkov, 2004). A more comprehensive study conducted in 2006 found that R&D activity was carried by 2490 industrial enterprises in Russia, that is 9,4% of their total number (Gokhberg *and alii*, 2008). Main Russian companies invest 0,2% of their revenues in R&D, whereas the figure is 2-3% on average in foreign companies – not to compare with technological leaders, in which it is 3,5% (RVC, 2013, p. 32).

Internationalisation? (Fig. 1 - G)

Innovation is often associated with internationalisation. Developing relations with foreign markets and foreign capital may help modernising Russian firms in some cases, but not in all circumstances (Vazyakova *et alii* 2011, p. 65). While internationalization is a factor statistically associated with various indicators of innovation (PricewaterhouseCoopers, p. 15) and while foreign direct investments (FDI) are often presented as facilitators of technology absorption (Vazyakova *et alii*, 2011, p. 57), there is no decisive indication that the causality between internationalisation and innovation is going in a direction or another. In addition, in Russia large export-oriented companies in Russia cannot be seen as “innovative locomotives for the business networks assembled around them” (Lenchuk and Vlaskin, 2006, p. 36).

Nevertheless, commentators often insist on the necessity of closer cooperation between Russian and foreign companies. Among Russian big and middle-sized enterprises, less than half are involved in technological cooperation with foreign partners. Products and services upgrading, new products and services development, new production processes

design, are the main fields of cooperation. Main foreign partners are Germany (36% of responses of a study conducted in 2009), United States (23%) and China (16%). 10% of those cooperation projects involve CIS countries (Prazdnichnykh and Liuhto, 2010, p. 19).

In fact, it seems that the only factor that can be considered as determinant for the innovation behaviour of firms is their level of technological achievement: in a recent empirical study conducted on Russian firms, the level of technology in manufacturing industry is a good predictor of the attitude of the management regarding cooperative R&D tasks, dissemination of technology, attention paid to intra- and extra-organizational sources of information as stimuli for technological innovation: the higher is the technology, the most important it is for managers to gather technological information and disseminate it in their ecosystem (Gokhberg *and alii*, 2008, p. 48).

3. Achievements: how Russian industrial enterprises compare to foreign in terms of innovation?

Among the 1000 biggest firms in the world according to their R&D expenditures, only three are Russian³. Russia industrial enterprises are poorly evaluated in world rankings of achievements regarding R&D. Some studies provide a picture of the perceived degree of innovation in Russian production system. According to a survey of more than 600 Russian industrial enterprises of all sizes, 47% did not produce any innovative product in 2010. Among the others, 37% declared producing products new to the enterprise, 15% new to Russia, and 2% new to the world (Simachev *and alii*, 2012, p. 12). In another survey conducted among 100 large Russian companies, 50% considered their technologies as similar with those of their direct competitors or global leaders, 33% declared them in advance when compared to their Russian-based competitors, 18% thought they were slightly or significantly behind. The proportion was of 39% and 10% respectively when compared to global leaders (PricewaterhouseCoopers, 2010). Innovation is associated with higher productivity: enterprises that consider to be above the national level of technology exhibit productivity levels 45 % higher than the national average (Kusnetsov *et alii*, 2011, p. 375). Innovation is also associated with higher expectations for the future: innovating firms tend to expect significantly stronger sales growth than non-innovating ones (EBRD, 2012, p. 71).

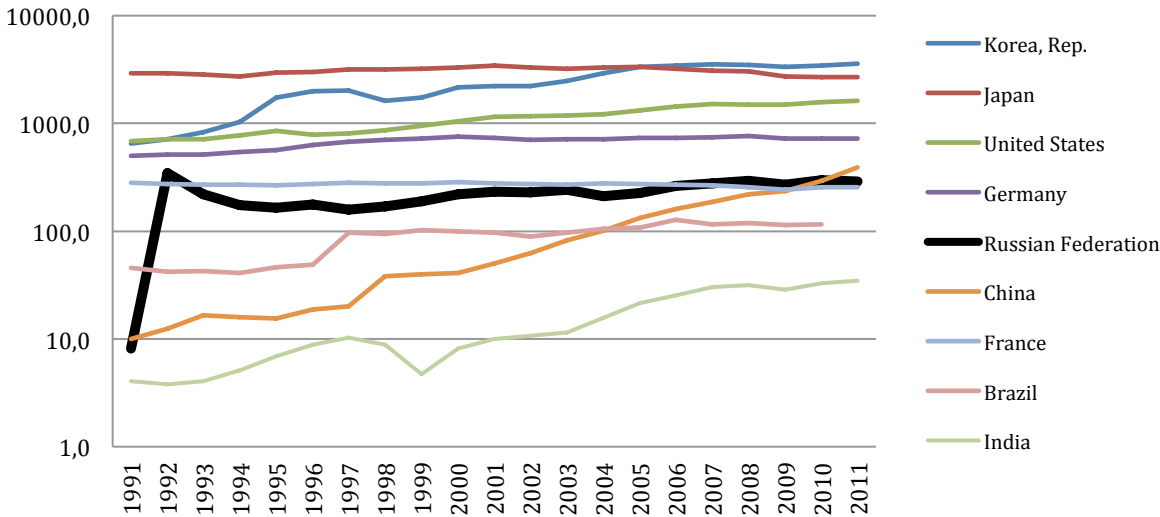
When asked about their immediate business environment, companies' leaders are typically less optimistic: 52% of them think that the average technological level in their industry is lagging behind global leaders, 39% that it is on a par with them. The assessment for the entire Russian economy is even less favourable: for 61 % of them, the level of innovation in the Russian economy is slightly or significantly behind global leaders. Besides, technologically advanced companies are often foreign companies: among the first 13 US patenting enterprises based in Russia, 12 are not Russian (Vazyakova *et alii*, 2011, p. 51). Those figures can be confronted with the World Competitiveness Report, which interviewed 708 business leaders in Russia in 2012 and 2013. Businessmen's assessments over Russia's innovation system are severe. According to the innovation criteria selected for the survey, Russia's best rank is 64th

³ Gazprom (108th, with a R&D budget of 0,6% of its turnover), Avtovaz (758th, 0,8%), Sitronics (868th, 18%).

among 148 countries. Technology transfers via FDI, company-level technology absorption and production processes, the role of government procurements in fostering innovation are particularly badly evaluated. Education, scientific research institutions and general innovation capacities of firms are considered to be in a better situation (World Economic Forum, 2013).

These aggregated subjective evaluations are flawed with obvious limitations, especially blatant when the results are compared with inter-subjective evaluations in other countries, as it is done in the GCI methodology. Cultural bias can explain much of inter-countries discrepancies observed through this kind of soft data collection. How do these results fit with more objective measurements? As the performance of an innovation system is typically of a multi-dimensional nature, it is not easy to define any satisfactory measure that would depend upon a single indicator. Patents and exports of high value added products are often used to evaluate the output of innovation activity. Comparing Russia with developed and emerging countries on this basis can bring some useful information.

Graph 4. Patents applications by residents and non-residents per 1 million habitants in selected countries, 1991-2011 (logarithmic scale)



Source: World Development Indicators, author's calculations.

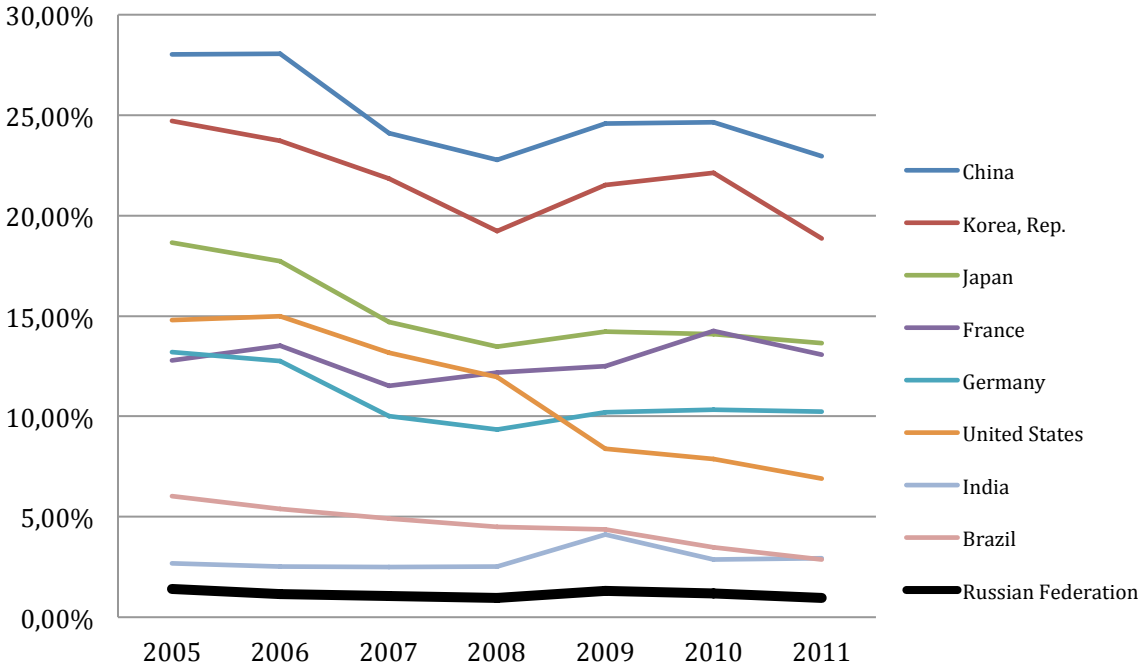
With more than 40,000 patents applications in 2011, Russia registers as many patents per inhabitant as France or China, and far much more than Brazil or India. After a brisk growth following the collapse of the soviet regime, the patents application dynamics declined during the great depression, before recovering again (Graph 4). However, compared to India or China the growth of patent applications in Russia is slower. Moreover, the total number of patents in 2012 represents still one-tenth of their number in the United States or China.

Outside the Russian territory, patenting activities of enterprises registered in Russia are also growing, but remain modest in international comparison. Between 2004 and 2009, the number of patent applications to the European Patent Office (EPO) by Russian organisms has grown yearly by less than 1% (4,2% for India, 25,7% for China). Consequently, Russia's share in total EU-27 patents has not increased in the period,

representing under 0,5% of the total. By contrast, during this period the share of China climbed from 1,7 to 5,3% and India crossed the 1% threshold. In addition, in Russia the business sector contributes only to 56% of patent applications, whereas the proportion is 91% for the United States, 86% for China, 82% for France. The share of foreign enterprises in Russian-based applications to the EPO is also considerably higher than in other countries (54% in 2007 against 22% for France, 18% for Germany, 3% for Japan) (Eurostat, 2012). Russian enterprises contribute to about 100 patents over a total of almost 60000 that are registered yearly in the European Union.

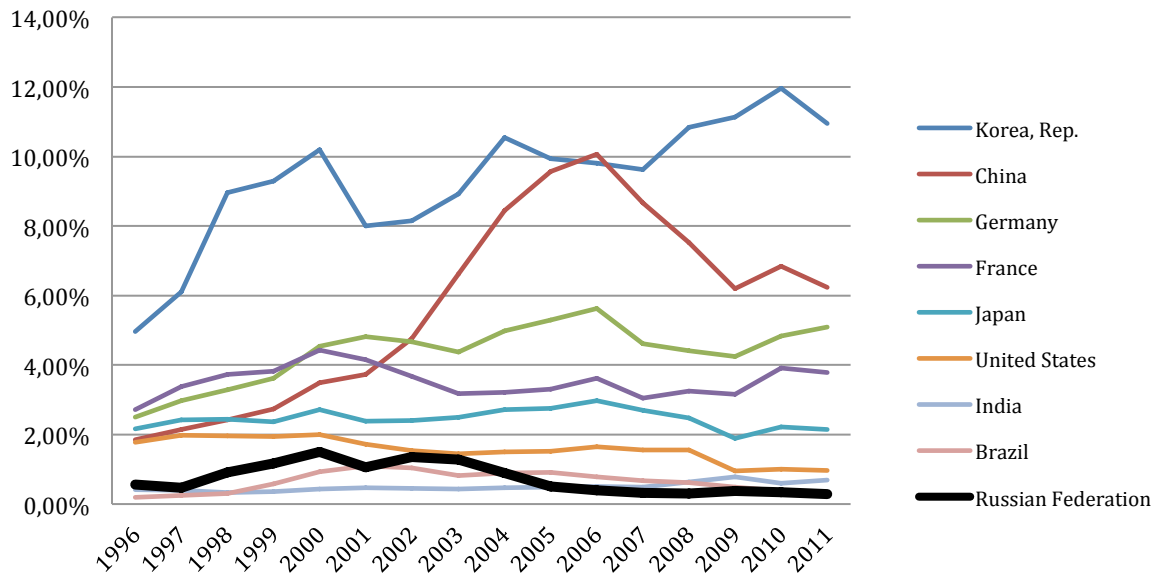
When it comes to commercialization of technology, the results are not better. Russia is 28th high-tech exporter in the world in 2011, exporting less than 0,3% of the world total high-tech products, whereas China accounts for almost 25%, and France, 5,5%. Since 1996 its ranking has not improved (Russia was 26th at this time) and the average growth rate of high-tech exports has been slower than for its counterparts of the BRIC. Due to its specialization in energy, the share of high tech products in total exports is the smallest among BRIC countries (Graph 5). The same is true for the high-tech exports intensity of GDP, which displays a steady decline since 2002 (Graph 6).

Graph 5. Share of high-tech exports in total exports for selected countries, 2005-2011



Source: World Development Indicators, author's calculations

Graph 6. High-Tech Export Intensity relative to GDP for selected countries, 1996-2011



Source: World Development Indicators, author's calculations

In spite of notable transformations of the institutional framework of R&D activity, and notwithstanding considerable amount of resources devoted to innovation in the country, economic and commercial performances of the Russian industry are still lagging far behind its main competitors. In the last section of this paper, we try to show that part of the explanation of this paradox lies in the current role of the state in the Russian innovation system.

4. Coordinating actors' strategies: a Russian policy dilemma (Fig. 1 - F)

Confronted with disappointing results in the R&D field, policymakers adopted progressively an extensive vision of the state's role, ranging from the definition of main objectives and priorities, to the building of key institutions whose mission is to give decisive impulsions in targeted sectors. Problems arise in this policy when it induces inconsistent incentives without reducing the uncertainty of R&D activity for innovative actors.

Defining the ends

Observers vary in attributing to the authorities one or another preference regarding the methods by which technological improvement should be induced in Russia: some consider that Russian authorities are following a strategy of imitation (Government of Russian Federation, 2011, p. 16), that is rewarding only in the short term but must be completed with the creation of an "innovation system capable of stimulating productivity growth in the long run" (Gianella and Thompson, 2007, p. 9). Others state on the contrary that Russia's innovation policy has aimed, to date, "not just at the imitation or adaptation of technology, but also at the development of cutting-edge technology with the aid of funding and other support for R&D" (EBRD, 2012, p. 80). Meanwhile, the government of the Russian Federation has tried to clarify the main

objectives of its policy by publishing its “Innovative Russia 2020” program. Table 6 summarizes and classifies these objectives.

Table 6: Key objectives and key means of technological modernisation policies

	Typical objectives	Means
Science policy	Production of scientific knowledge	Grants, public institutes activity, fiscal advantages for firms, defence of IPR
Technological policy	Development of technological level and potential of sectors	State purchases, subsidies, cooperation, standards, previsions and framework
Innovation policy	Improvement of level and results of innovative activity	Competition policy, legislation of business activity, regional and sectorial clusters, defence of users, ecological regulation, prevision

Source: Gokhberg *et alii*, 2008.

In the field of horizontal policies aiming at building an environment conducive to innovation, competition policy, regulation of markets, sectors and technologies, intellectual property rights, tax incentives for innovation, investment climate and engineers formation are given priority. In the field of vertical policies, targets are big firms, priority innovation sectors, new high-tech firms in early stage of development, machine-building companies (Government of the Russian Federation, 2011). Among the “economic tasks” listed by then-Prime Minister V. Putin during its presidential campaign (February 2012), the priorities for 2012-2016 were to raise the competitiveness of infrastructures and industry, to develop the services sector and to modernise the technology by attracting foreign talents and capital⁴. As far as the “imitating versus innovating” debate is concerned, the 2012 EBRD report on the perspectives of diversification of the Russian economy dismisses the assumption that Russia could innovate more through imitation than through the commercialisation of cutting-edge inventions, helped by its population of large, incumbent firms: since large Russian firms are often the successors of soviet firms, “Russian innovation is less likely to emerge in large firms with market power” (EBRD, 2012, p. 68). This statement assumes that the two variants (imitation and innovation) of the modernisation process are realised by different types of actors, but no justification is given to this assumption.

So far, vertical stimulation, targeting specific sectors of a strategic importance, has been the main channel by which Russian authorities implemented their policies, even if the targeted sectors changed during the process of policy definition. When it comes to the building of the organisational vectors of implementation, some priorities disappear, while others appear. As it is shown in Table 7, only two sectors – information and communication technologies, nanotechnologies – have been constantly put forward as priorities since 2006.

⁴ V. Putin, « Economic tasks », February 2012, *Press release of the Russian Government*, <http://www.rusembassy.ca/ru/node/657>

Table 7. The changing list of sectorial priorities (2006-2012)

	25 th of May 2006: Presidential priorities for development of science, technologies and techniques.	2008: "Strategy 2020" report (Gokhberg and alii, 2008, p. 34)	2011: "Innovative Russia" (Government of the R.F., 2011)	2012: V. Putin's "Economic Tasks"	2006-2007: State corporations
Information and Communication Technologies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Nanotechnologies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<i>Rosnanotech</i>
Biotechnologies ("living systems")	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Extractive technologies	<input checked="" type="checkbox"/>				
Energy efficiency	<input checked="" type="checkbox"/>				
Transport	<input checked="" type="checkbox"/>				
Security	<input checked="" type="checkbox"/>				<i>Rostechnologii</i>
Armament	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<i>Rostechnologii</i>
Pharmaceutics				<input checked="" type="checkbox"/>	
Chemicals				<input checked="" type="checkbox"/>	
Composite and non metallic materials				<input checked="" type="checkbox"/>	
Aeronautic and space industry			<input checked="" type="checkbox"/>		<i>OAK</i> (United Aviation Corporation)
Atomic industry			<input checked="" type="checkbox"/>		<i>Rosatom</i>
Shipbuilding industry			<input checked="" type="checkbox"/>		<i>OSK</i> (United Shipbuilding Corporation)
Education services			<input checked="" type="checkbox"/>		

Source: author's elaboration.

In order to monitor the modernisation process, Russian authorities have proposed a list of quantitative indicators that serve also as criteria of success and failures in the implementation of the policy. Table 8 provides the Government's « Innovative Russia » list, published in 2011.

**Table 8. Indicators of realization of the objectives of the
« Innovative Russia 2020 » strategy**

Indicators	2010	2013	2016	2020
Value added of innovative sector (% PIB)	12,7	13,5	15,2	Not less than 17
Coefficient of inventive activity (number of patents issued for inventors in Russia, for 10000 inhabitants)	2,0	2,1	2,3	2,8
Intensity of R&D expenditures in industrial firms (weight of expenditures for innovation in industrial organizations)	1,9 (2009)	1,95	2,0	2,5
Number of national agreements of licencing and user rights for patents	2860	More than 4000	More than 15000	More than 40000
Share of innovative products in industrial exports (%)	5,5 (2009)	8,2	12	15
Value of shipments of products, labour, services linked to nanotechnologies (billions of rubles)	112,1	160	350	600
Share of organizations, realizing technological innovative activities:				
- All organizations:	7,7 (2009)	9,6	15	25
- In industry:	9,4 (2009)	10,8	20	40
- In communication and information technologies	10,1 (2009)	22,1	25	35
Share of industrial organizations realizing innovation in the marketing, organization or technological spheres	11% (2009)	24%	47%	60%
Share of innovative products in the total of industrial products	4,9	7,2	15,4	25
Share of industrial products new to the market (% of total industrial products)	0,4 (2009)	2	5	8
Share of industrial products new to the world (% of total industrial products)	0,03 (2009)	0,04	0,12	0,28
Number of small enterprises implementing a R&D budget	600	1500	2000	4000
Organization having a high speed internet connection (% of total)	56 (2009)	85	95	98
Organizations having a website (in % of total)	24 (2009)	75	80	90

Source: Government of the Russian Federation (2011)

Identifying impediments to innovation: from business actors to policymakers

How do firms react to stimulations emanating from the state? Russian officials complain that their efforts in creating infrastructures for innovation (“technoparks”, business incubators, technology transfers centres, centres for collective use of professional equipment) suffer from under-utilisation by local enterprises (Government of Russian Federation, 2011, p. 20). To a certain extent, business reactions are linked to what they consider as impediments to their development path. These impediments include poor availability of financing (Lenchuk and Vlaskin, 2006, Prazdnichnykh and Liutho, 2010, PricewaterhouseCoopers, 2010), excessive bureaucracy in their administrative environment, insufficient effectiveness of intellectual property protection, shortage of

well educated, well trained employees and managers (Prazdnichnykh and Liutho, 2010, PricewaterhouseCoopers, 2010), and lack of reliable procedures to assess risks and returns of an innovating project (PricewaterhouseCoopers, 2010).

Scholars point other characteristics of the business environment that impair innovation development. Gokhberg and Kuznetsova (2010) are critical about the mass of formal strategic documents that “end up in a list of individual means, that have nothing to do each with another and do not guarantee the expected results” (p. 141). They also point out the short-term horizon for strategic planning within public organizations, trapped in their annual budgetary procedures. Other observers underline institutional and organizational failures: mainly, monopolistic structure of key markets, intra-corporate bureaucratization, and lack of effective innovation policy instruments engaging companies in R&D (Simachev *and alii*, 2012). International organisations and the Russian government provide their own assessment of the key factors prohibiting greater innovation. The Russian government identifies six main problems:

1. Insufficient quality of the business environment, investment climate uncompetitive, unfair competition conditions.
2. Barriers to the diffusion of new technologies throughout the Russian territory, complex and sometimes opaque regulations.
3. Weak capacities of regional bodies to support innovative activities of the local business, to integrate best practices initiated in other regions in terms of innovation policies.
4. Weak ability of enterprises and administration to collaborate in order to implement innovation policies, weak ability of small firms to organise themselves and defend their interests.
5. Insufficient effectiveness of the policy instruments supporting innovation, notably for risk-sharing between private and public sectors and for the linkage between the actors of the innovation process (universities, research centres, small and medium-sized businesses, big firms, business networks).
6. Inexistent mechanisms of detection and discouragement of out-dated initiatives (Government of the Russian Federation, 2011).

International organisations add to this list poor economic institutions, a lagging education system and public R&D activity, the low level of protection of property rights, the difficulty, particularly for smaller companies, to secure financing for their R&D expenditures, and the limited complementary investment (EBRD, 2012, p. 68). One factor often underlined is the poor linkage between domestic and foreign innovative enterprises: “Russia is continuing to miss out on one of the most powerful sources of innovation owing to the relatively limited presence of multinational companies in its economy” (EBRD, 2012, p. 88). But no example of innovation spill overs from foreign to national companies – as one would expect, for instance, in China - are provided to buttress this judgement.

Administration itself may lack coordination mechanisms necessary to avoid incoherence and waste. Budgets devoted to state contracts regarding R&D are disseminated among more than eighty governmental purchasers, depending of twenty federal structures, coordinated by five governmental organs. Therefore, more than one hundred of state structures are involved in the implementation of intellectual property, and in practice,

according to some observers: no one⁵. Another problem is the irregularity of budgetary decisions regarding tenders that can discourage applicants: uncertainty emanating from bureaucracy is still prevalent.

An indirect way to identify the blocking factors of the technological modernisation is to look at the measures expected from the government by companies themselves. Several empirical studies show that the priority of business leaders in this field is to find financial support. Public support via tax incentives, accelerated amortization of scientific fixed assets, and public co-financing are unanimously considered as necessary by Russian firms. Another improvement would concern education and scientific research system: raising quality requirements of higher education institutions, increasing financing of R&D in universities and laboratories. Last type of public support strongly claimed by the business community is of a protecting nature: strengthening technological and industry regulations and intellectual property protection, and protecting national markets from foreign competitors are often cited. It is interesting to note that some of these measures may contradict other long-standing claims of the Russian business community, as WTO accession (Prasdnichnykh and Liuhto, 2010, PricewaterhouseCoopers, 2010, Simachev *and alii*, 2012).

Targets or relations? An insight into the coordinating role of state

As regards R&D, the current dominant conception among Russian authorities about what should be the role of the State is clearly bending toward planning: vertically targeting priority sectors⁶ and institutions, ex-ante allocating funds, strengthening existing – and, if needed, building new - state organizations responsible for technological and industrial development of a whole range of activities are the main answers to the problem of stimulating innovation in Russia. One explicit objective of “innovative Russia” strategy for 2020 is “direct administrative stimulation of large-size companies in the public sector and natural monopolies to create and implement innovation-oriented programs” (RVC, 2013, p. 33). As a result, the 60 largest state-owned enterprises have begun to implement their programs of innovative development. Among them, twenty two programs are directly inspired by four sectorial Governmental programs (Aviation Industry 2013-2025, Ship Building Industry 2013-2030, Electronic Devices and Radio Electronics Industry 2013-2025, Space Program 2013-2020).

In these cases, the state is viewed as a technological development planner at the scale of the country, able to set the stage for the next twenty years for others actors of the economy. For this to be done, experts are solicited in order to find examples of success stories as *Finnmeccanica* in Italy for *Rostekhnologii* for example (RVC, 2013) that could validate the choices made from above. Another illustration of this planning dimension of the innovation policy is the launching of big projects. Several studies conducted in Russia supports the idea that the bigger is the size of the enterprises, the more likely they are to be technologically innovative (Gokhberg, 2008, p. 39, PricewaterhouseCoopers, 2010, p. 17). The decision taken in 2007 to build state corporations in priority sectors was grounded on the idea that merging several middle-sized enterprises would permit to

⁵ Statement by V. Lopatin, director for intellectual property in the State administration, quoted in Gokhberg *et alii*, 2008, p. 76-77.

⁶ Information technology, medical, space and nuclear technologies, nanotechnologies and energy efficiency have received 35% of all public funding (EBRD, 2012).

reach the critical mass synonymous of international competitiveness. Table 9 provides an insight into some public corporations created by the Russian government in high-tech sectors since 2006-2007.

Table 9. The 2006-2007 technology-oriented state corporations

State corporation	Text and date of creation	Main activities	Budget	Other assets
Vnechekonombank	FZ n°82, 17/05/2007	Financing innovative projects	250 bns R	
Rosnanotech	FZ n°139, 9/07/2007	Implementation of Government policy regarding Nanotechnologies and nanoindustry	130 bns R	
Rostechnologii	FZ n°279, 23/11/2007	Support to Russian producer of high-tech productions (civilian and military)	130 bns R	100% stake in Rosoboronexport
Rosatom	FZ n°317, 1/12/2007	Implementation of the Government policy regarding civilian Uranium and Nuclear Industry	1000 bns R	Scientific Laboratories, 10 closed cities, 10 nuclear plants
OAK (United Aviation Corporation)	RF President Decree n°140, 20/02/2006	Maintaining and enhancing the scientific and production potential of the Russian aircraft industry	96,7 bns R	Stakes in "Sukhoi", "Aviaexport", "Ilyushin", "Gagarin", "Sokol", "Chkalov", "Tupolev", "Irkut" companies
OSK (United Shipbuilding Corporation)	RF President Decree, 22/03/2007	Unifying shipbuilding companies of the Russian Federation	2,9 bns R	Stakes in more than 50 regional shipbuilding companies in 2013

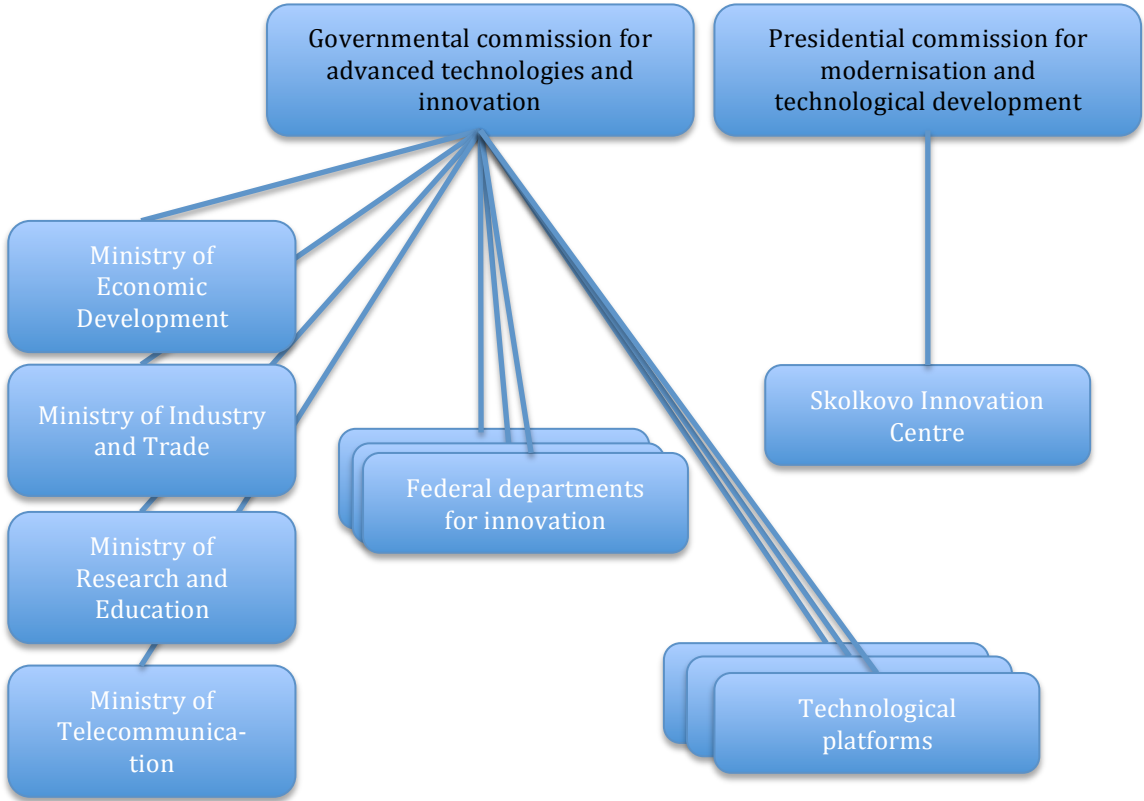
Source: Gokhberg et alii, 2008, p. 99, OAK and OSK official websites, author's elaboration.

The Skolkovo innovation centre is the last example of this "big push" policy. The Skolkovo project is an attempt to create from scratch a large complex of universities, research centres, foundations and innovative industrial enterprises operating together in order to attract foreign talents and capital. Skolkovo, doted with a governmental budget of 3 bns \$ for 2010-2014, is conceived as a special economic zone regrouping five clusters focused on priority technologies (information technologies, energy, nuclear technologies, biomedicines) and hosting the *Sk Tech* institute of science and technology and the *New Economic School*, private economics and management universities. Skolkovo is also considered as a testing field for tax incentives that could be replicated, if successful, in some of the 25 other territories that have been identified to host eventually similar initiatives in Russia (RVC, 2013).

The organizational structure of coordination designed to implement innovation policy is symptomatic of the centralisation of innovation policy in Russia. All administrative services responsible for innovation development depend on a unique governmental commission that monitors four ministries (Economic development, Industry and trade, Research and education, Telecommunications). At the same time, the commission overlooks the development of technological platforms and of federal departments for

innovation development. A special case is made for the Skolkovo Innovation Centre, placed under the exclusive control of a presidential commission for modernisation and technological development (Fig. 2). On this topic, the presidential commission represents a clear challenge for the governmental commission's extensive powers. Since in March 2012 Vladimir Putin came back to the Presidency, its role will probably be extended.

Fig. 2. The Governmental Model for Coordinating the Russian Innovation System

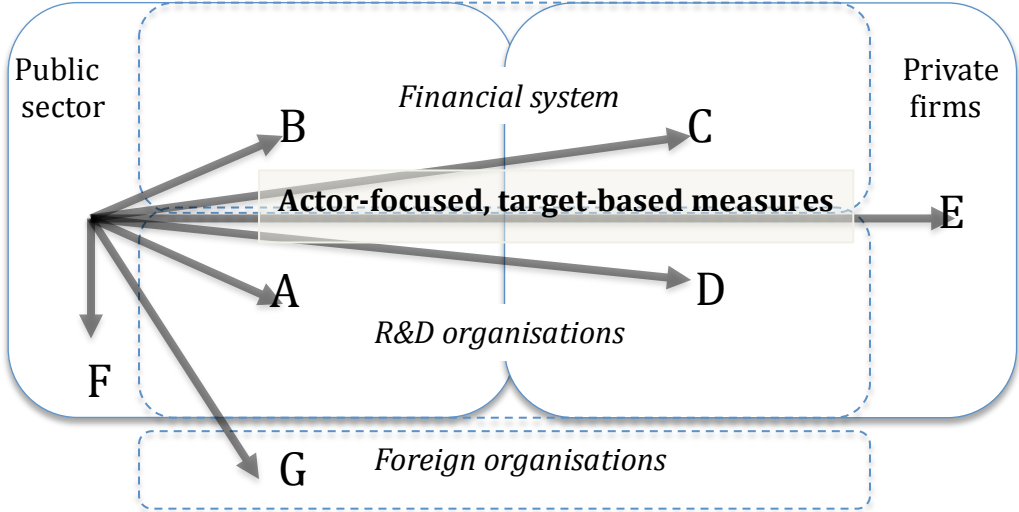


Source: Government of Russian Federation, 2011.

However, favouring national champions and, at the same time, trying to foster the autonomous development of cutting edge, small-sized innovators can be seen, in some case, as contradictory. The risk of selection failures in the administrative work is often underlined (Vaziakova *et alii*, 2011, p. 20, EBRD, 2012, p. 68 and 75-76). Capture of policymakers by national lobbies - and the associated development of corruption -, absence of proper risk-rewards balance for government officials in conceiving and monitoring the implementation of their policies are among the main drawbacks of this strategy. An external audit submitted to the government in December 2011 found that a total of 4% of 2010 budget was spent in subsidies for state-owned enterprises, up from 1,7% in 2006. Part of the explanation of this sudden increase lies in the anti-crisis policy: the peak was reached in 2009, with subsidies amounting 5,4 % of GDP. Another part lies in the presidential creation of state corporations in 2007 (see tables 7 and 9). Those corporations have been criticised by the economy ministry and the Federal Accounts Chamber for their lack of transparency and their diversification strategy, increasing the level of concentration in their sectors and reducing new entries. Vladimir Putin admitted

in 2012 that the results of *Rostekhnologii*, *Rosatom*, *OAK* and *OSK* were not convincing to date⁷ and announced that they should be privatised by 2016. There is no evidence, however, that it is merely the fact that these companies are publicly owned that explains their lack of transparency, their intriguing strategy or their poor results. Nor is there evidence that their privatisation won't lead to privatising their rents, as it has been the case in other circumstances in the past.

Fig. 3. Representing an target-based policy in a Lundvall-type Model of Innovation System



Source: author's elaboration based on Lundvall (2010), p. 14.

Given the uncertain quality of information about innovation development prevailing in Russia, the weak ability of the state apparatus to carry out any new duty with all desirable efficiency, the risk of undue interference of private lobbies in public decisions in this matter and the complexity of the task itself, this actor-focused, target-based approach (Fig. 3) is flawed by a lot of well-known failures: ill-grounded targets, ill-conceived indicators, incoherence between injunctions, inability to monitor effectively the efficiency of a given set of financial supports, corruption, etc. (Vazyakova *et alii*, 2011). An example of the difficulties encountered by local actors within an over-centralized institutional setting is given by the public research system. With the progressive centralization of the direction of scientific activity imposed by the Government since 2001, there is a widespread concern that the autonomous development of applied and fundamental research can be impaired by political and administrative, non-scientific obstacles (Milard, 2008, Kastoueva-Jean, 2012). At the same time, the coordination mechanisms between public and private organisations didn't improve significantly: a 2012 survey of the Russian IT market found that even large foreign corporations find it difficult to cooperate with big city universities. Another survey confirmed that 49% of companies working with colleges or universities think the process of setting up collaboration is very cumbersome (RVC, 2013, p. 29), illustrating what is sometimes qualified of "insularity of institutions and attitudes" in Russia (EBRD,

⁷ V. Putin, «Economic tasks», February 2012, *Press release of the Russian Government*, <http://www.rusembassy.ca/ru/node/657>

2012). These inefficiencies have led some scholars to recommend insider privatisations of research and development public institutions (Vazyakova *et alii*, 2011, p. 14), but it is doubtful that the problems of coordination between public institutions and business are simply of a property rights nature.

In fact, the lack of appropriate consultation between government and private sector is systemic. It can be noticed also in other problematic fields as technical regulation, national standards and certification (EBRD, 2012, p. 75-76). Among the problems identified in the public-private relationships by Russian scholars in 2008, the absence of consultation of private enterprises about the definition of the sectors concerned by public-private partnerships and the prevailing conditions of public tenders, that tend to diffuse uncertainty to the private sector, are underlined (Gokhberg *et alii*, 2008). Another question to the Russian top-bottom model is asked by counter examples, as the software sector in Russia: while having received weak support from the state, the software industry has nonetheless constantly raised its level of competitiveness. Now, it appears as one of the most successful industrial sectors in Russia, exporting more than 6 billion US \$ of high value added software and services (forecast for 2013) and employing 110000 engineers with high programming skills (Russoft, 2012, p. 39).

In some cases, federal authorities have recognized the obstacles created by over-centralisation and have tried to alleviate them. For example, in contradiction with a 2008 law limiting access to offshore oil & gas projects to Russian state-majority-owned firms with at least five years of experience in continental shelf operations⁸, the government recognized in august 2012 that the duopoly formed by Gazprom and Rosneft over the exploration of the arctic continental shelf had delayed considerably its development⁹, and could eventually fail without the participation of foreign and private companies. In April, after the government granted substantial tax breaks for the project, Rosneft signed cooperation agreements on oil and gas exploration in continental shelf with foreign companies¹⁰, involving substantial technology transfers¹¹.

An alternative approach of the role of State in fostering innovation is to envision its action as a catalyst. Acting as a long-term linking pin, facilitating and orienting interactions within the network of innovation actors, public agencies can provoke and develop positive spill over between them. The main coordinating tasks shift from coordinating organizations toward coordinating interactions. In this sense, the policy becomes systemic (Fig. 4). The planning and forecasting roles of state agencies do not disappear: they play a decisive role in reducing uncertainty among local actors and stimulating their cooperation. Key property of state action is to help developing and maintaining platforms of cooperation between innovation actors in order to engage them in long-term projects that are essential for fuelling the R&D process. Improving and effectively implementing existing instruments would secure the environment of technology development of all participants of the Russian innovation system: private

⁸ This law was rapidly coined the « Rosneft-Gazprom law », since it was obviously edicted in the aim to favor these two public companies.

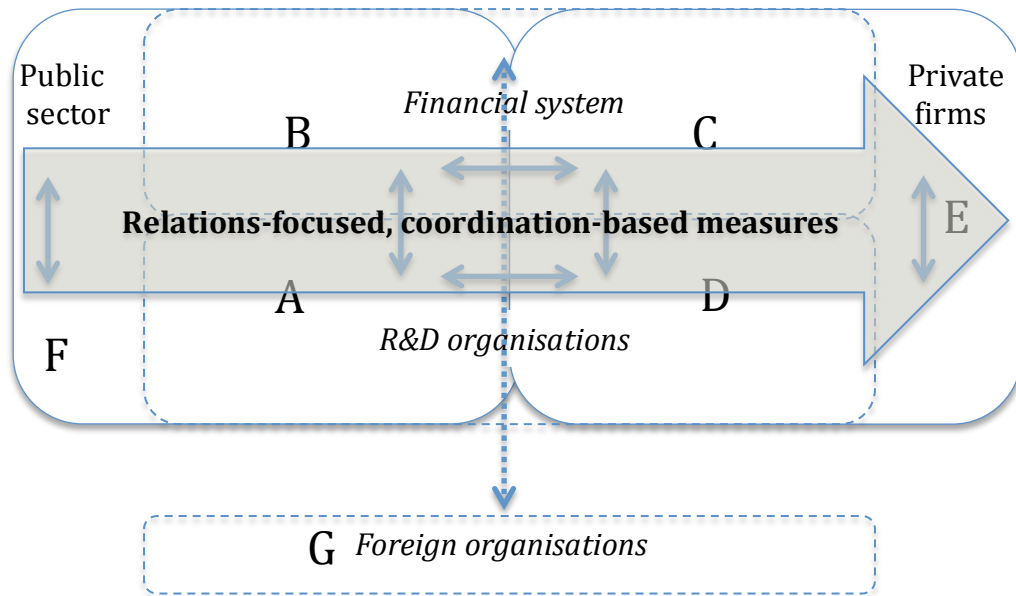
⁹ In doing so, the Government was pushed by several national companies Lukoil, Surgutneftegaz, Bashneft and TNK-BP.

¹⁰ Exxon Mobil, ENI and Statoil.

¹¹ Bofit Weekly, 10/08/2012.

businesses, scientific organizations, public agencies, universities and foreign partners (Gokhberg and Kuznetsova, 2010, p. 143).

Fig. 4. Representing a coordination-based policy in a Lundvall-type Model of Innovation System



Some steps were taken recently in this direction: in 2009, federal law 217 authorized research organizations to participate in the creation of business enterprises. Before this law, relations between business and budget-funded research were generally considered as difficult. Since the inception of the law, more than 1500 small innovative businesses have been created with the involvement of public research organizations (RVC, 2013, p. 23). According to the Russian Agency for Patents and Trademarks, the share of public research organization in patent licensing increased anew after the adoption of the law (Table 10).

Table 10. Share of public research institutions in patent licensing, 2005-2012

	2005	2008	2009	2010	2011	2012
Share in total patents	8,3%	7,6%	8,9%	13,8%	16,3%	20%

Source: Russian Agency for Patents and Trademarks, quoted in RVC, 2013.

Another example of horizontal networking organized on the basis of public agencies is given by the agreement signed in 2010 between FASIE (Foundation for Assistance to Small Innovative Enterprises in Sciences and Technology), RVC, RUSNANO, and several funds and banks operating in Russia¹² in order to exchange information about promising

¹² Namely, the Fund for Infrastructure and Educational Programs, *Vneshekonombank*, SME bank, OPORA ROSSII, Russian Venture Capital Association, MICEX-RTS (via a specialized venture facility).

start-ups and activity on the venture capital market. In 2011, the agreement was enlarged to the Skolkovo Foundation, and in 2012 to the Russian Technological Development Fund. Studying the venture capital market development, RVC notes its timid, but steady internationalization: in 2012, among 120 deals, 18 were realized with a foreign investor (RVC, 2013). In these cases, far from being seen as a national asset that need protection from foreign competition, cooperation platforms are being extended horizontally to international companies, leading to further technology transfers, hence contributing to future innovation capacities of Russian SMEs.

Concluding remarks

Despite considerable emphasis put on innovation in policy priorities since mid-2000's, the recent technological trajectory of Russia has not evolved very much and it there is no evidence that the much-desired catching-up dynamic is under way. This situation can appear as paradoxical, since at the same time, many Asian emerging countries, starting from a less favourable position, have obtained far more impressive results than Russia.

Of course, one should not expect rapid favourable outcomes of an innovation policy that is, by essence, oriented toward long-term and structural changes. But as far as main indicators are concerned, soft and hard data suggest that the Russian innovation system is not experiencing radical changes in its orientation: still dominated by state financing and public agencies, relatively hermetic to foreign cooperation, it is also impaired in its development by not favourable institutional conditions.

That said, one shouldn't conclude that all problems of inefficiency of the Russian innovation system come from an inadequate conception of what is an environment favourable for innovation. The problem lies also in business community's behaviour: the demand for innovation emanating from professional users is insufficient, while their time horizon is too short to engage industrial enterprises into a steady, costly research and development activity (Gurkov, 2011, p. 515). In that sense, impediments appear to be systemic.

Within the business sector, even if the prevalence of a small number of big firms in some sectors and their dominance in some regions can be detrimental to innovation, it doesn't imply that so-called innovative SMEs have to be systematically opposed to big, necessary rent-seeking enterprises. On the contrary, in Russia many large enterprises can play a decisive role for the development of the whole innovation system. The problem for the government is to set the conditions that can foster collaboration between actors that don't spontaneously develop cooperation skills. Technology platforms, open databases, incubators and other territories devoted to R&D activities, cooperation projects and other public organisations can prove useful coordinating devices in order to foster autonomous local, national and international collaborations within the R&D community. Therefore, bottom-up initiatives able to develop such coordinating devices should be encouraged by the federal organs and, if successful, disseminated throughout the territory, with appropriate incentives to emulate them.

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