OECD Review of Innovation Policy – Russian Federation
Overall assessment and recommendations

Introduction

The challenge of diversifying Russia's economic structure and reducing its reliance on natural resource sectors has loomed large on the policy agenda for well over a decade. Even during the boom years before 2008, there was widespread awareness that growth was being driven by transitory factors and that steps were needed to facilitate Russia's transition into self-sustaining, investment- and innovation-led growth. Since late 2008, the global financial and economic crisis has underscored the importance of this challenge. Attention has therefore increasingly focused on modernisation and, in particular, on innovation, as the keys to Russia's successful development over the long term.

Modernisation and innovation are two faces of the same fundamental process through which a country can optimise the accumulation, renewal, allocation and use of the material and immaterial capital in order to increase its sustainable growth potential. The Long Term Social and Economic Development Plan until 2020 of the Russian Federation, adopted in November 2008, recognises that this involves consolidating existing comparative advantages while creating new ones based on the development and creative mobilisation of human resources and intellectual capital.

Considering what government can do to effectively promote such deepening and widening of comparative advantages, a wide array of public policies ought to be mobilised:

- *Monetary policy* must avoid an excessive appreciation of the rouble which could spread a Russian form of "Dutch disease".
- *Budgetary policy* must ensure fiscal sustainability in a way that secures an appropriate amount of public investment in innovation, as well as an innovation-friendly tax treatment of assets and income.
- *Competition and trade policy* should work in tandem to discourage rent-seeking behaviour and help improve the position of Russian businesses in global innovation networks and markets.
- *Financial policy* must promote the development of financial institutions that are able to value properly innovation-related investment and manage efficiently part of the risks inherent to innovation.
- *Education and training policy* should work with labour market policy to help secure the quantity, quality and efficient allocation of human resources required for more knowledge-intensive and market-oriented productive activities.
- *Research policy* must help develop and mobilise, for socially useful purposes, mutually reinforcing research capabilities in the public and private sector.

- *Industrial and regional policy* must provide appropriate infrastructure, frameworks and other support to realise the innovation potential of specific sectors and clusters.
- *Social and health policy* should consider innovation a means, but also a result of, the improvement of quality of life.
- *Environmental policy* should see pro-innovation regulations and incentives as important means to encourage value-creating responses to the need to decouple economic growth and use of natural resources.
- *Judiciary policy* must enforce the rule of law, protecting innovation activities that are already inherently risky against additional unbearable uncertainties.

It is likely to be insufficient to boost investment in research and development (R&D) and innovation through direct public support if too little attention is paid to the necessary improvement of the broader economic context.

The innovation system concept provides a unifying analytical perspective for the whole-of-government policy approach advocated by the OECD Innovation Strategy (Box 0.1). This report takes this perspective in assessing the current strengths and weaknesses of the Russian innovation system with a view to identifying institutions and policies that, with appropriate modifications, could enhance its performance. It does not examine in detail all aspects of relevant institutions and policies; after reviewing briefly those that shape what can be called framework conditions for innovation, it devotes more attention to dedicated science and technology (S&T) and innovation policies, with a special focus on research policy.

Achievements, shortcomings and challenges

An assessment of Russia's innovation system must adopt an evolutionary perspective (Figure 0.1). It must take into account both the enormous changes in the political and economic context since 1992 but also the important constraints imposed by the legacy of the past. This combination of radical transformation and the resilience of some former institutional arrangements and mindsets makes the modernisation trajectory of Russia very different from that of China, where the combination of a gradualist approach to the modification of the overall politico-economic framework has been accompanied, in a context of rapid industrialisation, by faster and more radical microeconomic structural reforms, notably in an admittedly less mature S&T and R&D corporate and public sectors. For example, one finds in Russia today the coexistence of increasingly prevalent market-oriented mechanisms for the allocation of economic resources with others that are more social/political network-based. There is a sharp contrast between progressive territorial, scientific, technological and industrial nodes of excellence and a rather large stagnant pool of firms and organisations with very low productivity and little innovation.

Despite the persistence of some of these problematic features, recent years have seen continuous progress in creating or empowering agents of positive change, whether individuals, productive, research and educational organisations, or public support institutions. This has brought the country closer to what could be a turning point in the development of an efficient national innovation system which, while maintaining distinctively Russian characteristics, would make a decisive contribution to the realisation of an ambitious national socio-economic development agenda.

Box 0.1. The innovation system approach in the Russian context

The innovation system approach emphasises the following ideas which are particularly important to be considered in Russian context:

- Innovation is not a specialised activity carried out by specific institutions that the government can create and direct but the result of more diffused primary forces that the government can mainly empower and influence.

  Russia has not yet entirely overcome the legacy whereby each task strategic for the society was entrusted to dedicated institutions, according to a strict division of labour.

- Innovation results from the interactions between a number of competent market and non-market institutions responding to compatible incentives. Relevant competencies are a mix of capacities inherited from previous phases of economic /historical development and new ones, which permanently develop in response to current and prospective opportunities, as signalled by the incentive structures.

  In Russia this process is still distorted by the strategies pursued by some powerful actors, including those who have inherited capabilities but resist their upgrading and redeployment when this would weaken their institutional position and those who have built economic and political influence through rent-seeking behaviour but have no pressing need to invest in new innovation-related competencies.

- Innovation systems are an evolutionary set of institutions and processes. They never reach a steady, optimal state but constantly co-evolve with surrounding economic and social conditions. As countries grow richer, the determinants of their competitiveness change as do the role and type of required science, technology and innovation capabilities. Initially, they compete primarily on the basis of factor endowments, before moving to an efficiency-driven stage of development, in which the key factors include a country's efficiency of its financial, labour and product markets and the quality of its institutions. The most advanced countries come to depend primarily on their ability to innovate.

  Russia developed substantial scientific and technological capabilities very early on, but these were poorly geared to wealth creation processes. It now faces the challenge of making the transition to an innovation-driven growth model whereas there is still a great deal of unfinished business at the second stage – in terms of institutional quality and market efficiency.

- In the most advanced innovation systems firms that operate on competitive markets are the main locus of innovation activities, *i.e.* the main places where new knowledge or new combinations of existing knowledge is transformed into economic wealth. But public research retains a key role in mission-oriented activities and as a supporting knowledge infrastructure for market-oriented actors.

  The Russian innovation system is not yet firm-centered, despite the high share of the corporate sector in R&D intensive activities, because the majority of technology-oriented enterprises are only to a limited extent driven by market incentives and are insufficiently submitted to market disciplines.

- Throughout their evolution and integration within global networks national innovation systems incorporate lessons from international experience but retain country-specific features which may be sources of competitive advantage or disadvantage.

  For all reasons given above the Russian innovation system exhibits strong distinctive features. Some of them are not imperfections but rather form the basis of knowledge-based competitive advantages which could be better exploited if other, more problematic features were removed through the adoption and adaptation of relevant international good practices.

Figure 0.1. Russia's innovation policy: Institutional reforms and learning curve

	Soviet background (till 1990)	Turbulent restructuring, with early experimentation of new innovation policy approaches (1990s)	Stabilisation, with significant additions to the innovation policy framork (2000-2005)	Consolidation and exp ansion of the innovation policy framework (2005-2010)	Towards a mature and efficient national innovation system (2010+)
Russia's innovation policy learning curve	*Systemic efficiency threshold ?* Creation of the Russian Academy of Sciences (RAS) which inherits all facilities of the USSR Academy of Sciences on the territory of Russia (1991) Creation of the Ministry of Science, Technology and Higher Education (1991)	Fundation for Technological Development (1992) New legal framework for IPR (1992-93) Fundation for Basic Research (1993) Fundation for Research in Humanities (1994) Fundation for Assistance to Small Innovative Enterprises (FASIE) (1994) Creation of the status of State Research Center(1993) Creation of the status of Federal Research and Production Center (1995)	1st Federal Target Programme (2002-2006) Russian Technology Transfert Network (2002) FASIE START Programme (2003) Innovative Mega Projects (2003) Creation of the status of Science City ("Naukograd") (2000)	Presidential Priorities & List of Critical Technologies (2006) Restructuring plan for public R&D organisations (25% downsizing by 2008) (2004-05) Government Commission on High Technology and Innovation (2007) Federal programme to support development of high-tech clusters (technoparks) (2006) Russian Venture Company (2006) 19 Regional Venture Funds (2006) OJSC "SEZ" founded to develop Special Economic Zones (2006) "Long Term Social and Economic Development Plan" (2008) Improved IPR legislation (2008) Improved tax treatment of R&D and patenting activities (2008) Creation of the status of National Research Center (1st is "Kurchatov Institute") (2008) Creation of technology-oriented State Corporations, Rosnano, Rostechnologii, Rosatom (2007) 2nd Federal Target Programme (2007-2012); Innovation Initiatives in Higher Education (2007)	? Presidential initiative to create a Russian equivalent of US DARPA (2010) Creation of "Technology Platforms" (2010) Presidential Initiative to create Innovation Centre Skolkovo (2010) Government Commission on High Technology and Innovation (reformed, 2010) Presidential Commission for Modernization and Technological Development (2009) Special status and support granted to 14 (+15 in 2010) national research universities and 7 regional universities (2009) New funding principles for the RAS (2009) MICEX launches new hi-tech segment on Russian stock exchange (2009-10)
Innovation drive	Government demand dictates technological innovation in large scale engineering projects. Science is largely mobilised for the needs of the defense industry. Little innovation in consumer goods and non-priority capital goods sectors.	Collapse of government demand for innovation and of corresponding supply chains. With a few exceptions, successful firms in the new market environment rely mainly on foreign technologies and business know how.	First success stories of market-led innovation in some areas, e.g. software, advanced materials. Small innovative firms emerge, often as spin-offs of public research.But innovation remains low on the agenda of most large, often state-owned enterprises.	FDI and R&D centres of multinational corporations start to play a significant role. The number of innovative SMEs continues to grow but not enough to compensate the lack of a sufficient demand for innovation from large firms and the government.	
Public research	The Academy of Sciences carries out most of basic research. A myriad of specialised institutes and other organisations carry out applied research and technological development for civilian and military purposes.	Abrupt downsizing and restructuring. Many organisations involved in applied research or engineering design are abolished or incorporated to the business sector. Foreign financing help survival but pauperisation leads to large scale emigation of scientists and engineers.	Inceased federal spending stops the degradation and lays the ground for renewal of viable organisations. Better working conditions, including salaries, and the development of innovation networks create new motivations and opportunities.	Sustained federal budgetary support allows upgrading of research capabilities through an increasingly selective approach. Reinforcement of university research capabilities. New support programmes and infrastructures facilitate commercialization at national, regional or local levels. But conservative forces continue to resist both market-led and government selection process.	
Innovation infrastructures	Idiosyncratic features with geographical distribution reflecting strategic (military) and political considerations, as well as historical circunstances (especially World War II).	First Technoparks appear in Tomsk, Moscow and Zelenograd (1990-91). First Innovation Technology Center created in Saint Petersburg (1996). Necessity encourages many experimental commercialization strategies in the public research sector.	Constant development of Incubators, Technoparks, Centers of Technology Transfert and Innovation Technology Centers, around both universities and public research institutes. Many bottom-up Initiative at local (e.g. science cities) and regional levels.	In 2008, there were about 120 Business Incubators, 85 Technoparks and 100 Centers of Technology Transfert. New programmes and approaches aims at consolidating these infrastructures around stronger nodes. technology-oriented Special Economic Zones (SEZs) are created in Saint Petersburg, Zelenograd, Dubna and Tomsk. Industrial SEZs are created in Lipetsk region and Republic of Tatarstan.	
Policy governance (Leading ministries and agencies)		Ministry of Science, Technology and Higher Education (*In charge of coordination of civilan R&D budget*) → Ministry of Industry, Science and Technology Ministry of Economy, Ministry of Trade → Ministry for Economic Development and Trade Ministry of Communications → Ministry of Communications and Informatization Ministry of Defence Russian Academy of Sciences	→ Ministry of Education and Science (*Federal Agency for Science and Innovation*) → Ministry of Economic Development → Ministry of Communications and Media	→ (*abolished in 2010*)	

The notion of a turning point conveys the idea that a system does not develop as a more or less rapid continuous process, but through phases that usually emerge when certain critical components reach maturity and start to interact fruitfully in the presence of appropriate catalysts. In terms of components, Russia now has a quite complete portfolio of competent actors (small and large firms, research universities, public research institutes) and supporting institutions and measures, although these are still insufficiently co-ordinated, some are still experimental, and others lack critical mass. Some recent additions to the institutional landscape may have catalytic effects. For example, changes at the highest level of policy governance may provide the needed policy catalyst if these are complemented by efforts to break with the top-down tradition in policy implementation and to build more distributed, co-ordinated and adaptive governance structures at lower policy levels.

Over the past few years, the political leadership has made innovation a national priority, and a series of concrete presidential initiatives prove that this is not mere rhetoric. To ensure that, beyond their individual merits, these initiatives can catalyse wider beneficial transformations, it is necessary to examine the current set of policy instruments and frameworks for gaps, weaknesses or inconsistencies. This should be based on a shared diagnosis of the current status of the innovation system, the strengths on which to build to exploit new opportunities in a challenging and highly competitive global environment, and the barriers to be rapidly overcome.

Table 0.1 provides a summary SWOT (strengths, weaknesses, opportunities and threats) analysis of the Russian innovation system. It shows that Russia has some useful legacies on which to build, including relatively high educational capabilities and strong positions in certain S&T fields. The recent high-level commitment to innovation has created the conditions for renovating and building new infrastructures in support of S&T and innovation along strategic lines. This in turn has led to efforts to target spending on priority areas and to introduce greater competition in the allocation of resources.

At the same time, the performance of the innovation system continues to be undermined by several factors, some of which are legacies of the former Soviet system. Among these are the very low levels of R&D and innovation activities in firms, weak framework conditions for innovation (particularly a lack of competition, low levels of trust, and high levels of corruption), and weak infrastructures and regulations. Furthermore, policy efforts at reform are often frustrated by active resistance from established groups and/or institutional inertia.

The current state of the Russian innovation system is represented in the top left-hand side of Figure 0.2. This shows that while firms are placed at the centre of the picture – as the natural loci of innovation activities – they have yet to assume a central role in the innovation system. Instead, in a set of arrangements peculiar to many (former) socialist systems, a large number of branch research institutes and design bureaus continue to play a dominant role in R&D and innovation. Although the number of personnel employed fell sharply in this sector during the 1990s, many institutes adopted preservation strategies and managed to survive, often at a level of basic subsistence. Many have been transformed into joint-stock companies while remaining government-owned. Their funding comes mostly from the public purse in one form or another, *e.g.* as block grants from government ministries or as contract research and design work from other, production-oriented, state-owned enterprises (SOEs).

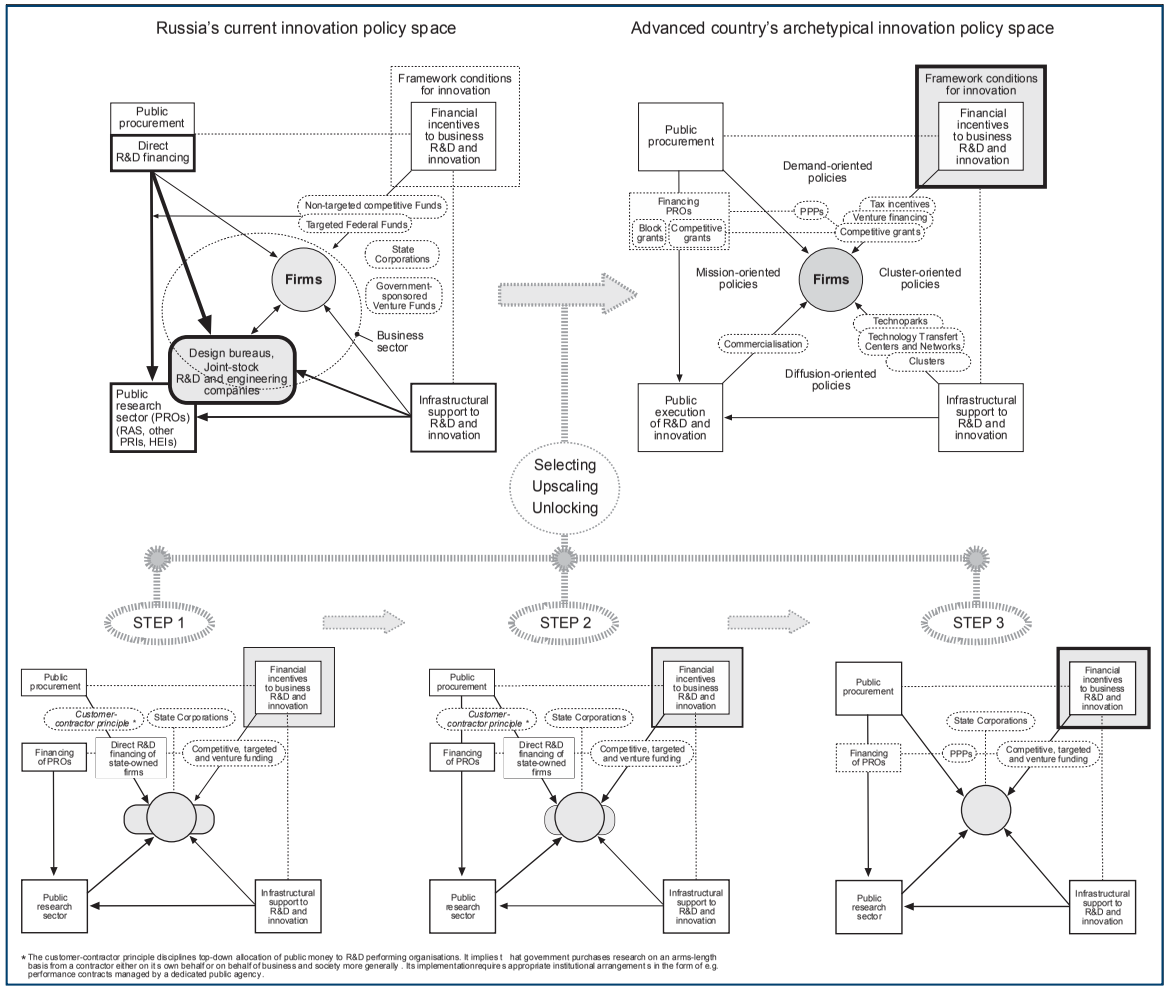
Table 0.1. SWOT analysis of the Russian innovation system

Strengths	Weaknesses
• Generous endowment of natural resources and accumulated intellectual capital. • Geographical proximity to, and historical links with, many advanced and emerging countries. • High general level of education of the population. A well developed and recently reinforced higher education system in science and technology which attracts a large but decreasing share of enrolments. • Long-standing scientific and engineering culture and many centres of world excellence in the modernised part of the public research system. International reputation and even prestige in key S&T fields, such as aerospace, nuclear science and engineering, and advanced software. • An increasing number of firms, including a significant proportion of fast-growing ones, with best practice production and management methods capable of seizing new market opportunities through innovation when incentives are sufficient. A critical mass of new technology-based firms in some sectors and locations. • Rapidly developing diversified innovation infrastructures. Revitalised science cities, such as Dubna and Zhukovski. New multidisciplinary centres of excellence, such as Kurchatov. • Federal government commitment to the modernisation and innovation agenda, and ability to mobilise resources in priority areas. • Accumulated experience in designing and using, at least experimentally, most innovation policy tools. • Improved balance between co-operation and competition among the different components of the public research system. This includes an increased share of competitive funding in the budget of the Russian Academy of Sciences (RAS), as well as new incentives and mechanisms to pool resources in responding to national priorities. • Well-articulated innovation strategies in pioneering regions, such as Tomsk and Tartarstan.	• A low rate of investment has reduced the structural benefits of fast growth in the last decade, restraining knowledge acquisition embodied in capital goods and lowering demand for innovation. • The composition of business investment is distorted to the detriment of innovation owing to disincentives in the business environment, notably the lack of competition. Many large firms with defective governance still survive using outdated capital stock to serve relatively captive markets. Inefficiencies in the state-owned corporate sector compromise Russia's ability to compete on high-technology civil markets. • Some innovation-related infrastructures and institutions are still immature or poorly enforced, such as knowledge networks and clusters or intellectual property rights legislation. • International linkages are strong and balanced in science and large-scale mission-oriented technological undertakings (*e.g.* aerospace) but less so in market-driven ones, partly due to internal and external barriers to high-technology trade and foreign direct investment. • The public research sector still contains many segments that do not satisfy the criteria of excellence and/or relevance. Allocation of resources too often is not performance-based. • The governance system and its practices have so far tended to encourage multiple and partly competing visions, as well as overlapping and too top-down implementation strategies by different federal agencies and state corporations. • The current mix of policy objectives and measures presents several biases, *e.g.* active science, technology and innovation policy is used to substitute rather than complement the improvement of key framework conditions for innovation, which remain weak. It emphasises supply rather than stimulation of demand, and public investment in innovation is channelled through an instrument portfolio which tends to crowd out business investment.

Table 0.1. SWOT analysis of the Russian innovation system (*continued*)

Opportunities	Threats
• Growing worldwide demand for innovation and related knowledge. Better integration into global value chains, facilitated by accession to the World Trade Organization, would help Russia channel its resources to areas in which international competitiveness significantly increases growth potential. • Reinforced research universities, working in closer synergy with the best parts of the RAS and other public research institutes, as well as a new generation of firms, managers and entrepreneurs can be powerful additional engines of innovation. • Rapidly expanding global markets for engineering services present great promise for Russian firms and specialists in aerospace, software, information and communication technologies, etc. • Russia's geography creates great challenges for the development and maintenance of transport and communication infrastructures, many of which are currently sub-scaled and outdated. This can be an opportunity if a modernisation programme emphasises innovative solutions and public procurement becomes more innovation-friendly. The same holds true for the modernisation of the extractive industries and the implementation of the new ambitious public health and environment policy agenda. • More generally, the vintage capital structure in many sectors makes it possible to leapfrog to best productivity levels once the rate of investment picks up. • A vast reservoir of would-be innovative entrepreneurs exists among the younger generations, as revealed by responses to several programmes of the Foundation for the Promotion of Small Enterprises in Science and Technology. • Over the last few years, brain circulation involving the Russian diaspora has significantly increased. This can be amplified and some recent government initiatives will help. • The multiplication of success stories brought about by new commercialisation channels and platforms, such as Rosnano or emerging high-technology clusters, can contribute to a change of mindset in the broader research and business communities. • Growing innovation awareness and initiatives at the level of municipalities and regions.	• Strong competition for grasping new global opportunities from both advanced countries and very dynamic emerging economies. • An ageing society, with an even more rapidly ageing population of engineers and researchers. • Lack of competition aggravates technological backwardness in many sectors and exacerbates the decoupling of profitability and productivity patterns, thus distorting resource allocation to the detriment of investments yielding high long-term social benefits. In response, government accentuates its direct involvement in innovation processes instead of correcting the problem at its roots. • Persistent low leverage of public S&T spending on business investment in innovation makes sustained budgetary effort more problematic from a fiscal perspective. Government is therefore tempted to interfere directly through other, non-market-friendly means. • RAS remains a glorious learned society but uses its well-deserved prestige to resist the need to improve the efficiency of its management. • The state-owned corporate sector remains a black box from the perspective of civil innovation policy; non-transparent processes for the allocation of resources create numerous "black holes" (large resources are used to produce little marketable outcomes). • State corporations do not fulfil their mission and drift towards outdated and inefficient national champion approaches (Rostechnologii) or develop an alternative, entrepreneurial model of national innovation policy loosely co-ordinated with other existing initiatives (Rosnano). • Russia loses out in the intensifying global competition for talent. • Lack of decentralisation prevents national goals and priorities from being translated into actions that fit regional capabilities. In turn, regions develop innovation strategies that do not add up to an optimal national outcome. • *In fine*, the Russian paradox, *i.e.* the low ratio of innovation outcomes to innovation capabilities, is eventually resolved by a decline in capabilities.

Figure 0.2. Advancement of the Russian Federation's innovation system and policy: A stepwise transition path



In the corners of the same picture, four functions of public policy intervention in support of firms' innovation efforts are highlighted:

1. In the bottom left-hand corner is public research carried out in the academies, higher education institutions (HEIs) and other research institutes. Such activity is intended to provide the innovation system with new codified knowledge and trained human resources. At present, its contribution to firms' innovation is considered weak and in need of strengthening. The dominant branch research institutes occupy an overlapping space with these institutes as they consume the largest share of public spending on R&D.
2. In the bottom right-hand corner is infrastructural support to R&D and innovation. This consists of both tangible, *e.g.* technoparks, and intangible, *e.g.* networks, infrastructures. A lot of policy attention has been given to such infrastructure, particularly as a means for diffusing and commercialising the knowledge produced in public research institutes. However, much of this effort has a knowledge supply-side bias and has remained largely disconnected from limited attempts to encourage (existing) firms to innovate and fund R&D.
3. In the top right-hand corner are the fiscal incentives offered by governments to encourage firms to innovate or fund their own R&D. These have been relatively under-utilised in Russia, but when they are used elsewhere, their uptake and effectiveness depends heavily on the wider framework conditions for innovation, including competition, regulation, the legal framework, etc. This is probably the weakest link in an otherwise increasingly comprehensive innovation policy mix and will need to be tackled if Russia is to fulfil its innovation potential.
4. Finally, in the top left-hand corner are public procurement and direct R&D financing. Although these tend to be distinct functions in most countries, in Russia they are conflated to some extent, within quite opaque arrangements, owing to their strong support for the branch institutes and design bureaus. In effect, R&D is a major procurement item in itself, largely through the direct R&D financing of branch institutes. At the same time, the use of public procurement to drive innovation in other types of firms, whether public or private, remains underdeveloped.

In summary, the current system suffers from a number of serious imbalances. Specifically, firms are not the central players they should be, and this distorts the balance in the public sector's contribution to Russian innovation performance. Publicly owned branch research institutes and design bureaus are still the central players in the current innovation system. The inadequacies of this arrangement were already well documented in the late Soviet period: weak knowledge flows and lack of interaction between technology developers and technology producers/users are a major problem. A range of solutions are available, the most obvious being the full merger of viable former branch institutes with production-oriented enterprises. Under more favourable circumstances, such mergers should already have occurred during the 1990s, but the uncertainty and short-termism of that period would probably have led to even greater asset stripping and layoffs.

The investment climate today is rather different and offers a window of opportunity to transform the innovation system along the lines outlined in the top right-hand side of Figure 0.2. Here, firms fulfil their central innovation-performing role and fund a higher proportion of gross domestic expenditure on R&D (GERD) than the public sector as in

most OECD countries. In this scenario, the public sector continues to support firms in their innovation and R&D activities through a well-balanced mix of activities, including public research carried out mostly in the academies and HEIs, and through R&D and innovation infrastructures, financial incentives to conduct own R&D and innovation, and innovation-promoting public procurement. The main change from the current system is the shift away from the public research system, and notably the former branch research institutes, as the central players in the innovation system. Instead, this role is assumed by production-oriented firms, whether public or private, whose innovation and research activities are enabled by much more favourable framework conditions.

The key issue, of course, is how to shift from the current to the more desirable innovation system set out in Figure 0.2. Reorienting the current system towards production-oriented firms as the central players will involve more than simply reorganising the former branch institutes. Crucially, it will depend on firms developing the interests and capabilities to innovate and carry out R&D. More favourable framework conditions for innovation, combined with an appropriate mix of financial incentives and other policy measures, will play an important role.

There are obviously no "silver bullets", and such transformation can take various routes involving different trade-offs and complementarities, over more or less longer time periods. One such route, but not the only one, is outlined in the bottom half of Figure 0.2. Here, after a period of shifting direct funding of the former branch research institutes to a customer-contractor principle, these institutes are merged into production-oriented firms. As previously indicated, the likelihood and success of such a transformation will depend on whether firms are interested in taking on the institutes, which will depend on their research and innovation strategies. These will be shaped by the framework conditions for innovation and by more dedicated science, technology and innovation (STI) policy actions. The condition of the institutes would also be an important consideration for firms. Some of the best have already been acquired, but there are probably questions about many of the others, particularly given the prolonged period of under-investment. In some cases, outright closure might be the most sensible option.

Guiding principles for policy

Redressing the imbalances in the Russian innovation system requires a more balanced innovation policy that covers a broader spectrum of goals and targets. Specifically, framing the orientation of Russian innovation policy in terms of the following "balancing acts" should be a useful guide:

- *Industrial widening and deepening*: Diversification of the Russian economy will mean widening industry beyond strong dependence on natural resources to emerging (high-technology) sectors (including services) and to formerly strong sectors that have been relatively neglected during the transition period (*e.g.* heavy machinery, defence and aerospace, etc.). At the same time, deepening in existing industry sectors – technological upgrading through knowledge assimilation and own innovation efforts, as well as building backward and forward linkages – will be important for their future competitiveness.
- *Large firms and small and medium-sized enterprises*: These are often offered as alternative locomotives for the modernisation and diversification of the Russian economy. Most industrial economies are driven by large firms; they account for around 70% of the R&D performed by business enterprises in OECD countries.

Large firms have the scope and scale to develop and market innovative technologies, but their size also means they are easily locked into particular technological trajectories. This can make it difficult to adjust to disruptive developments. Innovative small and medium-sized enterprises (SMEs), given the right conditions, can overcome some of the rigidities associated with larger firms and become the basis for new areas of growth. Yet, this requires the presence of demand for innovative products and services, which typically comes from larger firms, the government or sometimes final consumers. In Russia, while support to innovative SMEs should be reinforced, more attention should be given to enhancing the innovativeness of large firms, primarily, but not only, through structural reforms of state-owned enterprises. This would yield double benefits for small firms, in the form of increased demand for their innovations and reduced unfair competition from less efficient or creative, but subsidised, large firms.

- *Public and private innovation efforts*: Private-sector enterprises are the main source of innovation in OECD and fast-developing economies, spurred by the need to build market competitiveness. If R&D spending by enterprises is taken as a proxy for enterprise innovativeness, Russian enterprises perform relatively badly. Innovation survey data, which includes non-R&D innovation, also show Russian enterprises to be weak innovators compared to their international counterparts. In principle, government policy can offer the private sector incentives to encourage innovation. In Russia, the most significant policy contribution would be to improve the framework conditions for innovation. Government can also use existing state-owned enterprises to drive technological upgrading, though this is not without significant risks. The public science base cannot, for the most part, be expected to drive the renewal of Russia's industrial fabric, *e.g.* through the creation of high-technology spin-offs, but it can play an important part in collaboration with existing public and private sector enterprises.

- *Low-technology and high-technology innovation*: A conclusion of recent OECD work is that many countries tend to focus too much on developing high-technology sectors and pay insufficient attention to the benefits of promoting innovation in other sectors. The latter often implies more mundane forms of technological upgrading, *e.g.* acquisition of new machinery, but is of critical importance in raising productivity levels across the economy. Some commentators have argued that Russia should focus on this form of innovation, given that it lags behind S&T frontiers in many areas. But this confuses current status and potential and overlooks the fact that Russia has existing and emerging strengths in high-technology fields, *e.g.* defence and aerospace, nuclear, new materials, information and communication technologies (ICTs), etc. Innovation agendas therefore need to take a balanced approach to supporting high-technology and low-technology sectors of the economy and to avoid what can be described as "high-technology myopia".

- *Domestic and foreign sources of knowledge and technology*: Examples of successful catch-up demonstrate the importance of accessing foreign sources of knowledge through a variety of mechanisms, *e.g.* equipment purchase, foreign direct investment (FDI), original equipment manufacturing (OEM), student mobility, international R&D collaboration, etc. In fact, it is nearly impossible today for any country to rely primarily upon indigenous knowledge for sustainable technological upgrading and productivity growth. This is as true for countries at technological frontiers as for fast-followers and laggards. Accordingly, Russian firms should seek to acquire and adapt foreign knowledge and should be supported

in (or at least not prevented from) doing so, where appropriate, by government policy. At the same time, it should be widely acknowledged that indigenous scientific and engineering capabilities play an essential role in modernisation, particularly in areas in which Russia is close to scientific and technological frontiers, but also as a source of absorptive capacity in less advanced sectors and as a seed bed for the emergence of new industries.

- *Science-push and demand-pull dynamics*: Developments in science and technology are important drivers of innovation but are insufficient on their own. Demand, mediated mostly through markets, but also through networks and in-house hierarchies, plays a crucial role in promoting and shaping innovation. Users are also now recognised as important sources of knowledge in shaping innovation. Russian policy, which has inherited from the Soviet era a mostly supply-push perspective on innovation, should pay greater attention to demand and the role of users in promoting and shaping innovation.
- *Military and civil technologies*: This is a crucial issue in Russia given the high share of military-related R&D in total public R&D spending and the prominence of the military-industrial complex in the state-owned enterprise sector. The relationships between civil and military applications have changed dramatically, with the reversal of the direction of knowledge exchange flows in many cases in the dominant scientific and technological paradigms, especially in the field of ICTs. The armament industry now depends increasingly on critical technologies developed in an open civil environment. The announced creation of a Russian version of the US DARPA (Defense Advanced Research Projects Agency) responds to the need to better mobilise creative resources for radical innovations with military applications. At the same time, Russian defence policy should view the broader innovation agenda, notably the restructuring of the state-owned technology-oriented enterprise sector, as an important contribution to its own objectives.

Specific policy recommendations

Broadly speaking, policies can be divided into those that are dedicated to STI and those that are concerned with the framework conditions for innovation. While the former have an essential part to play in driving the modernisation agenda, they cannot substitute for the relatively weak framework conditions for innovation that prevail in Russia. STI policies must therefore be accompanied by policies that improve the framework conditions for innovation, particularly in terms of competition, corruption, property rights (including, but not confined to, intellectual property) and the rule of law. While the specific policy recommendations made below are mostly concerned with dedicated STI policies, these other policy issues should also be borne in mind.

Public governance of the innovation system

The OECD Innovation Strategy has identified a number of desirable qualities in innovation policy governance, including legitimacy, coherence, stability, adaptability and ability to steer and give direction. There are both complementarities and trade-offs between these qualities, and the manner in which they are managed differs from country to country. In Russia, legitimacy depends to a large extent on the involvement of the central government, particularly the offices of the president and prime minister. The

reinforcement of the governance structure at the highest level, through the creation of the Presidential Commission for Modernisation and Technological Development and the Government Commission on High Technology and Innovation, offers a golden opportunity to achieve a nation-wide consensus on the problems to be solved, to make crucial decisions on high-level policy trade-offs and strategic tasks, and to prioritise and sequence concrete actions on a broad front, notably to remove key blocks that have been left in place in previous generations of reforms. Paradoxically, but most importantly, such high-level initiatives could also open the way for less centralist, top-down policy formulation and, crucially, minimise the risks of implementation failures by empowering the key actors distributed across the innovation system and by drawing upon their extensive knowledge. The newly announced technology platforms could make a useful contribution in this regard.

A major criticism of S&T policy a decade ago was its inability to set and implement spending priorities. Funds were spread thin across research-performing institutes which adopted, more or less successfully, preservation strategies. At the same time, the system had little stability. The situation today is markedly different, at least in terms of new funding. For example, the commissions have set clear, albeit rather broad, priorities; the results of the 2006 critical technologies exercise have formed the centrepiece of a federal targeted programme; and the establishment of the state corporation Rusnano has given a strong boost to the area of nanotechnology. The use of foresight techniques, particularly technology road-mapping, is increasingly popular at many different levels and demonstrates the more strategic and future-oriented perspectives being adopted.

The increasing use of federal targeted programmes (FTPs) is also a significant development, as they allow for targeted actions that transcend traditional administrative boundaries and their fixed duration provides a certain degree of adaptability. There is usually a trade-off between adaptability and stability, however, and this applies to the FTPs given the limited duration of their funding.

Evaluation practices appear to be rudimentary and not well established, in part because of the absence of a strategic approach to S&T planning during the years of transition. The FTPs appear to include *ex ante*, mid-term and *ex post* assessments, and some major new programmes, such as the establishment of national research universities, seem to have incorporated similar arrangements. However, these appear to fall short of full-fledged evaluations. Moreover, their strong reliance on assessments against set quantitative indicators (*e.g.* numbers of registered patents) risks distorting behaviours to fulfil artificial targets. In light of these considerations, 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 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.
- Extend the scope of foresight exercises beyond the identification of S&T priorities. They should be designed so as to better catalyse networking across innovation systems and to create advocacy coalitions to champion change.

- Evaluate FTPs for their success in prioritising issues and activities of importance to Russia, for their mobilisation of a mix of innovation system actors, and for their contributions to inter-departmental and industry-academic co-operation.
- Adopt a more nuanced approach to evaluation, with less reliance on quantitative indicators and greater appreciation of evaluation as a tool for learning as much as a tool for accountability.

Framework conditions for innovation

The quality of framework conditions is essential for achieving strong innovation performance. The framework conditions include macroeconomic stability, many aspects of the regulatory regime and the tax system, competitive markets, openness to international trade and foreign direct investment, as well as an intellectual property rights regime that fulfils its function to provide incentives for innovators while not unduly impeding the diffusion of ideas. It is these framework conditions that allow private innovators – individuals and firms – to plan ahead and take risk because they can reap the gains of their innovation efforts that also benefit society at large.

Flaws in framework conditions can also constrain policy makers' action and prevent the use of policy tools that have been proven effective in more favourable circumstances. For instance, pervasive corruption can make governments very reluctant to give direct subsidies to business firms. Countries with a weak and ineffective tax system and administration tend to be reluctant to introduce fiscal incentives for R&D, or do so very cautiously. In this way flawed framework conditions can lead to distorted policy responses.

In the past two decades, Russia has made significant progress in many respects. Most importantly, it has succeeded in moving towards a market economy and has taken important steps to manage and stabilise the macro economy. Yet, there remain noteworthy shortcomings. These have been extensively analysed in recent years and need to be addressed effectively if Russia wants to embark on a more innovation-driven growth trajectory. They include exceptions to the rule of law, overly restrictive regulations, corruption, a lack of competition in many parts of the economy, underdeveloped supporting institutions, *e.g.* for financing innovation and intellectual property rights protection.

Taken together, these adverse conditions exert a stifling impact on value-creating entrepreneurial activity, including innovation. They create an environment in which incentive structures work against complex, long-term, inherently risky productive activities such as innovation. Rather, they tend to favour legal or illegal activities aimed at redistributing value. The expected result would be a low level of business investment in innovation and thus a shortfall in innovation output. A bias of incentives towards redistribution is a heavy burden on future development, including the realisation of an innovation-based development scenario.

Rule of law, corruption and administrative burden. Progress in reducing corruption, strengthening the rule of law, reducing the "bureaucratic burden" on business and reforming public administration will be vital elements of any policy aimed at fostering innovation. Russia's basic institutional environment still leaves much to be desired. Policy makers from the president on down have repeatedly expressed dissatisfaction with the performance of the public administration, law-enforcement agencies and the courts, in terms of efficiency, effectiveness and probity.

Competition in product markets. There is clear evidence of a positive correlation between innovation and competition. Most Russian firms appear to be in a situation in which innovation activity increases with competition. This is supported by survey data showing that Russian firms in more competitive environments spend significantly more on R&D and innovate more than firms facing less competitive pressure. Firms with greater market power innovate less, and monopolistic firms innovate least of all. There is also evidence that similar conclusions can be drawn about the outcomes of innovation activity in terms of total factor productivity growth. Overall, product markets in Russia are insufficiently competitive and unusually concentrated, particularly at regional level. On various measures, large firms loom larger in the Russian economy than in many OECD and other countries. In markets characterised by a small number of large firms, the challenge of ensuring effective competition and preventing cartels is all the greater. In many regional markets, a few incumbent firms operate in close co-operation with regional or local officials. While this often reflects corruption and rent-seeking behaviour, such arrangements also arise as a result of the limited fiscal autonomy of sub-national authorities which often pursue their social objectives through more or less informal arrangements with large incumbent enterprises operating in their territory. This typically translates into effective barriers to entry from outside competitors. At the same time, it must be acknowledged that there appears to have been real reduction in the bureaucratic burden on small firms over the last decade.

Financial markets. A well-developed financial system, which reduces the cost of external financing and is able to manage risks, is an important catalyst of innovation. Russia's financial system, despite rapid expansion in recent years, is still relatively underdeveloped, leaving considerable scope for financial deepening to contribute to long-term growth. A large majority of Russian firms rely on retained earnings to finance investment and innovation, and enterprise surveys almost always report the shortage of own funds and the cost of borrowing as the principal barriers to investment. This points to the importance of strengthening the banking sector and non-bank financial institutions. Funds for innovation and risk financing are scarce in Russia, partly owing to the dearth of venture capital. The development of risk capital markets is still impeded by the overall underdevelopment of financial markets.

Intellectual property rights. The new IPR code, which entered into force on 1 January 2008, is basically in line with IPR protection legislation of most developed countries. However, problems of enforcement remain, *e.g.* lack of transparency in court decisions and in administration bodies, especially concerning copyright.

To cut through a maze of unfavourable framework conditions and the opportunistic and rent-seeking behaviour that has evolved through attempts to derive private benefits from them is a gargantuan task. One approach is to create "special zones" (enclaves that could take various forms, *e.g.* selected regions, technoparks, business entities, projects, etc.) that would be shielded from the influence of the prevailing, non-conducive environment, and to provide them with special privileges, such as access to the highest

levels of power to cut through red tape, readier access to resources, etc. This approach has some merits. It was widely applied in the Soviet Union and produced a number of impressive results in mission-oriented research and technology development (*e.g.* in the aerospace or nuclear industries). However, the experience of the Soviet Union also provides compelling evidence of the inherent limitations of that approach; these were due precisely to the insular character of these efforts. To achieve a sustainable, innovation-driven growth trajectory, it is necessary to get the framework conditions right on a broad basis.

To summarise, despite progress made, there is urgent need for further improvements in the framework conditions for innovation, and the potential gains from such improvements are higher than in most OECD countries. To this end and to prepare a solid ground for innovation and to create an environment in which other, more dedicated, instruments to boost innovation can be effectively applied, the government should screen the current situation with the following main objectives:

- Maintain sound macroeconomic conditions, including the sustainability of public finances, one of the most important conditions for sufficient and dynamic evolution of both private and public investment in innovation. Better performance in innovation can, in turn, help to attain healthy macroeconomic and fiscal conditions.
- Move towards a more pro-competition stance to strengthen market incentives that reward innovative behaviour and continue efforts to improve the business environment and reduce administrative burden, including on business start-ups. This could be achieved, for example, by introducing an overarching competition policy to support free and fair market competition by providing for more vigorous and uniform implementation of competition law and strengthening the powers of relevant institutions; by further reforming the public administration and reducing red tape; by increasing the transparency and accountability of public administration; and by minimising uncertainty and the need for subjective decision making by the government administration.
- Continue to address aspects of the financial system and related regulation that could constrain the financing of innovative projects in the business sector, notably for SMEs.
- Continue to improve the practice of intellectual property rights enforcement.

Education and skills

The Russian Federation produces one of the highest proportions of science and engineering graduates in the world, well above the OECD average. It also has very high rates of university admission, which has led to concerns about quality in a system designed for much smaller numbers. Furthermore, like other areas, higher education was not immune from the austerity of the transition years and has suffered some degradation in facilities and services, particularly in the regions. Curricula in many departments are also in need of updating to better reflect the labour market's demand for skills. This includes innovation management skills and initiatives that will nurture an entrepreneurial spirit among graduates.

Russia inherited a relatively strong system of vocational colleges from the Soviet Union, but this has been somewhat neglected over the last 20 years and is now in a state of serious decline. Indeed, with demographic changes, many colleges may be forced to close in the next few years, particularly in the regions. Demographic change is, however, not the only factor in the decline in admissions. As in most parts of the world, Russia's university student population has grown enormously, partly at the expense of vocational colleges. In fact, it is rather common for students to use vocational colleges as a means to gain access to universities. Russian policy makers should therefore seek to:

- Encourage universities and colleges to update their curricula to better respond to the skills needs of an increasingly innovation-driven market economy. In this regard, the business sector's involvement in advising on curriculum design and in offering placements, particularly to graduate students, should be actively encouraged.
- Explore ways of enhancing the standing of vocational training and improving the facilities at vocational colleges. The problems facing Russian vocational colleges are similar to those in many other countries and experiences and lessons should be shared for mutual benefit.

Promotion of business innovation

Corporate governance

It is widely recognised that SMEs, especially innovative start-ups, play an important role as innovators and in rejuvenating the economy. However, it would be a mistake to neglect the contribution of large firms to innovation. It is hard see how Russia can become an innovation-driven economy without boosting innovation in large firms, many of which hold valuable assets and could become backbones for larger-scale innovation. In practice, many of Russia's large firms are far from as strongly engaged in innovation activity as might be expected. Therefore, the discussion of framework conditions for innovation and corporate governance has to take due account of the (dis)incentives they provide for large firms to engage in innovation.

The Russian Federation's corporate sector has emerged from the legacy of the Soviet system, followed by privatisations, shake-outs and restructuring, starting in the years of transition, and given a new direction in more recent efforts to consolidate and re-establish state influence in what is perceived as strategic areas. Russia's corporate sector has a number of specific features –in terms of structure and corporate governance – which may have important implications for the future development of Russia's innovation capabilities. Today, state control in the Russian economy is extensive, via direct state ownership and control over economic activity. State-owned enterprises are found across a wide range of sectors and often occupy a dominant position in their industry. Furthermore, there is a pervasive blurring of the line between the public and private sectors; this is due to the extensive role of state-owned enterprises. Recent industrial consolidation into ever-larger holdings has been accomplished by merger and acquisition activities of some major public and private firms (particularly in resource-based industries) and by government policy to establish "national champions" capable of competing in international markets.

While consolidation holds the promise of increased economies of scale and scope, and can overcome, in part, the lack of external financing for high-risk innovation, it risks

being economically harmful if powerful incumbents stifle competition and effectively deter innovative entrants. This can eventually lead to a decline in national competitiveness in the long run. This danger is a real one and is heightened by the fact that for state-owned enterprises the effectiveness of corporate governance is weakened by a number of factors, including diminished likelihood of bankruptcy and very little risk of takeover. Both of these reduce the discipline markets would otherwise exert on management, by threatening to penalise inefficiency. In view of these arguments, the government should consider the following:

- Improve standards of transparency and disclosure in SOEs. This can be aided by accelerating the appointment of independent and accountable directors on SOE boards and by increasing the independence of government representatives. The non-commercial activities of SOEs should also be moved to relevant government departments where they can be consolidated.
- Ensure that "national champions" put innovation at the heart of their business strategies through a mix of incentives and regulatory moves, *e.g.* by reducing barriers that shield them from international competition. At the same time, monitor closely the activities of state corporations to ensure they remain on track to deliver on their ambitious objectives.
- Carry through and extend plans to part-privatise SOEs and state corporations, as this should provide greater access to foreign know-how and accelerate the modernisation agenda.

Business sector R&D

The state-owned technology-oriented business sector comprises business enterprises in the true sense and related incorporated research organisations. However, some aspects of the research part of this sector are striking. In the Russian Federation – as in many high-performing countries within and outside the OECD – business enterprise expenditure for R&D (BERD) performed in the business sector accounts for nearly two-thirds of total GERD. However, the funding pattern is radically different. In Russia, the R&D expenditure of the business enterprise sector is largely funded by government, not – as is the practice in high-performing economies – by the business sector itself. This highlights the continuing dominance of the mostly publicly owned former branch institutes and design bureaus in performing business R&D. While they perform more than 80% of business enterprise R&D, these institutes, perhaps half of which operate in the defence sector, remain separated organisationally from production enterprises, which tends to weaken their contribution to technological innovation. Any substantial improvement of the overall performance of the Russian innovation system requires a clarification of the roles these institutes actually play in industrial innovation and the ways in which their activities are steered.

For their part, production enterprises performed less than 9% of business expenditure on R&D in 2008 while providing 36% of the funds. This indicates that production enterprises – many of which are state-owned – outsource much of their R&D to branch institutes and design bureaus. They perform relatively little in-house R&D and are not especially encouraged to do so by the government's research policy. For instance, very few research policy measures involve direct financial transfers to production enterprises, and tax incentives and public procurement are underdeveloped. Therefore, the government should:

- Clarify the role of research institutes and design bureaus within the state-owned technology-oriented business sector, their missions in selected areas such as defence or energy, and the whole Russian innovation system. Further transparency is needed regarding the operations, funding, governance and performance of these organisations.
- Explore options for privatising research institutes and design bureaus and/or merging them into production enterprises. Their organisational separation diminishes their contribution to production in many instances.
- Encourage production enterprises to conduct more in-house R&D. A critical first step involves getting such enterprises to put innovation at the heart of their business strategies, thereby creating a stronger requirement for in-house R&D. The recent government instruction to SOEs and state corporations to elaborate "R&D and technological performance contracts", while an unusually directive move, is an attempt to do just that. Ultimately, however, a mix of policy measures will be required to further encourage enterprises to conduct in-house R&D, including direct funding of R&D, indirect fiscal measures, regulation, public-private partnerships, and public procurement.

Supporting innovative SMEs

The contribution of SMEs to the Russian economy is relatively small when compared to OECD economies, accounting for around 12% of GDP and a similar proportion of employment. In contrast to some other transition economies, the growth of a vibrant SME sector in Russia has been stunted by the dominance of large firms, particularly in the resource-based industries that dominate the economy, and by unfavourable framework conditions for operating small businesses. The number of innovative SMEs, defined as high-potential enterprises in the science and technology field, make up less than 2% of the overall SME sector. This figure is particularly low when compared with EU countries.

Recent legislative changes have sought to promote the SME sector. These include the reduction of inspections, and, specifically for innovative SMEs, the law on the organisation of small innovative enterprises with universities, research institutions and microfinance (Federal Law No. 217-FZ), which focuses on standardising the creation of start-up and spin-off companies by federally funded scientific and educational institutions. The hope is that such laws will contribute to the creation of the necessary legal framework for promoting the efficient development of innovative SMEs and will significantly simplify their creation.

Since 1994, a dedicated public non-profit organisation, the (Bortnik) Foundation for the Promotion of Small Enterprises in Science and Technology (FASIE), has been successfully promoting science-based entrepreneurship. Its resources amount to 1.5% of the total civil R&D budget, which it uses to provide a wide array of support measures, ranging from direct financial support to start-ups to the provision of information and other support services to small innovative enterprises. The most significant measure is "Start", targeted at start-ups, and modelled to a certain extent on the US National Science Foundation's Small Business Innovation Research (SBIR) programme. It provides two-stage support, with seed money followed by development grants. FASIE has funded about 10 000 projects. In recent years, it has increasingly moved towards nurturing "innovation seeds" and young scientists (more from HEIs than from the RAS).

For financing, the federal government founded the Russian Venture Company in 2006 with the aim of stimulating the creation of a venture capital industry in Russia. It has also encouraged the creation of regional venture funds, and 23 of these have been created in 21 regions. The number of companies that have benefited from both the national and regional funds seems rather small – fewer than 50 companies by mid-2009. One problem seems to be too few opportunities for funding; another seems to be that the venture funds show insufficient interest in investing in early stages of project development.

A variety of technoparks, business centres, and business incubators have also been created across Russia, some of which have been rather successful in developing innovative businesses (*e.g.* Tomsk Innovation Technology Centre "Technopark"), others less so. A federal programme targeting the creation of a network of technoparks was initiated in 2006 and has seen their number grow in recent years. In light of these developments, the government should consider the following:

- Expand the FASIE programmes given their success and popularity. At the same time, it should acknowledge that the vast majority of start-ups from the science base, even the most successful, are likely to have only marginal effects on the industrial landscape of the Russian economy in the near future.
- Acknowledge that the limited growth potential of innovative SMEs in Russia is due to the relative lack of interest of larger firms in innovation. If this situation changed, markets would begin to open up for innovative products and services offered by SMEs.
- Improve the framework conditions for innovative SMEs. Small firms tend to be more sensitive to the framework conditions for innovation than their larger counterparts. As long as framework conditions remain relatively unfavourable, the scope for SME-led growth will be limited.
- Better facilitate access to finance, for example by increasing competitive pressures in financial markets, reducing risks and transaction costs, strengthening financial institutions' capacity to serve small clients, etc. The Russian Venture Company has a role to play here, though it will tend to be more niche than mainstream. The recent introduction by Vnesheconombank (Bank of Development and Foreign Economic Relations) of a programme for supporting innovative SMEs is perhaps more promising. Generally speaking, more needs to be done by the government to promote the financing of SMEs' innovation efforts, *e.g.* through the use of reimbursable subsidies and state guarantees for bank credits.

Linking education with research

R&D carried out in HEIs has several benefits, the most prominent being the close connection to training and the knowledge diffusion to other parts of society and the economy that graduate mobility brings. Like some other countries with a strong mission-oriented focus (*e.g.* China, Korea, France), Russia has a relatively weak HEI research system. The institutes of the various academies of science are the traditional location for conducting the sorts of fundamental research carried out in HEIs in many OECD countries.

Since 2000, the government has sought to strengthen research in HEIs through a number of targeted initiatives. These investments have seen the number of researchers in HEIs rise slowly in absolute and relative terms, although as a proportion of the total

number of researchers in Russia – at 8.8% in 2008 – this remains very low by international standards. Furthermore, the proportion of GERD performed in the HEI sector in 2008 was even lower, at 6.7%. More recently, the government has launched new flagship initiatives, notably the FTP Research and Academic Teaching Potential of an Innovative Russia (2009-13) and Federal Targeted Support to Leading High Schools (2010-12). These initiatives have significant budgets – around USD 3 billion each for their duration – and seek to address a range of challenges related to promoting and diffusing/using research carried out in HEIs. Much of the new investment is targeted at establishing an elite cadre of research-led HEIs, similar to that found in many OECD countries. It covers several measures, including: large blocks of funding awarded to Russia's two elite institutes, Moscow State University (MSU) and Saint Petersburg State University (SPbSU); the establishment of federal universities and national research universities (NRUs); promotion of R&D co-operation with high-technology industrial corporations; development of a university innovation infrastructure for the creation of small firms; and promotion of inward academic mobility, by attracting the Russian scientific diaspora and other leading foreign scientists to Russian universities.

These significant investments indicate a strong and welcome commitment to strengthening education and research links, but they are just a start and much remains to be done over the medium term. In this regard, the government should:

- Institutionalise some of these new funding lines so that they become an established feature of the HEI research landscape. This is important given the generally low levels of investment in public science since Soviet times. Furthermore, institutionalisation will remove uncertainties around the government's intentions, thereby aiding HEIs' planning and long-term strategies.
- Maintain the competitive element in such funding initiatives, as they can catalyse useful reform and the reorientation of HEIs if appropriate selection criteria are used. Ultimately, the competition for funds in a well-funded system should be based on fully transparent arrangements for performance measurement, based, for example, on comparable publication, teaching quality and commercialisation indicators.
- Evaluate the appropriateness and effectiveness of the increasingly sophisticated portfolio of policy measures now in place, both at the level of individual instruments and at the levels of the wider portfolio. The novelty of many of these initiatives in the Russian context makes them somewhat experimental in nature and they will need to be viewed as such by monitoring and evaluation activities. Ultimately, some should be superseded by alternative instruments as the HEI sector evolves.
- Accelerate the transition towards a more research-intensive HEI sector through a more radical organisational transformation. In some instances, action beyond R&D collaboration with RAS institutes and the like may be warranted, to include the full amalgamation of existing research institutes with HEIs, perhaps along the lines of the French CNRS-HEI model.
- Acknowledge that the budgetary focus on creating an elite cadre of research-led HEIs will result in an implicit stratification of the HEI sector, determined largely by research performance. At the same time, policy should recognise that a broad innovation agenda also needs to pay attention to other layers in the sector – which,

after all, means the majority of HEIs – and seek to identify and build upon their strengths and address their weaknesses.

- Incorporate or align HEI upgrading measures with regional development agendas. Since less research-intensive institutes are more likely to be found in the regions outside of Moscow and Saint Petersburg, their strengthening along strategic lines is important for balanced regional development. In this regard, HEIs should serve as regional growth poles, for example through active cluster policies that require the development of close working relationships with businesses and local research institutes. At the same time, measures to enhance the contribution of HEIs to regional competitiveness should be designed so as to acknowledge that the main contributions of HEIs to regional growth are likely to be through the training of graduates and their subsequent mobility through the local economy.

Public research organisations

Various types of public research organisations, aside from HEIs, account for the largest share of GERD in Russia. In this review, although the vast majority of former branch institutes are still publicly owned, they are dealt with under the section devoted to business innovation.[1] This section is confined to the various academies of science and the National Research Centre programme, piloted at the Kurchatov Institute.

The purpose of the academies of science has been questioned for some time, often on the presumption that Russia, a middle-income country, can ill afford the luxury of funding hundreds of institutes largely, though not exclusively, dedicated to fundamental research. This view tends to miss the considerable contribution that the academies make to training and industrial innovation, although these contributions could certainly be enhanced. It also fails to acknowledge the importance of fundamental research for Russia's long-term development. Furthermore, the academies account for just 15% of GERD, levels that are considerably lower than those spent in applied research institutes, although this is around twice the amount spent in the HEI sector.

The academies are not without their problems. They have been repeatedly criticised for their preservation strategies and have been under considerable pressure in the last five years to cut the number of staff and institutes in return for extra resources. Accordingly, the number of R&D personnel in the Russian Academy of Sciences declined by around 12% in the period 2002-08, although the number of institutes has remained relatively stable. In return, salaries have increased markedly, but remain uncompetitive in large cities and have yet to prevent the long-term ageing of the workforce. Buildings and equipment are in need of major renovation and renewal in most institutes. Some progress has been made on this front in the last few years, but the academies have not benefited to the same extent as selected HEIs from major cash injections, owing to the government's priority to develop a stronger research-intensive HEI sector.

While these resource factors have hindered the productivity of the academies, critics argue that a major weakness is the dominance of block grant financing and an inadequate regime of monitoring and rewards/sanctions for good/poor performance. The RAS, for its part, intends to increase competitive funding to 25% of its allocation (it currently stands

1. This is also in line with the statistical treatment of these institutes by the Russian authorities, which includes them in the BERD figures.

at around 15%). This is a move in the right direction, but is still a low proportion by international standards, probably because a higher proportion would threaten the continuing existence of institutes that are unsuccessful in any competitive bidding process. Policy makers have attempted to bypass these funding arrangements in the academies by introducing parallel funding streams that allocate funding through competitive calls, mainly by the Russian Foundation for Basic Research (RFBR) and the FTPs. In this regard, a larger proportion of the federal budget for basic research could be allocated through the RFBR.

Beyond the academies, the aim of the new programme National Research Centres (NRC) is to provide platforms for the development of breakthrough advances in key technologies in which Russia would like to develop or maintain world leadership, such as nanotechnologies or neurosciences. The programme is being piloted through the Kurchatov Institute, the first of a possible eight institutes to be set up in the next few years. Special funding procedures provide a greater degree of flexibility and set out to minimise bureaucracy. For example, the institutes are free to award R&D contracts, and their researchers are free to invest in commercialisation of their research and in technology-based firms and start ups.

In the area of public research organisations, the government should:

- Enhance the contributions of the academies to training (especially PhD students) and to industrial innovation in strategic industries. The challenge for the academy institutes is to identify and exploit channels of knowledge diffusion beyond academic publications to enhance their contribution to the national innovation system.
- Ensure that the principle of research excellence lies at the heart of the academies' activities. With this in mind, the proportions of block grant and competitive funding allocated to institutes should be further rebalanced in favour of the latter and greater use should be made of performance-based assessments. Increased participation in international funding programmes (see the section below on internationalisation) will also provide additional information on research quality.
- Reform the governance structure of the RAS to allow for a more strategic approach to managing its large portfolio of institutes and to increase its agility in responding to new research opportunities.
- Monitor and evaluate stringently the NRC programme, given the large investments involved. Extension of the programme should perhaps progress in stages to allow time for drawing lessons. Furthermore, every effort should be made to explore opportunities for extending good practices, *e.g.* around research commercialisation, to other parts of the public research system.
- Take further steps to reduce the dependence of all Russian research institutes on block grants. Although Russia has made some progress in moving towards a more competitive funding allocation system, too much funding is still funnelled as block grants to established institutes. On the other hand, it should be borne in mind that block grants are important for providing a modicum of financial stability and direction to institutes and should not be eliminated entirely. Instead, performance-assessment regimes should be established that allow for transparent periodic (intervals of five to ten years) assessment, the results of which should determine the size of block grants received.

Internationalisation

There are many channels available for Russia to source foreign knowledge and technology and to export its own. Foreign direct investment is often touted as one good way, and Russia is increasingly host to many of the world's leading technology-based companies, *e.g.* in aerospace and ICTs, which are looking to exploit high skills at an internationally competitive price.

In common with many other countries, Russia has sought to attract FDI through the establishment of various types of special economic zones (SEZ). For the purposes of this review, the four technology-oriented SEZ in Saint Petersburg, Zelenograd, Dubna and Tomsk are relevant. As these were established quite recently it is difficult to assess their effectiveness. Nevertheless, they appear not to have been particularly successful so far in attracting FDI. More recently, the government has announced plans to establish an innovation city at Skolkovo, a greenfield site just outside Moscow. Much has been made of Skolkovo's reference to Silicon Valley in California as a source of inspiration. The latter is, of course, a largely self-organising phenomenon that many have tried to reproduce in other parts of the world without much success. The proposals for Skolkovo do not appear to fall into such a trap and seek to address failures that are specific to the Russian context. A few large high-technology firms, notably Cisco and Nokia, have already signalled their intention to invest in Skolkovo, and the hope is that many more will follow suit.

FDI can of course work in both directions, and many large Russian firms have become increasingly active in acquiring overseas companies, transforming themselves into multinational enterprises with operations in multiple locations. Some of these acquisitions have been directed at accessing particular technologies or technological capabilities. Joint ventures with foreign companies are also a popular means for accessing technologies and sharing risks. A recent example is the collaboration between Sukhoi and Finmeccanica of Italy on development of the Superjet 100 airliner.

More generally, technology balance of payments (TBP) data, which register the international flow of industrial property and know-how (*e.g.* through patent purchase and licensing, trademarks, technical services, etc.), show a rapid increase in payments and receipts in recent years, an indication of the growing internationalisation of Russian industry. Payments in 2008 were around 2.5 times larger than receipts, with Russia running a TBP deficit of around USD 1.4 billion. Perhaps the most utilised channel for sourcing foreign technical knowledge is the acquisition of foreign capital goods. Indeed, innovation survey data show purchasing of equipment to be the most important source of innovation, though the levels are still very low compared to other countries.

Progress in and, finally, the successful conclusion of Russia's WTO accession process is important for the success of an "innovation scenario" as envisaged in President Medvedev's "Russia, Forward" declaration. In one sense, WTO accession can be seen as safeguarding against the adoption of an overly inward-looking approach to Russia's economic development that could eventually stifle innovation. In another sense, it would help innovation by removing barriers Russian companies currently face in international markets, including in high-technology areas. WTO membership would exercise some leverage for making more progress with competition-enhancing reforms.

On the science side, Russia is in negotiations with the European Union to acquire associate membership in the Framework Programme. This would allow Russian researchers to participate in the Framework Programme on an equal footing with their

European counterparts and could have potentially large benefits. For example, it would better integrate Russian research teams into highly competitive European R&D associations which should lead to a rise in their competitiveness and the quality of their scientific and technological results. A further science-related issue concerns nurturing links with the very extensive Russian scientific diaspora. Government policy has awoken to the potential of a more structured engagement with the diaspora, for example through lab twinning initiatives, mobility grants and a new scheme to facilitate the recruitment from abroad of highly qualified staff. In pursuing and broadening these efforts, government policy should:

- Embrace technology acquisition from overseas as part of a wider strategy to upgrade the technological capabilities of Russian industry. Several channels are relevant, including inward and outward FDI, joint ventures with foreign firms and equipment purchases. These should be exploited as fully as possible to foster technological learning.
- Use the Skolkovo innovation city initiative as an experimental space for testing and demonstrating arrangements that could be extended to the wider economy. It is mainly in this way that Skolkovo can contribute to Russia's modernisation. At the same time, other useful references, besides Silicon Valley, should be found to guide thinking and to frame realistic objectives for Skolkovo, *e.g.* Beijing's Zhongguancun science city.
- Ensure that investments in support of Skolkovo do not crowd out other essential investments that are vital for upgrading Russia's innovation performance and for increasing the presence of Russian actors within global innovation networks.
- Conclude negotiations with the EU on associate membership in its Framework Programme. Policy makers should recognise, however, that successful participation will require further learning and perhaps even some adaptation by Russian research teams, which will naturally take time.

Regional aspects

The Russian Federation is divided into 83 constituent units or federal subjects, 21 of which are republics, of very different sizes and economic specialisation. Outside Moscow and Saint Petersburg a small group concentrates most of the remaining science-based and technology-intensive activities and high-quality higher education institutions. The best mix of federal and regional policies to enhance their innovation potential is recognised as an important, but as yet unresolved, issue. In contrast, the role of innovation in regions that are less well endowed in S&T resources, with a view to avoiding a widening of regional development gaps, is less debated.

Regarding the first issue, Russia can do more to empower regional innovation-led growth engines more fully to the benefit of national performance. Awareness and political will has built up and encouraging initiatives have emerged in regions. A centralisation trend in Russian fiscal federalism has in fact encouraged some regions rich in oil and gas, such as Tomsk and Tatarstan, to bet more on knowledge-based development. One problem is that regions have become even more dependent on federal financial support to fund their initiatives in this new direction. This leads to two types of inefficiencies. First, it pushes regions to compete even when they should co-operate. Second, national priorities and the criteria determining access to federal support seldom fit regional needs and capabilities perfectly. This reduces their impact both on local development and on the

overall efficiency of federal spending on innovation. Another problem is that even when they have sufficient resources to act on their own, regions face legal restrictions in some important areas, such as investment in universities to ensure that their research and education programmes are better attuned to local demand.

Regarding the second issue, the widespread lack of attention to non-technological innovation has contributed to benign neglect by federal authorities and rather passive attitudes of local authorities. Too little is known about the real innovation potential of regions with economies that are less R&D-intensive than the national average. The role of all forms of innovation in their modernisation should receive much greater attention.

There have been interesting developments at the sub-regional of governance, whereby cities originally created as closed military research-industrial complexes have, over time, developed a social identity. This is the case for science cities such as Dubna and Zhukovski in the Moscow Region. Populations and municipalities are willing to contribute to local development, most importantly by improving attractiveness for investors, including through enhancing the quality of life. Therefore, the government should:

- Help establish a platform for inter-regional innovation policy learning. To feed this learning process and reinforce its own ability to monitor and assess regional trends, the Federation could promote the harmonised development of statistics and other benchmarking instruments by the regions. International benchmarking should be part of this process, with the selection of a panel from foreign regions corresponding to the main types of Russian regions (large/small, diversified/highly specialised, knowledge-intensive/more traditional industries, etc.). The regionally self-organised Association of Innovative Regions, newly established in 2010, could be a candidate for providing such a platform.
- Acknowledge that many successful initiatives result from a combined and concerted approach by federal and local/regional authorities. This co-ordination is essential for the funding and deployment of any significant project.
- Encourage development of self-organisation capabilities at the regional and local levels. In parallel, review existing restrictions on regional action to boost innovation, with a view to relaxing those that might have little justification in the new economic policy paradigm.
- Concentrate federal funding on areas of regional comparative advantage to avoid spreading resources too thin. This should discourage wasteful inter-regional imitation and competition, notably the proliferation of sub-scale, ill-designed innovation infrastructures, and instead reinforce support to region-led promising cluster initiatives associating public and corporate actors.
- Avoid "high-technology myopia" and embrace the potential of innovation in low-technology manufacturing and services sectors, as well as non-technological innovation, for creating jobs and wealth.
- Connect efforts to promote innovation in large enterprises to regional development agendas. Currently in many regions, there are major hurdles for linking education and research structures, as well as small business, to established industries, on account of the lack of interest in innovation among large incumbents.

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