ERAWATCH COUNTRY REPORTS 2010: Russian Federation

ERAWATCH Network – Centre for Social Innovation, ZSI

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Executive Summary

Russia is the largest country in the world in terms of area, and spans over nine time zones. It has a population of 141.9m (Federal State Statistics Service, 2011), which is concentrated in the European part of the country and makes it herewith the largest European country. It is an upper middle income country with a GDP[1] per capita of USD 8,684 in 2009 (World Bank, 2011). Its economy depends largely on primary goods production (oil, gas, mining and metallurgy).

Russia invested over the period 2005-2009 slightly above 1% of GDP in R&D (GERD). In 2009 GERD amounted to 1.24% of GDP, which was equivalent to €11b. GERD is financed largely by the government (66.4% in 2009), whereas the business enterprise sector financed only 26.6% of GERD in 2009, showing even a declining trend (EUROSTAT, 2011). Most of GERD is performed in the business enterprise sector (62.4% in 2009), a sector which is marked by big R&D intensive companies in state ownership.

The EU and associated countries to the EU's Framework Programme for RTD (FP) are Russia's main international cooperation partners in R&D. The multilateral cooperation with the EU is legally based on the EU-Russia S&T agreement. Russia has the highest participation rate in the EU Framework Programmes, of all so-called "Third Countries" (non-EU and non-associated countries to the FP). In addition around fifteen bilateral S&T agreements and related bilateral R&D and innovation funding programmes underpin the cooperation with the EU.

Russia has an important scientific tradition with major successes in fields such as physics, space, aeronautics, and nuclear energy. It can rely on a well educated labour force and a significant number of R&D personnel.

Stimulating private investment into R&D and innovation is a major challenge for Russian policy makers. The structure of the economy with a focus on big companies and a large share of state ownership, as well as framework conditions (e.g. legal system) are not very conducive to private investment. Several stimulation measures have been taken in recent years: co-funding by business is a requirement in the main competitive R&D funding instruments, the Federal Targeted Programmes. Tax incentives and special economic zones for technology development were introduced. Venture funds and technoparks were added to the portfolio of measures. In 2010-2011 Technology Platforms were selected and a new funding tool for collaborative projects between business and higher education institutions (the HEI-business programme) was established.

The interactions and exchanges within the knowledge triangle education, research and innovation are not working well in Russia. Research is traditionally performed mostly in research institutes, and is more weakly established in universities and business enterprises. The measures mentioned above are targeting not only private R&D investment, but also an

[1] See the Glossary at the end of the report for explanations of abbreviations

improved interaction in the knowledge triangle. In addition, specific support tools for enhancing research within universities were introduced since 2009 with the programmes for selecting and supporting National Research Universities and for attracting leading scientists to Russian universities. Innovation infrastructure at universities was enhanced and spin offs from HEIs and PROs facilitated through a new law. The following table provides a brief overview of Strengths and Weaknesses within the knowledge triangle:

Knowledge Triangle

	Recent policy changes	**Assessment of strengths and weaknesses**
Research policy	Strengthening research at universities	S: opening up to international cooperation, new funding tools introduced for e.g. attracting foreign scientists and Russian scientific diaspora, focus on cooperation with the EU. W: HERD rather low in international comparison, domination of government sector
Innovation policy	Flagship project Skolkovo	S: commitment of policy makers to modernisation and innovation stimulation W: selective activities, without targeting the broader framework (e.g. legal framework); lack of evaluation of measures; weak R&D and innovation funding by business enterprise sector
Education policy	Selecting an elite group of universities and enhancing it with specific funding tools	S: upgrading of equipment and curricula, Bologna process joined and transformation to two cycle system W: streamlining of the university sector necessary
Other policies	Law on spin-offs issued in 2009	S: support tools for small innovative companies provided by FASIE, venture funds through RVK and funding through Rusnano available, framework conditions for spin-offs improved W: industry structure marked by a lack of SMEs

European Research Area

Assessment of the national policies/measures which correspond to ERA objectives[2]

	ERA objectives	**Main policy changes**	**Assessment of national strengths and weaknesses**
1	Ensure an adequate supply of human resources for research and an open, attractive and	- Funding programme launched in 2010 for attracting leading scientists (especially from abroad)	- Adequate supply for science & engineering, but qualifications not fully

[2] Of course non-ERA countries do not strive to achieve ERA objectives. This part of the report is simply to allow a comparison with the activities of ERA countries on these issues

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
	competitive labour market for male and female researchers	to Russian universities - Simplifications for hiring foreign highly qualified specialists introduced	matching the market demand - high levels of tertiary education attainment - Overall limited attractiveness of working conditions for researchers: low basic salaries, good RIs only at leading institutions, however, significant improvements over the last years
2	Increase public support for research	- Public budget for R&D decreased in nominal value in 2009, but increased as percentage of GDP to 1.24%	- Overall, medium levels of R&D expenditure, affected by the crisis - in absolute figures significantly increased financial inflows in R&D and innovation over last years - low business financing of GERD
3	Increase coordination and integration of research funding	- Russian participation in ERA.Net RUS project	- ERA.Net RUS calls for R&D and innovation projects implemented - Russian co-funding of EU-Russia coordinated calls within FP7 - R&D spending targets in terms of GERD as a share of GDP set (similar to EU), but not attained
4	Enhance research capacity	- in absolute figures substantially more funding available in Russia over last years	- Salaries of researchers improved over last years - a certain outflow of talented people and researchers abroad continuing
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	- participation in international infrastructures - plans for "Megascience" projects for national infrastructures	- participation in international R&D infrastructure projects (especially in Germany) - financial means for investing in big infrastructures in Russia available after long time - big infrastructures in Russia outdated - variety of infrastructures discussed, possibly not enough focus on most relevant infrastructures
6	Strengthen research institutions, including notably universities	- stimulation measures for strengthening research at universities introduced	- several new funding tools for university research and related knowledge transfer introduced: attracting

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
			leading scientists, HEI-business programme, Federal Universities, National Research Universities - HERD increasing, but still low in international comparison
7	Improve framework conditions for private investment in R&D	- tax incentives introduced	- legal framework still problematic: rigid public procurement law, customs and tax legislation and its application - effectiveness of measures not evaluated yet
8	Promote public-private cooperation and knowledge transfer	- Technology Platforms (TPs) selected in spring 2011	- stimulation tools implemented: FASIE, TPs, Rusnano, Russian Venture Company - results of stimulation measures not verified - limited level of business co-funding in the major R&D funding programmes, the FTPs
9	Enhance knowledge circulation	- S&T Cooperation Agreement with the EU since 2000, agreement to develop strategic partnership in R&I with the EU	- Russia is traditionally strongest third country performer in FPs - lifting of visa proposed by Russia to EU
10	Strengthen international cooperation in science and technology	- new inward mobility programmes introduced	- broad and increasing network of international cooperation programmes (through RFFI, RAN, etc.) available - great international interest in programme for attracting leading scientists (mainly from abroad) to Russian universities - hiring of foreign staff in Russia still cumbersome - bureaucratic hurdles (customs, taxation, etc.) for international R&D cooperation
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	- Technology Platforms introduced in 2011	- attempt to create RU TPs similar to EU TPs; in EU industry-led, bottom up, in Russia more policy-led, top down- knowledge circulation among knowledge triangle weak
12	Develop and sustain	- monitoring of some programmes	- output verification and

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
	excellence and overall quality of research	introduced (e.g. National Research University programme)	related indicators only recently introduced and only partly applied - discussions on appropriate evaluation indicators ongoing
13	Promote structural change and specialisation towards a more knowledge - intensive economy	- Skolkovo flagship innovation project	- modernisation and innovation taken seriously at top policy maker level - IT industry developing well - focus of the economy on primary goods production and big state-owned players is a weakness
14	Mobilise research to address major societal challenges and contribute to sustainable development	- presidential (thematic) priorities for modernisation issued	- international cooperation on major challenges, e.g. on energy in ITER project - several major challenges (e.g. climate change, sustainability, ageing) not yet taken seriously enough
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	- R&D statistics upgraded	- R&D statistics for Russia included in international databases (OECD, EUROSTAT) - some indicators e.g. on HRST still not available

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1 Introduction

The main objective of the ERAWATCH International Analytical Country Reports 2010 is to characterise and assess the evolution of the national policy mixes for the non-EU countries in the perspective of the Lisbon goals and of the 2020 post-Lisbon Strategy, even though they do not pursue these policies themselves. The assessment will focus on the national R&D investments targets, the efficiency and effectiveness of national policies and investments into R&D, the articulation between research, education and innovation. In doing this, the 15 objectives of the ERA 2020 are articulated.

Given the latest developments, the 2010 Country Report has a stronger focus on the link between research and innovation, reflecting the increased focus of innovation in the policy agenda. The report is not aimed to cover innovation per se, but rather the 'interlinkage' between research and innovation, in terms of their wider governance and policy mix.

2 Performance of the national research and innovation system and assessment of recent policy changes

The aim of this chapter is to assess the performance of the national research system, the 'interlinkages' between research and innovation systems, in terms of their wider governance and policy as well as the most recent changes that have occurred in national policy mixes in the perspective of the Lisbon goals. Each section identifies the main societal challenges addressed by the national research and innovation system and assesses the policy measures that address these challenges. The relevant objectives derived from ERA 2020 Vision are articulated in the assessment for comparison reasons.

2.1 Structure of the national research and innovation system and its governance

This section gives the main characteristics of the structure of the national research and innovation systems, in terms of their wider governance.

Russia is the largest country in the world in terms of area, and spans over nine time zones. It has a population of 141.9m (Federal State Statistics Service, 2011),[3] which is concentrated in the European part of the country and makes it herewith the largest European country. Russia invested in 2009 a share of 1.24% of GDP in R&D (GERD), which was equivalent to €11b (EUROSTAT, 2011).

The EU and countries associated to the EU's Framework Programme for RTD are Russia's main international cooperation partners in R&D. Russia has the highest participation rate in the EU Framework Programmes, of all so-called "Third Countries" (non-EU and non-associated countries to the FP). In addition around fifteen bilateral S&T agreements and related bilateral R&D and innovation funding programmes underpin the cooperation with the EU. As a consequence and with the aim to strengthening cooperation further, Russia expressed in 2008 its interest in an association to the EU's FP7. In February 2011, Commissioner Geoghegan-Quinn met with the Russian Minister for Education and Science, Andrei Fursenko, and confirmed that the EU would not open negotiations on Russia's association to FP7 (under the new, general EU-Russia Agreement), stating that the timing for this was no longer meaningful. Instead, it was agreed to build a new 'strategic partnership' between the EU and Russia for S&T.

Main actors and institutions in research governance

The main player in Russian S&T policy making, strategy and implementation is the Ministry of Education and Science (MES; in Russian: Minobrnauki or MON). Several other ministries have responsibilities for R&D and respective budgets: e.g. Ministry for Economic Development, Ministry of Industry and Trade, Ministry of Energy, Ministry of Information Technologies and Communication, Ministry of Defence.

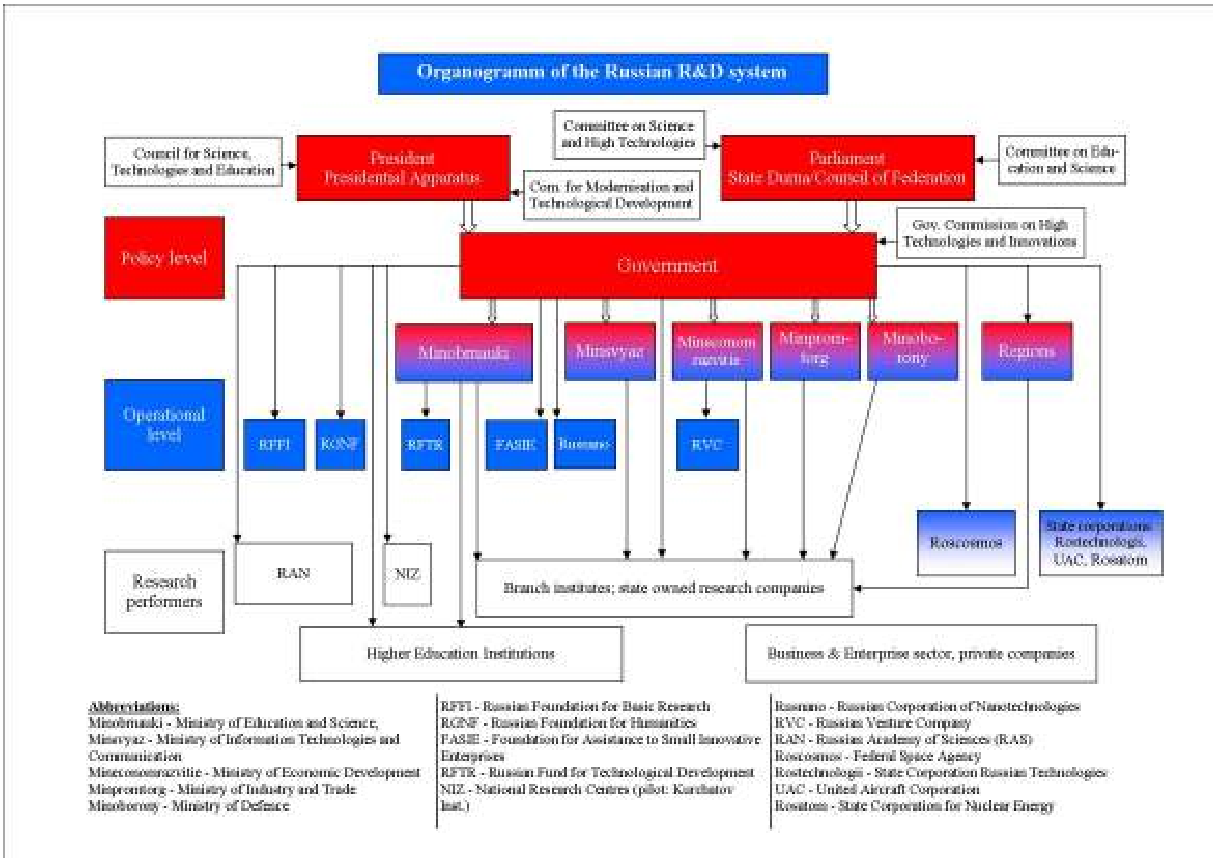
[3] Russia's population is declining since it became an independent state in 1991. Other sources estimate the population at around 139m in 2011.

Research policy is coordinated at the governmental level by the Governmental Commission on High Technologies and Innovations. Research related advisory bodies to the President are the Council for Science, Technologies and Education and the Commission for Modernisation and Technological Development of the Russian Economy, the latter one dealing especially with innovation related matters, which are high on the agenda in Russia.

Within the Russian Parliament two committees take care of research policy: in the lower house, the State Duma, the Committee on Science and High Technologies, and in the upper house, the Federal Council, the Committee on Education and Science. Both committees propose and scrutinise legislation relevant for R&D.

For policy implementation several funding bodies are in place besides the Ministry of Education and Science and the other relevant ministries: for basic research support, the Russian Foundation for Basic Research (RFFI) and the Russian Foundation for Humanities (RGNF) have been established. And for the innovation side, the Foundation for Assistance to Small Innovative Enterprises (FASIE), the Russian Foundation for Technological Development (RFTR), the State Corporation for Nanotechnologies – Rusnano, and the Russian Venture Company are available. Some important research institutions have a mixed set of tasks, including research performance and policy implementation. This concerns for example the Federal Space Agency: it is a major research organisation and at the same time it is responsible for implementing the Federal Targeted (funding) Programme for the space sector.

Figure 1: Overview of the Russian Federation's research system governance structure



Source: ERAWATCH Country Fiche – Russian Federation

The institutional role of regions in research governance

The Russian Federation is a federal state, structured into so-called *Subjects of the Federation*; these are 46 regions (oblast'), 21 republics, 4 autonomous districts (okrug), 9 territories (kray), 2 federal cities (Moscow, St. Petersburg) and 1 autonomous region (avtonomnaya oblast'). Federal subjects are regrouped for governance purposes into eight Federal Districts, led by representatives of the president. In the following, the term **region(s)** is used generally, referring to all Subjects of the Federation.

R&D capacities are concentrated in certain Russian regions and especially in and around big cities. In first place Moscow and Moscow region need to be mentioned here. Second comes the second biggest city St. Petersburg and then follow a range of important regional centres, such as Rostov-on-Don in the south, Kazan and Nizhny Novgorod in the Volga Federal District, several big cities in Siberia: Irkutsk, Krasnoyarsk, Novosibirsk, Tomsk, and in the Urals: Yekaterinburg.

R&D policy is shaped and implemented predominantly at the federal level, by the government and the responsible ministries, above all the Ministry of Education and Science. The regions have de-facto limited tasks and resources for R&D available, but their relevance - especially in innovation related support - is increasing. Several regions have developed their own regional S&T programmes, which target the respective regional R&D capacities and which are focused on the innovation and industrial component of R&D. Regional venture funds, technoparks, and innovation incubators are being established and regional co-funding of RFFI and FASIE funding programmes is provided.

Main research performer groups

Research is performed in Russia de-facto mainly in public institutions, particularly in the academy and institute sectors, and in state owned enterprises. Paradoxically, the share of GERD performed in the business enterprise sector is relatively high and reached 62.3% in 2009. This can be explained by the fact that several public research institutes are organised as companies and by the important role of state owned companies: both of these categories are counted in R&D statistics to the business enterprise sector.

Public Research Organisations (PROs) performed in 2009 a share of 30.3% of GERD. This sector includes some important organisations: the Russian Academy of Sciences (RAN) is still a major player in Russia's research system and receives a substantial block grant from the state. The Federal Space Agency (Roscosmos) and the State Corporation for Atomic Energy (Rosatom) are two more important R&D players. Universities have traditionally cared foremost for education, but have been gaining in importance over recent years in research; a development, which is stimulated and furthered by the government's research policy. GERD performed by HEI amounted to 7.1% in the reference year (EUROSTAT, 2011). The private non-profit sector is still insignificant in Russia.

2.2 Resource mobilisation

This section will assess the progress towards national R&D targets, with particular focus on private R&D and of recent policy measures and governance changes and *the status of key existing measures, taking into account recent government budget data. The assessment will include also the human resources for R&D. Main assessment criteria are the degree of compliance with national targets and the coherence of policy objectives and policy instruments.*

2.2.1 Resource provision for research activities

The main current strategic document for the S&T sector, the Strategy for the Development of Science and Innovation in the Russian Federation up to the year 2015, was prepared by the Ministry of Education and Science and approved in early 2006.

Specific targets for R&D intensity measured in Gross Domestic Expenditure on Research and Development (GERD) as a percentage of GDP have been set in the strategy. It foresees an increase in R&D spending to 2% of GDP until 2010 and 2.5% of GDP until 2015. Russia is currently spending slightly more than 1% of GDP on R&D and is herewith quite far away from its targets: in 2009 R&D intensity was 1.24% of GDP. However, in absolute figures funding inflows into R&D increased substantially, which was due to strong GDP growth of around 7% annually up to the year 2008. This trend was disrupted in 2009 as a result of the international economic crisis.

A target has also been set for R&D funding from national non-governmental sources, where especially the business and enterprise sector is meant to contribute. According to the strategy document this indicator should increase from around 40% in 2004 to 60% of national R&D funding until 2010 and 70% until 2015. EUROSTAT figures show however that this indicator was even decreasing and reached 26.6% of GERD in 2009. It should also be noted that the state controls several R&D intensive businesses and that R&D funding by private companies is rather limited. Both the R&D intensity and the non-governmental R&D funding targets seem pretty difficult to reach for Russia.

The international economic crisis has had strong effects on the Russian economy: after several years of remarkable economic growth, the GDP has declined in 2009 by nearly 8%. Economic growth was back in 2010 and the GDP expanded again by around 4% (OECD, 2011a). Still, the effects on R&D and innovation funding are remarkable: the budgets of some ambitious funding programmes were reduced by up to 30% in 2009 and by up to 70% in 2010. This concerns for example the main funding programme of the Ministry of Education and Science, the Federal Targeted Programme R&D in Priority Fields of the S&T Complex of Russia 2007-13. To compensate for budgetary cuts in 2009/10, the programme was prolonged for another year until 2013 (as few other Federal Targeted Funding Programmes for R&D too), but the overall budget of the programme was reduced by around RUB20b (around €500m).[4] In spite of cuts on some funding lines, support for innovation has come high on the policy agenda. An anticrisis programme was adopted by the Russian government for 2010, which foresees special funds of RUB10b (€250m) and consideration of several policy measures (e.g. tax breaks, grants) for stimulation of innovation activities, particularly in the enterprise sector.

The budgets of the research and innovation funds have also come under pressure. The growth trend of the RFFI budget was disrupted and its annual budget stagnates at around RUB6b. For the coming years 2012-2013 hefty cuts are under discussion,

[4] An exchange rate of €1 = RUB40 has been applied throughout the report.

which would reduce its annual budget to only RUB4b. Discussions are ongoing and the budget has not been decided yet (in July 2011). The budget of the innovation fund FASIE was in the crisis period even increased, as it got the task to launch and manage a specific anticrisis programme for the sector of small companies. For FASIE substantial budgetary cuts for the coming two years are under discussion too.

In the soviet past, R&D funds were allocated generally as block funds, based on planning decisions. Since Russia's independence in 1991 this funding mode has gradually been changing and competitive and project based R&D funding schemes have been established. In 2005 around 25% of the civil governmental R&D funding was allocated competitively. The share of competitive funding is constantly increasing, while the share of block grant funding against reporting requirements is decreasing. Competitive funding tends currently towards 50% of civil governmental R&D funding and shall be further increased up to 70%. These are ambitious goals, but it should also be noted that effective competition is in some sectors still rather limited.

Research funding is allocated either directly from the state budget to research performing organisations, channelled through the ministries mentioned above or distributed via several agencies. The portfolio of funding instruments has been further diversified over the past five years, with a special focus on support tools for innovation and for universities. Competitive R&D funding allocation is handled by several ministries, above all the Ministry of Education and Science (MON). It manages the main Federal Targeted Programmes (FTP) for R&D support:

- FTP R&D in Priority Fields of the S&T Complex of Russia (2007-2013); budget RUB172.39b (€4.31b), whereby RUB111.33b (€2.78b) are funded out of the federal budget and the rest shall come from non-budgetary sources[5]
- FTP Scientific and Scientific-Pedagogical Personnel of Innovative Russia for the years 2009-2013, budget RUB90.45b (€2.26b), whereby RUB80.39b (€2.01b) are funded out of the federal budget and the rest shall come from non-budgetary sources

MON is also responsible for recent new funding tools for the university sector. An amount of RUB90b (€2.25b) is planned to be invested over the period 2010-2012 in addition to the usual budget allocations for universities:

- Federal Universities programme
- National Research Universities programme
- Attracting leading scientists to Russian Universities
- Programme for stimulating business-university cooperation

Three main funding organisations have been set up besides the ministry already in the early 1990s: the Russian Foundation for Basic Research (RFFI) and the Russian Foundation for Humanities (RGNF) distribute grants for basic research in the sciences, social sciences and humanities. For applied research and innovation related funding, the Foundation for Assistance to Small Innovative Enterprises (FASIE) takes care of support for small innovative enterprises and start-ups. The smaller Russian Foundation for Technological Development (RFTR) provides zero-

[5] With non-budgetary sources is meant co-funding mainly from business, but also from regional or other sources, which are not directly related to the federal budget.

interest loans to companies for innovative projects. More recently were additional funding bodies for innovation activities introduced. The Russian Venture Company (RVK) was set up in 2006 and operates as a fund of funds for establishing a network of national and regional venture funds. The State Corporation for Nanotechnologies (Rusnano) was established in 2007 and supports commercialisation of nanotechnology.

Federal Targeted Programmes and innovation related funding are implemented in a collaborative funding mode, requiring to different extents co-funding from private sources. This approach has still some limitations in Russia, as co-funding cannot always be attracted in the extent, as is planned in certain programmes.

Tax incentives, such as tax breaks on R&D grants, favourable depreciation periods, etc. have been introduced in Russia in the last years, but their role and effects are not well studied yet. It seems that especially companies do not yet well take up these incentives, for lack of trust in the applicability of regulations.[6]

2.2.2 Evolution of national policy mix geared towards the national R&D investment targets

According to statistical data, the business enterprise expenditure on R&D (BERD) amounted in Russia to 0.78% of GDP in 2009 and is significantly lower than the EU-27 average, which was 1.25% in the same year. In the preceding years 2005-2008, BERD had with some ups and downs been around 0.7% of GDP.

Data for BERD as a share of Gross Domestic Expenditure on R&D (GERD) indicate that business enterprises perform 62% of GERD, which is the same level as in the EU-27 (data for 2009, EUROSTAT, 2011).

But these data need to be considered with some caution. Especially public ownership in the business enterprise sector has to be taken into account. In Russia a range of fully or partly state owned research institutes are organised as companies and are calculated therefore to the business enterprise sector. Furthermore big state owned companies represent a major share of research intensive Russian companies. It is quite difficult to discern the R&D funding of private companies, although it seems quite limited. Overall, “the extent of *state control* in the Russian economy remains extensive as a result of a high degree of state ownership and control over economic activity” (Conway et al, 2009). The influence of the state and the role of state owned companies have even further increased over the last years, especially during the financial crisis in 2009-2010. But plans to privatise state companies, e.g. in the transport sector (Aeroflot, Sovkomflot), and in the financial and oil sectors, are in preparation by the Ministry of Finance (Kudrin, 2011). In the next 3-5 years the state shall reduce its role in the economy and Russia shall become a more attractive place for private investment, which is indeed much needed.

Leveraging R&D investment from companies is a strategic target. The main tool is here a co-funding requirement in applied research funding programmes, especially the Federal Targeted Programmes managed by ministries. This mechanism is not yet working properly and business investment cannot be raised to the extent, as was planned in strategic and programme documents.

A new strategy has now become inciting big state owned companies (Gazprom, Russian Railways, Rosatom, etc.) to develop innovation programmes and to outline

[6] See regarding tax policy Simachev, 2011.

herewith their support for innovation activities. With this top-down approach the government tries to generate more business enterprise investment into R&D.

The framework conditions for innovative start-up businesses and the business environment in general remain difficult. It takes not particularly long to establish a business in Russia: 30 days are required, which is similar to the duration in Austria. But on the indicator *ease of doing business* Russia is only on 123rd place of 183 countries (data for 2010, World Bank, 2011). Overregulation and bureaucratic procedures, as well as high levels of corruption restrain business and innovation activities. Regulations on Intellectual Property Rights have been improved, but are still distracting national and international business from investing in Russian R&D and innovation.

But these problems may also lead to an underestimation of innovative capacities, as successful firms may wish not to declare their true innovation performance to avoid controls by the authorities. Support for innovative start-up companies is offered through the well established and relatively renowned funding tools of the Foundation for Assistance to Small Innovative Enterprises available (e.g. START programme, etc.). For more serious investment, venture funds have been established through the Russian Venture Company (RVK) since 2006. And for business ventures and implementation of research results in nanotechnologies is the state-owned Rusnano company since 2007 available, which also acts as a kind of investment fund.

Public Procurement is a very important, but rather ambiguous tool in Russia. Innovation activities are driven mostly by government policy and public procurement of goods is highly relevant in major publicly dominated industry sectors, such as energy, aeronautics, defence and space. Public procurement is also the main implementation procedure for the most important competitive R&D and innovation funding tools, the Federal Targeted Programmes. These programmes launch their calls for projects according to the Russian public procurement law (FZ-94). But the rules of the law are not well adapted to the needs of R&D and innovation funding and are more a type of straightjacket than a proper legal framework. The law has been modified more than 20 times over the last years, and is therefore rather complicated and an example of overregulation. Some of the most pressing problems are:

- Among the selection criteria for projects, the price of a good or service has an overly important role. This leads to price dumping and to the selection of less qualified proposers over scientifically much better qualified teams.
- Project Budgets are very rigid. Financial means foreseen for a certain year have to be spent in the same year and cannot be transferred to the next one.
- The purchase of scientific material and equipment has to be tendered. As usually the cheapest offer has to be selected, scientists end up buying inferior material than would be necessary for their research.

Discussions on the appropriateness of the law for R&D and innovation funding are ongoing for years, but have not yet led to a satisfying solution.

2.2.3 Providing qualified human resources

Traditionally, science and education are valued very high in Russia. As a country having achieved major successes in space, nuclear research, and other fields, the country has a rich research tradition and prides itself of a range of Nobel laureates, especially in physics.

At the point of its independence in 1991, Russia had inherited a huge R&D sector with a significant related labour force. As a result of the transformation processes to a market economy and due to serious cuts in funding, the R&D sector experienced an important downsizing. The R&D personnel shrank by more than 30% since 1991 to reach 761,252 in head count in 2008 (Higher School of Economics, 2010b). The R&D personnel per 10,000 employed attained 127 in 2008, which was equivalent to the value for Germany on this indicator.

Tertiary education levels of the population are quite high. In 2008 a share of 53% of the population in the age range from 25-64 years had attained tertiary education. This is higher as compared to all OECD countries (Higher School of Economics, 2010a; OECD, 2010). Russia educates an over proportional share of students in the sciences, although this trend has experienced a certain correction with more students in social sciences, particularly in economics.

But low salaries, limited career perspectives and outdated equipment distract young talents from embarking on a scientific career and lead them to the business sector for better paid job options. The situation regarding salaries has improved significantly over the last five years, when strong economic growth allowed increasing financial inflows into the R&D sector.

In spite of a broad reservoir of educated personnel, it needs to be mentioned that qualifications do not always meet the requirements of the labour market and of research. In June 2011 President Medvedev held a discussion with scientists, which were selected in a competition to establish research labs at Russian universities in the programme *attracting leading scientists*. Scientists were coming mostly from abroad, with a majority being emigrated Russian scientists. They complained that they can barely find enough sufficiently qualified personnel for their labs and that an improvement of education needs to be tackled.

On the job training, life long learning, creativity, communication skills and critical thinking are all elements, which need to be significantly enhanced in Russia for that the labour force can meet the requirements of an innovation oriented economy that will not rely as strongly as currently on primary goods production. A certain overprovision with tertiary educated human resources may be the case, while qualification on the job in companies would need more attention.

2.3 *Knowledge demand*

This section focuses on structure of knowledge demand drivers and analysis of recent policy changes.

Knowledge demand is driven above all by government or the government sector. Major R&D intensive sectors of the economy - aeronautics, space, defence, and nuclear energy - are dominated by state owned companies. The picture is a bit more diversified in the overall main economy sectors - oil, gas, and metallurgy - where relevant private players are active besides state owned companies. An encouraging exception in knowledge demand is the ICT sector, where several private R&D intensive companies have become internationally renowned service providers (e.g. Yandex, Kaspersky Labs, etc.).

The data for GERD by socio-economic priorities are not very telling concerning knowledge demand, but at least it confirms that defence and industrial production are highly important fields of knowledge demand in Russia. GERD for defence reached

0.34% of GDP in 2006, while the overall GERD was 1.07% of GDP (EUROSTAT, 2011).

Thematic priorities for modernisation were defined in the frame of the presidential modernisation commission. President Medvedev suggested in 2009 to focus on five thematic areas for modernisation of Russia's economy:

- Energy efficiency and energy saving, including alternative fuels;
- Nuclear technologies;
- Space technologies, especially related to telecommunication (GLONASS);
- Medical technologies;
- Information technologies, including supercomputers

These priorities come in focus for governmental knowledge demand and are relevant also for the project to establish a top international innovation centre in Skolkovo, near Moscow, which is pushed by the President. Another more recent initiative launched in the frame of this modernisation commission concerns a top down stimulation of innovation activities within big state companies (e.g. Rosatom, Russian Railways, etc). These companies all have to develop specific innovation plans.

Knowledge demand is driven also through public R&D and innovation funding programmes. The main funding programme, the FTP R&D in Priority Fields, solicits in a first step of a call specific topics from potential proposers. The topic of a call is then specified by the responsible FTP bodies. The development of this FTP indicates that knowledge demand from companies has some weaknesses: the funding line, where the highest co-funding share of more than 50% was required, had to be cancelled, because of lack of interest by business.

Technology Platforms (TP), which were selected in spring 2011, shall also provide thematic input for calls in FTPs. These TPs are coordinated mostly by big R&D intensive state owned companies (e.g. Rosatom) or governmental R&D funding bodies (e.g. Rusnano) and cover the usual thematic fields: energy, nanotechnologies, space, etc. It is a question for the future how far private businesses will collaborate on TPs, how far TPs will reach beyond the usual topical fields, and whether they will not be another support tool focusing on the big state-owned R&D players. They claim to be modelled to the European TPs – which are industry-led and bottom up – whereas it appears that the Russian TPs are more policy-driven and top down.

2.4 *Knowledge production*

The production of scientific and technological knowledge is the core function that a research system must fulfil. While different aspects may be included in the analysis of this function, the assessment provided in this section focuses on the following dimensions: quality of the knowledge production, the exploitability of the knowledge creation and policy measures aiming to improve the knowledge creation.

2.4.1 Quality and excellence of knowledge production

In terms of input into the R&D and innovation system, Russia invests substantial amounts into knowledge production. In 2009, GERD as share of GDP reached 1.24% which was equivalent to €11b. It can rely on a considerable number of R&D personnel (more than 760,000 in 2008) and a quite high share of more than 50% of tertiary educated population. But research infrastructures are in many institutes outdated and researchers need to use their international contacts to work on modern scientific equipment. The situation has improved partly, as in the last years significantly more funding has flown into R&D and innovation. This allowed upgrading and bringing equipment up to date at leading institutes and research organisations, such as the National Research Centre (NRC) Kurchatov Institute.

Analysis of the R&D and innovation system usually finds out that input does not match with output and that the latter one is limited and stagnating.[7] This concerns publications, citations and patents for research: Russia produces roughly 27,000 articles per year in journals referenced in the Web of Science (2008). It has herewith a share of 2.6% of world production. Output of scientific articles has with some ups and downs remained at this level since 1981, whereas other competitors (e.g. Brazil and China) have significantly increased their shares (Adams/King, 2010). Triadic patent families are similarly stagnating for Russia, as compared to China or other countries (Gokhberg/Agamirzyan, 2011).

Training of human resources is not up to the needs of research and the knowledge intensive labour market. What is especially lamented, is the transfer of new knowledge into innovations and application in the business sphere.

Several institutes, which were previously subordinated to ministries or agencies (so-called branch institutes) and which are still linked somehow to governmental bodies, continue working with very limited output. Also, within the main public research organisation, the Russian Academy of Sciences, the picture is ambiguous: research institutes or groups, which are top equipped, successful in competitive funding acquisition, and internationally well connected exist besides decaying institutes, which survive on traditional block grant funding and produce little output.

2.4.2 Policy aiming at improving the quality and excellence of knowledge production

The government authorities are to some extent aware of the limitations of the R&D and innovation system. Russian and international studies have been commissioned and strategic documents have been prepared, which reveal the weaknesses. For example the new “Innovative Russia - Strategy 2020”, a draft of which was presented in early 2011, points explicitly to the weaknesses in knowledge transfer to business.

The situation with statistical indicators has improved a lot for Russia and many major indicators for the R&D and innovation system can now be found within OECD or EUROSTAT databases. International benchmarking is herewith facilitated and the benchmarking tool is therefore indeed already widely used.

The evaluation of research institutions and funding programmes, gives an ambiguous picture, reflecting the transformation processes the country is still undergoing. In 2009 a general regulation was issued by the government (Decree No 312), which obliges public research organisations to provide reporting on a defined set of indicators. However, a systematic evaluation is not well established yet; discussions are ongoing among scientists, how to best evaluate and which indicators to use. Accountability of research organisations has been enhanced and several funding schemes include now obligatory evaluations. The Russian Academy of Sciences is obliged to provide annual reporting and measurement of indicators against their large

[7] See for example OECD Reviews of Innovation Policy: Russian Federation 2011 (OECD, 2011b), or the draft innovation strategy of the Ministry of Economic Development (2010): Innovative Russia – 2020 (which was adopted by the Russian government on 6 September 2011).

block grant from the federal budget.[8] Implementation of the funding programme *National Research Universities* is accompanied by a monitoring, in which the funded universities have to provide figures on indicators such as number of articles produced per year, number of foreign students, etc. (Ministry of Education and Science, 2009).

Approximately 50% of civil R&D funding is provided in Russia through competitive funding programmes. Project proposals are evaluated in these programmes, although evaluation procedures, especially in Federal Targeted Programmes, have some flaws and competition is sometimes limited. International experts have so far only been involved in project evaluations for the *Leading Scientists* programme of the Ministry of Education and Science, which was launched in 2010 (see chapter 3.1.3 Open recruitment and portability of grants) and for few funding lines of the research funds RFFI and FASIE.

2.5 Knowledge circulation

This section provides an assessment of the actions at national level aiming to allow an efficient flow of knowledge between different R&D actors and across borders.

2.5.1 Knowledge circulation between the universities, PROs and business sectors;

Knowledge circulation between the universities, PROs and business sectors is a weak point. They operate in a rather separated mode, while interaction and circulation between the sectors are limited. However, several initiatives have been taken to stimulate knowledge circulation.

As a result of a competition in 2005, four Special Economic Zones (SEZ) for Technology Development have been established in St. Petersburg, Tomsk, Zelenograd and Dubna (the latter two situated in the surroundings of Moscow). All four zones have been created around important public scientific centres, to which private companies shall be attracted with the incentive of tax breaks. The presidential innovation flagship project *Skolkovo Innovation Centre* (near Moscow), shall provide an environment for interaction among research organisations and business, which comes with tax breaks and modern infrastructure.

The Ministry of Education and Science has launched in 2010 a new funding programme for stimulating business-university cooperation. The budget of the programme is RUB19b (€475m). Two calls were implemented in 2010 and overall 112 projects received financial support. One project may receive public support of maximum RUB100m per year (€2.5m), and it may last up to three years. The business partner in the project needs to provide co-funding of the project with at least the same amount as the public support.

While there is even a proliferation of different measures for stimulating knowledge circulation, and in general for innovation activities, proper evaluations of the effects of the measures have not been undertaken yet. Gokhberg/Agamirzyan (2011) mention though that SEZs and technoparks have not met the expectations. For some more recent measures (Skolkovo, HEI-business programme) it is too early to provide judgements.

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[8] The OECD Review of Innovation Policy: Russian Federation 2011 (OECD, 2011b) finds it striking that no systematic evaluation of the Academy of Sciences has been undertaken yet.

2.5.2 Cross-border knowledge circulation

Cross border knowledge circulation is one of the active points, although with the disadvantage that it is mostly the Russian scientists circulating and much less foreign scientists coming to Russia. Several policy measures have been taken for cross-border knowledge circulation, especially in the last years.

1) On the level of research organisations, the Russian Academy of Sciences has traditionally exchange programmes with a broad range of Academies of Sciences in other countries of the Former Soviet Union and in Europe.[9] These are financially small scale support schemes, but they allow for steady researcher exchange.

2) Involvement of Russian researchers in inter-governmental Research Infrastructures (RI) is well established and expanding. Russian scientists are collaborating already since 1964 in the frame of CERN, and the country considers enhancing its status from observer to associated member. Russia is a member of the ITER consortium and participates in several international infrastructure projects in Germany (FAIR facility, X-FEL, BESSY). It hosts itself with the Joint Institute for Nuclear Research (JINR) an international infrastructure and additional international infrastructures on Russian soil are under consideration (see chapter 3.2 Research Infrastructures).

3) Cross border knowledge circulation is supported through international programmes of the research and innovation funds RFFI, RGNF and FASIE and some ministerial programmes. Circulation is mostly a one way pattern, leading Russian researchers abroad, whereas inward mobility is more limited. A new support scheme to enhance inward mobility of experienced scientists and to bring them for longer time periods to Russia was introduced in 2010 (see chapter 3.6.2 mobility schemes).

To allow for a greater inflow of foreign researchers several framework conditions need to be improved. This concerns availability of modern equipment, housing infrastructure, visa and employment procedures, etc.

2.5.3 Main societal challenges

Some research fields, where Russia has strong scientific potential, or where it wants to push its capacities, are more relevant for intersectoral and international S&T cooperation than other fields. These fields concern for example cooperation on research in physics, energy (including nuclear fission and fusion), aeronautics, space and nanotechnologies.

An important grand challenge, where Russia is cooperating internationally concerns energy: on the one hand it is a major energy resource provider for EU countries and on the other hand it cooperates on future energy technologies with the EU, e.g. on the international nuclear fusion project ITER.

Another important field for Russia is nanotechnology, where it has put high priority on research, technology development and innovation. Support and stimulation activities have been getting off the ground in the last few years: the Russian state corporation for the support of nanotechnologies - Rusnano - has after a slow start begun funding of innovative projects and is organising annually an important international nanotechnology forum in Moscow.

[9] At the website of RAS there are 70 agreements with 48 partner countries mentioned, in the frame of which research cooperation is ongoing. See http://www.ras.ru/about/cooperation/internationalcooperation.aspx, last accessed 11/07/2011

The selection of Russian Technology Platforms, which shall stimulate the intersectoral cooperation among business, research institutes, universities and governmental organisations, confirms the thematic priority setting: of the 27 TPs selected for support in spring 2011, some 11 deal with energy related topics (nuclear energy, oil and gas, alternative energies, etc.). Another five TPs deal with nanotechnologies and new materials, whereby four of these are coordinated or co-coordinated by Rusnano. Other fields with more than one TP are space and ICT (Governmental Commission, 2011).

2.6 *Overall assessment*

Table 1: Summary of main policy related opportunities and risks

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	- in general increased funding available for R&D and innovation	- resource provision is dominated by and depending on the government sector; R&D and innovation funding by business enterprise sector is low and even decreasing
Knowledge demand	- policy measures to strengthen knowledge demand by government and in state owned enterprises: Technology Platforms, Innovation Plans of state owned enterprises	- low business enterprise knowledge demand
Knowledge production	- higher salaries and improved equipment due to increased R&D funding	- low productivity and output in certain research institutions - ageing of the R&D personnel due to migration processes and decline of population overall - rigid funding framework (public procurement law)
Knowledge circulation	- governmental stimulation measures: HEI-business support programme, Special Economic Zones - opening to international cooperation: attracting leading scientists programme, improving of framework conditions for hiring foreign scientists	- focus on government driven measures, but low interest from business enterprise sector - still complicated framework conditions and overregulation: visa, migration & employment rules, etc.

In resource mobilisation the situation has in Russia significantly improved over the last years up to 2009 and more funds have become available for R&D and innovation. This has allowed introducing specific measures to strengthen knowledge demand and knowledge circulation, e.g. through Technology Platforms, through stimulation of cooperation between HEI and business, etc. The situation is although marked by a strong focus on government driven measures, while business enterprise R&D and innovation funding is even decreasing. The opportunities offered by the new stimulation measures will have to come only to fruition and its efficiency needs to be verified at a later stage. A stronger focus on efficient research institutes and a certain streamlining of this sector, as well as measures regarding ageing of the R&D personnel will have to be considered.

Table 2: Main barriers to R&D investments and respective policy opportunities and risks

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
Framework conditions for business R&D investment: business environment, corruption, red tape, overregulation, cumbersome to "repressive" administration of taxation and customs	O: policy to enhance legal environment, top policy level committed to modernisation of the economy and stimulation of innovation R: ad-hoc measures to improve framework and selective solutions, not enough focus on tackling the overall framework and on simplifying regulation
Rigid legal framework for R&D funding: public procurement law 94-FZ applied for most of competitive R&D funding	O: revisions of the law under consideration R: more than 20 modifications of the law have not yet led to a reasonable solution
Weak linkages between HEI, PROs and business	O: stimulation measures taken: Special Economic Zones, HEI-business programme R: effectiveness of measures not systematically evaluated and the efficiency of some is doubtful
Lack of innovative companies, especially of SMEs	O: renowned programmes of FASIE for support of small innovative companies, improved legal framework for spin-offs from HEI and PROs, stimulation tools Rusnano for nanotechnologies and Russian Venture Company for venture funds established, tax incentives R: limited budget of FASIE, not very attractive business environment and framework conditions, some stimulation tools only recently established and effectiveness not verified yet
Structure of the economy: focus on big state owned companies, overly important role of the state in the economy	O: privatisation plans announced R: over-reliance on the state and on state owned companies as drivers of innovation

3 National policies which correspond to ERA objectives

3.1 Labour market for researchers

3.1.1 Stocks and mobility flows of researchers

There were 375,804 researchers counted in 2008 in Russia, which is only half of the researcher stock in 1991. This heavy decline illustrates the strong downsizing of R&D capacities and the migration trends of researchers, both internally in Russia to other sectors of the economy (e.g. to business) and externally as brain drain abroad. It is estimated that around 30,000-35,000 researchers emigrated abroad during this period.[10]

The overall R&D personnel has declined by more than 30%, which is much less than the reduction of researchers. This difference points to a certain quantity of unproductive R&D personnel and to emigration trends of the experienced and well qualified researchers. Researchers per 10,000 employed further illustrate this analysis: for Russia this indicator stood in 2008 at 66, whereas for Germany it was 73; on the indicator R&D personnel per 10,000 employed, the countries were in 2008 on a par with 127 (HSE, 2010b; for R&D personnel data compare chapter 2.2.3 Providing qualified human resources).

Postdoctoral researchers include in Russia *Candidates of Science* (equivalent to PhD) and at a higher level *Doctors of Science* (equivalent for example to habilitation in Germany); in 2009 the number of Candidates among researchers was 75,980 and the number of Doctors was 25,295.

Concerning postgraduate studies, in 2009 there were 154,470 students (*Aspiranty*) enrolled in the postgraduate study programme, the *Aspirantura*, for becoming a Candidate of Science. In this same year 34,325 students graduated (CSRS, 2011).

Mobility of researchers flows mainly from Russia abroad, with far less researchers moving to Russia. Mobility flows from Russia were for some time and are still to some extent driven by the need for international cooperation, which allowed access to modern infrastructure and equipment. Furthermore, international grants were essential to keep the strong research groups in science, particularly in the 1990s, in the immediate years after the break-up of the Soviet Union, when the Russian economy contracted importantly and R&D budgets experienced dramatic cuts. The significant brain drain of scientists might now be turned into an advantage through linking well established emigrated scientists all over Europe, the USA and other places of the world with their colleagues in their former home country.

Policy makers have taken the opportunity of increased R&D budgets for stimulating with specific funding programmes the cooperation with emigrated scientists (e.g. in the framework of the FTP R&D Personnel). Moreover, the Ministry of Education and Science discusses with Russian scientists abroad, for example through the “Russian

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[10] See “Round table: Emigration abroad and brain circulation in the scientific-technological sphere of Russia” (in Russian), published at www.strf.ru, last accessed 2 September 2011.

speaking Academic Science Association (RASA)"[11] and considers its suggestions in its policy making. Emigrated scientists are now also consulted for evaluation procedures within Russia, which is a very important development for improving, opening up and internationalising the national evaluation procedures.

A specific problem of the R&D personnel and researcher stocks concerns its age structure. Because of the important migration trends, especially the age brackets 30-49 are thinned out, whereas the age brackets 50-70 and over constitute more than 50% of researchers (HSE, 2010b).

3.1.2 Providing attractive employment and working conditions

It is not very tempting to embark on or follow-up a research career in Russia: the important and valued scientific tradition (with several Russian Nobel laureates), which makes research attractive, has to be seen against the difficulties of today's R&D and innovation system. A research career necessitates either true commitment to research, or it is triggered by a lack of alternatives. Otherwise the talented move to better paid jobs in business or abroad.

In the economic upswing phase up to 2009, salaries of researchers have been significantly increasing. But basic salaries of researchers are usually still low, especially when considering regional disparities in price levels. In Moscow and St. Petersburg, where most of the R&D capacities are situated, price levels are usually higher than in the rest of the country. The average monthly salary of the R&D personnel amounted in 2008 to RUB19,263.3 or around €480 (HSE, 2010b).

Researchers are employed by their organisation, e.g. the Academy of Sciences or universities, and are paid according to the internal salary regulations. Additional non-financial benefits, such as cheap housing, offer incentives for researchers to enter or stay in science. But it is with competitive grants from the research foundations (RFFI, RGNF, FASIE), with funding from competitive FTPs and other ministerial programmes, and with international projects that the leading researchers can improve their salaries. Another alternative is to follow-up a second job or additional paid activities besides the regular research employment.

Because of the economic crisis in 2009/10 not only funding programmes were cut, but also the budgets of research organisations. This has led to an additional pressure on salaries; cumulated with the already limited level of payment, it increased dissatisfaction. An indicator is here demonstrations organised in autumn 2010 by the union of academy collaborators and ongoing discussions on the salary levels within the academy.

Other working conditions are also not very conducive to embarking on a scientific career: equipment is in many institutions outdated, although increased research funding over the last years has helped improve the situation and the leading research groups dispose of up to date equipment. There are although no modern big infrastructures available and researchers have to move abroad in this case.

Ageing of the mentoring and supervisory staff for young researchers, limited career perspectives (e.g. because of the favouring of male colleagues over female for the top positions) are other discouraging factors.

[11] See http://www.dumaem-po-russki.org/

As in many countries, career breaks are not advantageous for professional advancement. Women take usually short maternity leave, also because of the need to earn a salary, and birth rates are in general rather low in Russia. Parental leave is regulated in chapter 41 of the Russian labour code (197-FZ). Duration of leave is specified in the code and the right to return to the same position after the leave guaranteed. The father of a child is also entitled to take parental leave.

More of a problem is the de-facto domination of male colleagues in leading positions. For example among the 56 members of the Presidium of the Russian Academy of Sciences, its top governing body, strikingly there is not a single woman.[12]

3.1.3 Open recruitment and portability of grants

In general, there is not many foreign staff working at Russian research institutions. The approach to employment of foreign specialists has been up to now restrictive and regulated through quotas. Migration regulation is confusing: at a hearing of the Federation Council was stated that 846 legal acts regulate migration, whereby many are contradictory.[13] Anyway, the attractiveness of moving to a Russian research institution is limited by the framework conditions for research: harsh living conditions, quality and availability of housing, language barriers, low payment, outdated infrastructure, etc.

However, attitudes in Russia are changing and the country has become since several years more open to international cooperation. This extends now slowly to recruitment. Some research institutions, especially universities (e.g. Higher School of Economics) are trying to attract foreign staff on their own initiative. The Ministry of Education and Science stimulates scientists from abroad, including from the Russian scientific diaspora, to establish labs in Russia through the new support programme *attracting leading scientists to Russian universities*, which was introduced in 2010. The programme follows for the moment an elite approach, and targets not yet at a broader internationalisation of research institutions: in the call 2010 in the frame of this programme 40 scientists were selected to establish research labs at universities. Only five of the selected scientists were permanent Russian residents (MON, 2011a). Interestingly, it is planned that in the future (probably as of 2012) the programme shall be opened to non-university research institutions. Recruitment of foreign specialists is also essential for the success of Russia's innovation flagship project, the Skolkovo innovation centre.

The more open attitude has brought about some changes in regulations too. Registration rules for foreign specialist have been relaxed. Highly qualified foreign specialists are defined by income, if they earn at least RUB2m (€50,000) per year. They need now only a confirmation on their status from their employer to get a work permit for three years.

The recognition of qualifications is improving due to Russia's adhesion to the Bologna process and adoption of European rules. The recognition of foreign diplomas shall be further simplified for attracting highly qualified specialists and for enhancing academic mobility. A modification of the law on recognition of diplomas is

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[12] See http://www.ras.ru/presidium/headquarters/presidiummembers.aspx, last accessed on 11/07/2011.

[13] See the article "A migration codex shall be established for the R[ussian] F[ederation] " on http://www.strf.ru/material.aspx?CatalogId=221&d_no=35218 (in Russian), last accessed on 20.07.2011.

under preparation, which would lead to recognition of diplomas issued by *"leading institutions"* without specific recognition procedures in Russia. A list of such leading higher education institutions shall be set up by the Ministry of Education and Science.

Research positions are to a certain extent published at the websites of research institutions, but usually only in Russian.

The portability of grants depends on the funding agencies, which provide the R&D or innovation support. The R&D funds RFFI and RGNF as well as few ministerial programmes provide grants, which are linked usually to the individual researcher and which are therefore portable. The innovation fund FASIE and the major funding tools Federal Targeted Programmes (of ministries) provide financial support through state contracts. These are linked to the research institution and are therefore not portable. Most competitive R&D and innovation funding is allocated through FTPs and related state contracts.

3.1.4 Meeting the social security and supplementary pension needs of mobile researchers

There are not many specific regulations for social security and complimentary pensions for mobile researchers in Russia. Mobile researchers (Russian or foreign) are usually required to provide confirmation of social security coverage for accidents and medical treatment, as a precondition for visas.

3.1.5 Enhancing the training, skills and experience of researchers

The postgraduate training is with the so-called *Aspirantura* quite formalised. Since Russia has joined the Bologna process, the system is in a transformation process to European standards. A credit system has already been introduced as a consequence. There are some examples of joint international postgraduate schools, e.g. the Postgraduate Training Network in Biotechnology of Neurosciences (BioN), a project supported by the EU's TEMPUS programme.[14] Through several international joint master programmes and through intensive exchanges in the ERASMUS Mundus programme, many students move to EU countries and use English in their studies. The same holds true for researchers, where many move abroad for research stays and some stay on for longer periods of employment abroad. For exchanges with the USA, various tools such as the Fulbright Program in Russia or the programmes of the Civilian Research and Development Fund (CRDF) Global are available.

Curricula modernisation at universities is stimulated by the various programmes introduced by the Ministry of Education and Science for enhancing the university sector: innovative universities programme, national research universities, etc.

3.2 *Research infrastructures*

Research infrastructures (RIs) are a key instrument in the creation of new knowledge and, by implication, innovation, in bringing together a wide diversity of stakeholders, helping to create a new research environment in which researchers have shared access to scientific facilities.

[14] See http://neurobiotech.ru/

3.2.1 National Research Infrastructures roadmap

Russia disposes of a range of major research infrastructures, in particular in physics. As a leading scientific power in nuclear energy, military technologies and in aeronautics and space research, respective research infrastructures have been built. A significant number of scientific infrastructures are situated under the roof of the Academy of Sciences. Some universities, for example Moscow State University, and organisations subordinated to federal agencies (e.g. Roscosmos) and state corporations (e.g. Rosatom), possess similarly unique facilities.

Some of the main installations are situated at the Kurchatov Institute in Moscow (synchrotron centre, beam technology), at the Joint Institute for Nuclear Research in Dubna (Moscow region – neutron reactor, beam technology), at the St. Petersburg Institute of Nuclear Physics in Gatchina (Leningrad region – high flux beam reactor), at institutions for space research, such as in Korolev (Moscow region) and Baikonur (in Kazakhstan).

New space related infrastructure is under construction with a cosmodrome in Vostochny and Russia's earth observation system GLONASS. An important programme for upgrading infrastructures in Russia is the Federal Targeted Programme Development of the nanoindustry infrastructure in Russia for 2008-2011.

Besides this programme, substantial funding for major scientific infrastructure projects is currently under discussion. Under the heading *Megascience*, six projects, mainly in the physics field, were in June 2011 preliminarily shortlisted for support over the coming years.[15] They shall now undergo a round of international evaluation.

- The tokamak IGNITOR project at Gatchina in St. Petersburg, which shall be implemented with international partners, especially Italian, in a 50-50% cost-share arrangement;
- The NICA collider project at the Joint Institute for Nuclear Research in Dubna, for which also an international 50-50% co-funding arrangement is in preparation;
- The neutron research reactor PIK in St. Petersburg;
- The synchrotron facility ISSI-4 at the Kurchatov Institute in Moscow;
- An ultra-high intensity laser complex in Nizhny Novgorod;
- The collider "Super Si-tau fabrika" (Super C-tau factory) at the Institute of Nuclear Physics in Novosibirsk.

The project costs range from RUB5b to RUB40.3b and overall an amount of RUB133b (€3.3b) would have to be invested over a period of up to 10 years. Some of the projects are already for a while in preparation, e.g. construction of the PIK reactor in St. Petersburg started already some 20 years ago, but works had to be stopped because of the serious cuts in research funding after Russia's independence in 1991. With a significantly improved funding situation for research, this project has been taken up again and construction of the infrastructure shall be finished.

There are some discussions ongoing, whether all the projects are still up to date and whether they are all necessary for Russia, given its strong investment in international physics related research facilities abroad. There is a certain danger of duplication of

[15] See http://mon.gov.ru/press/reliz/8629/

efforts at international and Russian level, whereas a concentration of resources on fewer projects and a greater diversification might yield more significant results.

3.3 *Strengthening research institutions*

This section gives an overview of the main features of the national higher education system, assessing its research performance, the level of academic autonomy achieved so far, dominant governing and funding models.

3.3.1 Quality of National Higher Education System

In Russia Higher Education Institutions (HEI) are differentiated into three types:

- Institutes,
- Academies or
- Universities.

Institutes and academies are usually thematically focussed on a certain speciality (e.g. Mining Academy), while universities have normally a broader approach (classical universities, technical universities or economic universities). In June 2011 there were 2,586 HEI searchable at the Russian Federal Education portal, the majority of which were state institutions (1,729 HEI).[16]

There are two Russian universities in the top 500 of the Academic Ranking of World Universities (2010): Moscow State University at 74th place and St. Petersburg State University, which is ranked in the span 301-400th place. There are different national rankings of universities established (e.g. by media), which are accessible at the federal education web-portal. These shall help potential students choosing an appropriate higher education institution.

Russian universities have traditionally cared mostly for education, while research was concentrated in institutes of the Academies of Sciences and branch institutes of ministries. The share of GERD performed by the Higher Education sector (HERD) is therefore rather low as compared to EU countries, but it is steadily increasing over the last years: HERD as share of GERD climbed from 6.1% in 2006 to 7.1% in 2009. In comparison, the average for the EU-27 reached 23.7% in 2009. Against this general picture, it needs to be mentioned that some of the main universities (Moscow State University, etc.) have always been performing research. Staff have been involved both in university teaching and research at institutes.

The Ministry of Education and Science tries to differentiate the university sector and single out a kind of elite group of universities. To this group belong:

- universities subordinated to the government: *Moscow State University* and *St. Petersburg State University*;
- a group of eight *Federal Universities*;[17]
- a network of 29 *National Research Universities.*[18]

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[16] See http://www.edu.ru/

[17] The Federal Universities are: Southern federal university in Rostov-on-Don, Siberian federal university in Krasnoyarsk, Northern federal university in Arkhangelsk, Privolzhsky federal university in Kazan, Ural federal university in Yekaterinburg, Far Eastern federal university in Vladivostok, North-Eastern federal university in Yakutsk, Baltic federal university in Kaliningrad.

Federal Universities are being established on the basis of already existing universities. National Research University is a status, which an existing university has received as a result of a competition. With improved and targeted funding shall the research component at universities be strengthened and the innovative capacities enhanced. Linkages with business shall be fostered, curricula be improved and human resources be better qualified.[19] It is without doubt an important and necessary policy initiative to focus more funds on a group of strong universities and to enhance their capacities. It may then also be expected that the broad field of organisations offering higher education will undergo a significant transformation and streamlining process, whereby weaker HEI will have to shut down. This will be triggered by the ageing trends, which leads to fewer students entering HEIs. Estimates of the Ministry of Education and Science project a reduction of more than 40% in student figures from 7.4m in 2009 to 4.2m in 2013 (MON, 2011b). The most prestigious and best universities are public; the broad and diversified field of private HEI includes few well renowned institutions, such as the New Economic School in Moscow.

Access to universities is possible through the Unified State Exam (EGE in Russian) at the end of secondary education, whereby universities may require additional entry exams. Tertiary education levels of the population are quite high for Russia. In 2008 a share of 53% of the population in the age range from 25-64 years had attained tertiary education, which is higher as compared to all OECD countries (Higher School of Economics, 2010a; OECD, 2010). It has to be considered here that half of the tertiary educated population attains only the shorter and usually more practical oriented tertiary type 5B education level (according to ISCED) and the other half attains the higher levels (ISCED 5A and 6). On these latter more advanced levels, Russia is not the leader, but still the indicator is rather high and it is in a top group of countries.

In higher education, Russia has taken in 2003 the important and far reaching decision to participate in the Bologna process and to adapt its educational system to European rules. This is an important basis for researcher mobility. It will certainly facilitate further exchanges and cooperation in S&T and confirms the priority which Russia has laid on cooperation with Europe. In October 2007 a new law (Federal Law 232-FZ) entered into force introducing the two cycle system with bachelor and master

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[18] The National Research Universities are National research nuclear university (established on the basis of Moscow Engineering-Physics Institute), National research technological university (established on the basis of the State technological university "Moscow institute of steel and alloys", State university - Higher school of economics in Moscow, Kazan state technical university of A.N.Tupolev, Moscow aviation institution (state technical university), Moscow state technical university of N.E.Bauman, Moscow institute of physics and technology (state university), Nizhni Novgorod state university of N.I.Lobachevsky, Novosibirsk state university, Perm state technical university, Samara state aerospace university of academic S.P.Korolev, Saint-Petersburg state mining institute of G.V.Plekhanov (technical university), Saint-Petersburg state university of information technologies, mechanics and optics, Tomsk polytechnic university, Belgorod state university, Irkutsk state technical university, Kazan state technological university, Mordovian state university of N.P.Ogarev, Moscow state institute of electronic technology, Moscow state university of civil engineering (MGSU), Moscow power engineering institute (technical university), Perm state university, Russian state medical university of the federal agency of public health and social development in Moscow, Russian state university of oil and gas of I.M.Gubkin in Moscow, Saint-Petersburg state polytechnic university, Saratov state university of N.G.Chernyshevsky, Tomsk state university, Institution of the Russian Academy of sciences - Saint-Petersburg academic university - Scientific-educational centre of nanotechnologies of the RAS, South Ural state university in Chelyabinsk.

[19] See for research related reforms of the university sector Dezhina, 2011.

degrees, but not yet concerning the PhD level. Universities should introduce the two cycle system over a transition period, which is currently (in 2011) ongoing and most students still study according to the traditional five year scheme. Russia has made until now most progress in adapting to Bologna principles in adopting comparable higher education degrees, introducing a credit system and in the provisions of learning quality.

The number of foreign students at Russian universities is with 1.3% in 2008 lower than in most EU countries (HSE, 2010a). The highest share of foreign students originates from countries of the Former Soviet Union.

3.3.2 Academic autonomy

The Russian Higher Education system comes from a rather rigid origin in the former communist system, where central control and guidance through the ministries were the rule. This has been liberalised importantly and a certain degree of autonomy introduced in the system with the law on education of 1992. Private universities were allowed and have proliferated. Nowadays there is even a too large number of public and private universities taking into account demographics with a steady decline of the younger population and potential students. Also, the educational standards are not up to the necessary quality level at certain institutions. The law on education has been completely revised and a new draft version was put to an open consultation in December 2010-January 2011. The law shall simplify and make the regulation of education more coherent, because besides the basic law on education many other legal acts were issued by different authorities. Moreover, the law shall be adapted to the new realities of the institutional structure (Federal Universities, etc.). The academic autonomy shall be specified now in a dedicated article.

HEI are in Russia accredited by the Federal Service for Supervision of Education and Science (Rosobrnadzor), which also takes care of quality control of educational activities and of curricula. Private universities are relatively autonomous, given they are accredited by Rosobrnadzor and given they can generate income through tuition fees for running their institution. The autonomy of public universities depends on its capacity to generate income besides the federal budget. Additional means through tuition fees, acquisition of research projects or additional funding from ministerial programmes (e.g. National Research University programme) give room to define new research fields and for hiring research personnel.

At the individual level, university personnel has usually huge teaching loads and often second or third jobs to prop up salaries. This limits their capacities to perform research, and in this sense their academic autonomy is restricted by availability of time for research.

The governance structure of HEIs differs slightly from institution to institution. HEIs are headed by the rector and the vice rectors. The rectors of the Federal Universities are appointed by the government, and the rectors of the two universities directly linked to the government – Moscow and St. Petersburg State Universities – are appointed by the Russian President. Other rectors in public universities are elected by the representative body of the university personnel, the conference of the university personnel. A scientific council is taking care of scientific and educational directions of a university. Several universities have established advisory councils or boards of trustees, where the participation of business representatives is still the exception (e.g. St. Petersburg State University).

3.3.3 Academic funding

Spending on tertiary education from public and private sources reached 1.4% of GDP in 2008 (UNESCO-UIS, 2011). Public block funding for universities is allocated only to public universities and makes up the main share of their funding. It is based on the number of students they educate and on some other indicators, e.g. the regional situation. Scientific performance criteria are of only limited relevance for block funding, but they are gaining in importance. Tuition fees are another important source of university income. Public HEI have to educate a certain quota of students without payment of tuition fees, and their costs are covered through funding from the federal and regional budgets. In addition to this minimum quota they are free to accept additional students against tuition fees. Since 2005 there are more students on tuition basis than on free publicly funded basis. The relation of public block funding (from federal, regional and municipal sources) versus income generated through tuition fees and from competitive sources differs largely between HEIs.

The budget of the major public universities, Moscow State University and St. Petersburg State University is directly included as a specific funding line in the federal budget. Private universities are funded by donors, tuition fees and generate income from competitive funding.

Funding for university research comes usually from competitive funding sources. These include projects supported under Federal Targeted Programmes and by the Russian competitive research and innovation funds (RFFI, RGNF, FASIE). Other competitive sources are grants for *leading scientific schools* and contract research. In the last years several specific programmes for strengthening university research have been introduced (e.g. National Research Universities), through which additional funds for research were made available. Own university funds, generated for example through tuition fees, may also be used for supporting research. Universities are relatively free to set research priorities, but depend on thematic priority setting of competitive funding programmes.

3.4 Knowledge transfer

This section will assess the national policy efforts aimed to promote the national and trans-national public-private knowledge transfer.

3.4.1 Intellectual Property Policies

Intellectual Property Policies are a long standing problem of the Russian innovation environment. IPR rules have long been contradictory and restrictive about ownership of IPR and its possible usage. According to the legislation, the Intellectual Property generated within public research organisations or publicly funded research projects mostly remains in the hands of the governmental bodies. This limits the private initiative to implement research results. A modification in the sense of providing the IPR to researchers or private bodies would help the implementation and stimulation of innovative activities.

In 2009 a new law (217-FZ) regulating spin-offs and Intellectual Property Rights (IPR) came into force. It was pushed by President Medvedev and allows universities and research institutions to establish companies together with other partners (e.g. businesses) for the commercialisation of generated innovations. Universities have an exclusive right on intellectual property generated at their institution. But they can transfer IPR through a licensing agreement and against a shareholding to a spin-off company.

3.4.2 Other policy measures aiming to promote public-private knowledge transfer

Russian framework conditions are not yet conducive to public-private knowledge transfer and innovation activities overall. The Russian Ministry of Economic Development admits in its draft Innovation Strategy 2020 (2011) that the quality of tax and customs regulation and its application have a "repressive" character regarding innovative business. Given this difficult starting point, some encouraging policy measures have been taken over the last years.

Involvement of private sectors in the governance bodies of HEIs and PROs

Few universities have yet established advisory councils or boards of trustees, where business representatives participate. Examples are St. Petersburg State University or St. Petersburg State Mining University. The board of trustees of the latter one, which is a key educational institution for the oil and gas, and metallurgy sectors, is composed only of business representatives (Gazprom, Alrosa, Surgutneftegas, Total, etc.). For PROs involvement of private sector representatives is usually not the case. But this depends on the PRO and its structure. The Federal Space Agency, which is by its nature a PRO, includes in its structure a broad range of companies, which are interlinked with research units and the central unit.

Inter-sectoral mobility

Researcher mobility between the education, research and business sector is rather low. The government tries to stimulate interactions between the sectors through new support tools, such as Technology Platforms and the funding tool for HEI-business projects (see for more details on these tools in chapters above). The measures are quite new and have just started the implementation of funded projects, therefore no information on its effects is yet available.

Promoting research institutions - SME interactions.

Interactions between research institutions and small innovative companies are stimulated by the Foundation for Assistance to Small Innovative Enterprises (FASIE) since 1994. Several funding tools have been developed by FASIE for specific aims: its UMNIK programme is designed for young scientists, or its main programme, START, provides support for market oriented R&D and establishing of start-up companies. The FTPs are other major tools, where in several funding lines cooperation between research organisations and business is required.

Spin-offs

Spin-offs from research institutions are stimulated specifically since 2009, when the above mentioned law 217-FZ on spin-offs was introduced (see chapter 3.4.1 on Intellectual Property Policies). Preliminary data indicate that 700 spin-offs were created from universities in 2010, but only 13 from the biggest Russian research institution, the Academy of Sciences (Shepelev, 2011). The rather solid figure for the university sector seems to be triggered firstly by a backlog of spin-offs, which made use of the new opportunities, and secondly by a certain need to provide figures, as spin-off creation is a priority of the Russian top leadership and an indicator for university performance. Given that there was a certain reservoir of spin-offs, then the comparably low figure for the academy may be explained by more bureaucratic procedures which have to be circumvented here. The law is a short lived measure yet, and the data will have to be observed over a longer time period, especially for survival rates and development paths of spin-offs.

Before this law came into force, potential spin-offs had the possibility to turn to FASIE for start-up funding; this is an option which is for the now "official" spin-offs still available and which can underpin their activities. Furthermore a broad infrastructure of around 80 technoparks is available in Russia, although there efficiency is doubted by analysts (Gokhberg/Agamirzyan, 2011). The public support programme for technoparks will be continued up to 2014, but a co-funding from regional or municipal budgets will be required.

Cohesion policy

Some funding for R&D and innovation activities is allocated to Russian organisations via structural funds and the European Neighbourhood and Partnership Instrument (ENPI). The transnational cooperation *Baltic Sea Region Programme 2007-2013* involves Russian organisations from the bordering regions to the EU (St. Petersburg, Leningrad oblast, etc.), but they can participate only as associated partners and receive limited funding out of the projects (up to 10% of project budgets).

Under the ENPI five specific cross-border cooperation programmes (CBC) were designed for cooperation with Russia:

- *Kolarctic* (FI-SE-NO-RU), programme budget: 70,48M€
- *Karelia* (FI-RU), 46,40 M€
- *South East Finland – Russia,* 72,36 M€
- *Estonia-Latvia-Russia,* 73,08 M€
- *Lithuania-Poland-Russia,* 176,13 M€

Co-financing of Russian participants by Russian sources was agreed with the Russian authorities. Calls in these programmes were launched mostly as of 2010 and it is therefore too early to assess, how far they support R&D and innovation. Some indications are given by projects supported under the South East Finland – Russia programme, where especially innovation cooperation is stimulated through several projects.

3.5 *Cooperation, coordination and opening up national research programmes with the EU*

This section assesses the effectiveness of national policy efforts aiming to improve the coordination of policies and policy instruments across the EU.

3.5.1 National participation in intergovernmental organisations and schemes

In the analysis of cooperation in the EU Framework Programme for Research and Technological Development (FP), it can be observed that Russia has consistently the highest participation of all "Third Countries" (countries not being EU Member States or Associated Countries to the FP) in the past FP's and the current FP7.

According to data of the European Commission, in FP6 in the period 2002-2006, Russian teams have been involved in 309 projects funded in the different programmes of FP6 (including Euratom). In these projects more than 450 Russian research organisations participated and received an EC contribution of around €50 million (without INTAS). Most projects with Russian participation were funded in the following scientific fields of FP6 in order of importance (citing here only the top three priorities):

- Sustainable development, global change and ecosystems;
- Nanotechnologies and nanosciences;
- Information society technologies (IST).

In the FP7, Russia is still the strongest "Third Country" performer in terms of funding it receives through the FP. In terms of participants in funded projects, Russia is in second place after the USA. Up to the year 2011, 391 Russian research organisations were involved in 264 funded projects and received financial support of €45 million.[20]

Russian scientists and teams participate in projects of the European initiatives COST and EUREKA. Russia has the highest participation in COST actions, of all countries not being a member of COST. What concerns EUREKA, Russia is member since 1993. But participation of Russian organisations is in comparison to the duration of its involvement rather low. This confirms the limited innovative capacities available in the country and lack of appropriate innovative companies. But it seems to some extent also be due to organisational arrangements within Russia. Russian participation has been fairly stable over the last 10 years, with on average around five project participations per year. Russia is not yet member of EUROSTARS, the EUREKA funding tool co-funded by EUREKA member states and the European Commission.

Russia has a certain tradition of cooperating with international partners on research infrastructures. Contacts between Russian scientists and CERN date back to 1964. A first formal agreement was concluded already in 1967. Currently Russia has a special observer status in CERN and considers upgrading it to associated member status. It participates in its major R&D programmes, for example in the Large Hadron Collider. Russia is also a member of the international ITER consortium for building a fusion reactor.

International cooperation on research infrastructures is particularly strong with Germany. Russia has pledged an important contribution of around €250m for the European XFEL project, an X-ray Free-Electron Laser facility which is under construction in Hamburg. The XFEL convention was signed in November 2009; Russia has with 23% the second biggest share in the project after Germany.[21] Russia is also involved in other major research infrastructures based in Germany, such as the international FAIR (Facility for Antiproton and Ion Research) at GSI in Darmstadt, and the synchrotron source BESSY in Berlin.

Russia hosts itself an international research infrastructure with the Joint Institute for Nuclear Resaerch (JINR) in Dubna near Moscow. In this framework it cooperates mainly with countries of the Former Soviet Union and from Central and Eastern Europe.

3.5.2 Bi- and multilateral RDI agreements with EU countries

On the bilateral level, Russia has concluded Science and Technology agreements with a broad range of EU Member States and Associated Countries to the FP. According to the Ministry of Education and Science[22], the Russian Federation has active agreements in place with thirteen out of the twenty seven EU members

[20] Data provided by the European Commission, 2011.

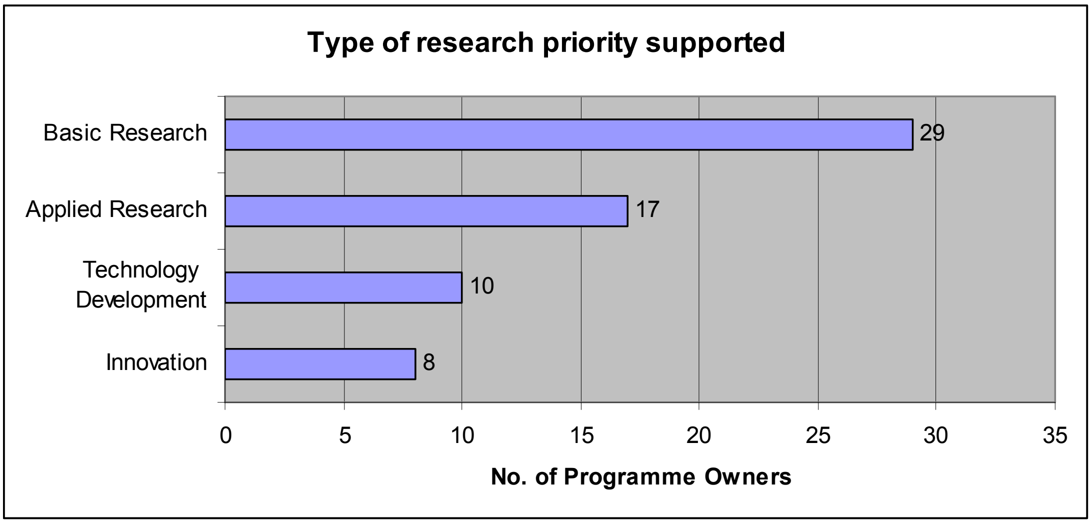
[21] See http://www.xfel.eu/news/2009/20091130

[22] See http://mon.gov.ru/work/mez/dok/

(Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Romania, Slovakia, Slovenia, Spain, and United Kingdom) and with four associated countries to FP7 (Israel, FYR of Macedonia, Serbia and Turkey). Another agreement was signed with Croatia in May 2011. Agreements with Austria, Netherlands, Norway and Switzerland were previously active, but are still in the process of renewal. Agreements have been established similarly on the level of research funding bodies, between the Russian Foundation of Basic Research (RFFI) and European counterparts. What concerns research organisations, mainly the Russian Academy of Sciences (RAN) has a dense network of cooperation agreements with academies in EU Member States and countries associated to FP7 in place.

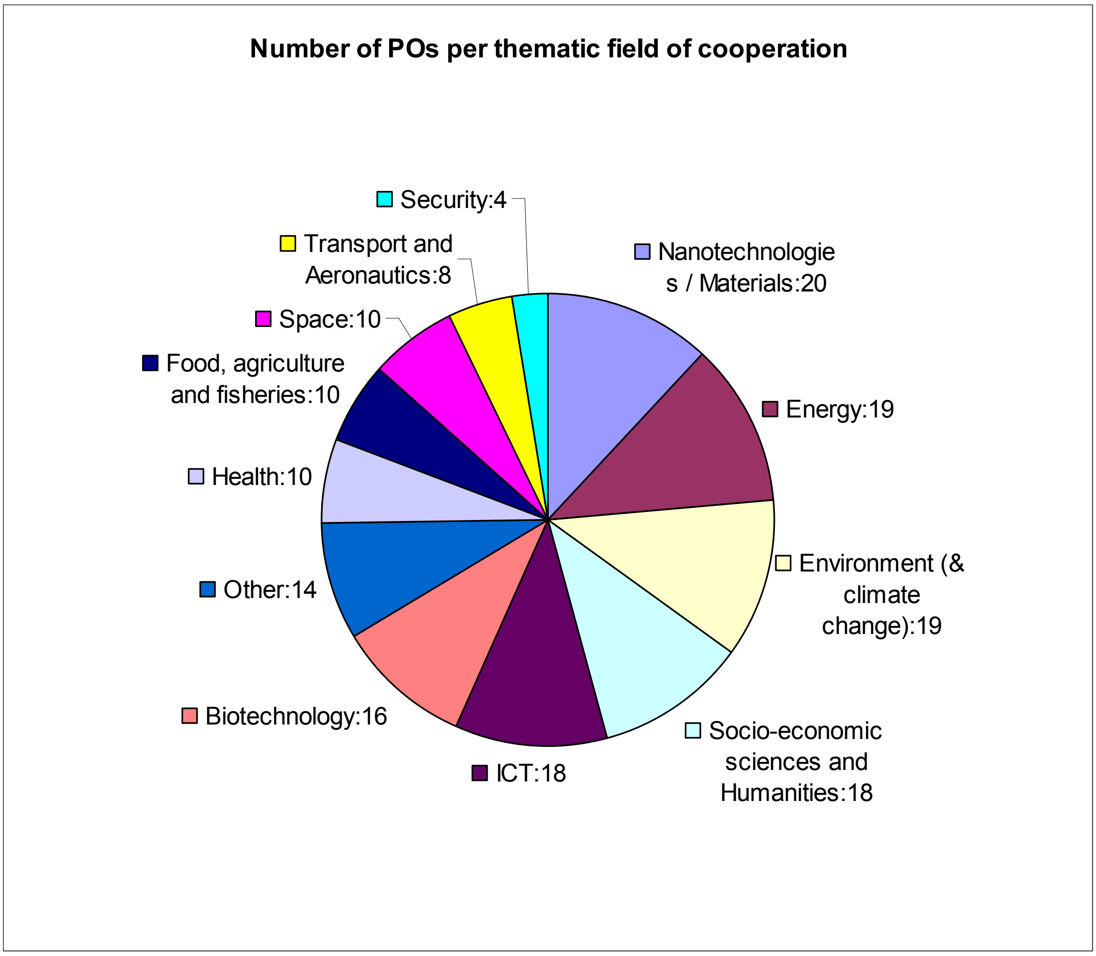
Not all of these agreements have resulted in substantial cooperation. But comprehensive cooperation with Russia has been developed between some of the bigger EU countries such as France, Italy and especially Germany, which ranges from mobility schemes, funding of joint research projects, co-funding of research infrastructure to joint laboratories. Also smaller EU countries such as Austria, Finland and Greece and countries associated to FP7 such as Israel, Norway and Switzerland have substantial cooperation ongoing on bilateral level with Russia and have established joint mobility and research funding schemes.

In the frame of the FP7 funded regional ERA-NET, the ERA.Net RUS project, a survey on unilateral or bilateral funding programmes relevant for cooperation with Russia was conducted in 2009/10 among R&D and innovation funding organisations (so-called Programme Owners – PO) in EU Member States, countries associated to the FP7 and in Russia. It revealed that in this R&D and innovation funding cooperation mainly basic research is supported: 29 of 32 responding organisations mentioned that they support basic research. Far less organisations support applied research (17 out of 29 responding organisations), technology development (10) and innovation (8) (Kougiou et al, 2010).



n=32

In the same survey, thematic priorities relevant for cooperation with Russia were questioned. The thematic priorities most frequently mentioned by the 35 responding organisations were nanotechnologies/materials (20), energy (19), environment (including climate change) (19), socio-economic sciences and humanities (18), ICT (18), and biotechnology (16).



n=35

3.5.3 Other instruments of cooperation and coordination between national R&D programmes

Russia has participated or is still participating in the following ERA-NET projects:

- ERA.Net RUS - Linking Russia to the ERA: www.eranet-rus.eu, which runs from 2009-2013. The ERA.Net RUS aims at coordinating bilateral funding programmes with Russia. As a result, it has implemented a joint multilateral call for R&D and innovation projects, financed by funding organisations from Russia, the EU Member States and countries associated to FP7. Furthermore, the project includes a foresight exercise on joint thematic priorities for the EU and Russia and on how the cooperation can be structured in a more efficient way, in particular through a sustainable joint funding programme.
- BONUS - Baltic Sea Science – Network of Funding Agencies: http://www.bonusportal.org/ was an ERA.NET project implemented under FP6 in the years 2004–2008. Under FP7 Bonus continued as an ERA.Net+ project and implemented a call with Russian participation. Bonus has meanwhile evolved to a European Economic Interest Grouping (EEIG) and a joint research programme with EU participation according to article 185 of the EU Treaty (TFEU). Russia is not yet a member of the Bonus EEIG.

- ERASysBio - Towards a European Research Area for Systems Biology http://www.erasysbio.net/index.php?index=311 was implemented under FP6 in the years 2006-2010.
- EUROPOLAR - The Strategic Coordination and Networking of European Polar RTD Programmes http://www.europolar.org/ was implemented under FP6 in the years 2004-2008.

Russia does not yet participate in European Public-Private Partnerships (Technology Platforms, Joint Technology Initiatives) or in Joint Programming.

3.5.4 Opening up of national R&D programmes

Russian national funding programmes are in principle open to participants from EU Member States. This openness is based on reciprocity between the EU and Russia, as Russian entities may also participate in the FP7. Openness of Russian programmes concerns above all the main public competitive funding instrument, the Federal Targeted Programme R&D in Priority Fields of the S&T Complex of Russia (2007-2013). Several other Federal Targeted Programmes are confidential and not accessible, as they are targeted at support of defence related research. An EU supported project, which facilitates access to Russian funding programmes, is ACCESSRU.[23]

3.6 *International science and technology cooperation*

In 2008, the European Commission proposed the Strategic European Framework for International Science and Technology Cooperation to strengthen science and technology cooperation with non-EU countries. The strategy identifies general principles which should underpin European cooperation with the rest of the world and proposed specific orientations for action to: 1) strengthen the international dimension of ERA through FPs and to foster strategic cooperation with key third countries through geographic and thematic targeting; 2) improve the framework conditions for international cooperation in S&T and for the promotion of European technologies worldwide. Having in view these aspects, the following section analyses how national policy measures reflect the need to strengthen the international cooperation in S&T.

3.6.1 International cooperation (beyond EU)

The main partner and the focus of Russia's S&T internationalisation policy is clearly the EU, its Member States and the countries associated to the FP7. Data on co-publications of Russian scientists show that the USA and the four big EU countries Germany, France, United Kingdom and Italy are the top collaborating partners (Adams/King, 2010). But also smaller EU Member States and countries associated to the FP7 have relevant shares of co-publications with Russia (e.g. Netherlands, Sweden, and Switzerland). Considering co-publication data, Asia is becoming more important for Russia. Cooperation with Japan is traditionally ongoing and increasing, but especially cooperation with China and South Korea shows an increasing trend.

The European Research Area (ERA) is an important concept for Russian research policy makers. Policy makers have stated that Russia should integrate as a full member in the ERA and accordingly Russia has declared in spring 2008 its interest in

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[23] See http://www.access4.eu/russia/index.php

becoming associated to the EU's 7th Framework Programme for Research and Development (FP7).

In May 2008 the first EU-Russia Permanent Partnership Council on Research took place, with then EU Commissioner for Research, Janez Potocnik, and Russian Minister of Education and Science, Andrei Fursenko, participating in the meeting. In the Joint Statement of the Permanent Partnership Council, it was highlighted that the European Research Area would be enriched and strengthened by Russia also becoming a full part of it. In February 2011, Commissioner Geoghegan-Quinn met with the Russian Minister for Education and Science, Andrei Fursenko, and confirmed that the EU would not open negotiations on Russia's association to FP7 (under the new, general EU-Russia Agreement), stating that the timing for this was no longer meaningful. Instead, it was agreed to build a new 'strategic partnership' between the EU and Russia for S&T.

Preparatory steps towards integrating Russia fully in the ERA have been taken with the concept of the common spaces between the EU and Russia, which includes a common space of research and education, including cultural aspects. For the implementation of the spaces, roadmaps have been agreed in 2005. The current EU-Russia roadmap on scientific and technological cooperation for the years 2010-12 covers thematic fields and sub-programmes of the FP.

Measures comprise among others the identification of thematic priorities for cooperation, facilitating the participation of Russian teams in the FP, and furthering the mobility of researchers. The EU and Russia have organised *coordinated calls* for R&D projects in the frame of the FP7, in which the call topics have been agreed between the partners. The Russian side has financed the participation of its teams in projects selected for funding from own resources. Russia uses mainly one action line of its Federal Targeted Programme R&D in Priority Fields of the S&T Complex of Russia (2007-2013) for funding the Russian participants in coordinated calls. Coordinated calls contribute to the implementation of the EU-Russian strategic partnership in science and technology and have been implemented meanwhile in the following thematic areas: Aeronautics; Energy; Food, Agriculture and Biotechnology; Health; ICT; Nanotechnology and New Materials; Nuclear Fission Energy.

Involvement of Russia into ERA is facilitated via strategic projects funded under FP6 and FP7, such as Scope-East, Bilat-Rus, ACCESSRU and especially the ERA.Net project for Russia, the ERA.Net RUS. This latter one has implemented a pilot call for R&D and innovation projects in spring 2011, which is jointly managed and funded by R&D funding bodies from EU Member States, countries associated to FP7 and Russia.

Some internal and external barriers are limiting the international cooperation activities of Russia. A significant problem concerns the export and import of scientific material and equipment. Customs services apply for some material a rather restrictive approach and delay or hinder its sending. This is, for example, critical for biologically active compounds and delays project implementation. Ad hoc measures ordered by the President shall help ease the problem: a specialised customs point was established in June 2011 within the National Research Centre – Kurchatov Institute, which will deal with customs clearance for scientific equipment and biological compounds for research.

For external barriers, the visa regime is an example. Russia has proposed on several occasions to the EU to lift visas, but the EU has not yet been receptive to this proposal. Some EU-countries are now considering individual solutions, e.g. France is planning a visa with five years duration with Russia and also Germany has announced to consider facilitating exchanges with Russia.

3.6.2 Mobility schemes for researchers from third countries

There are several Russian schemes in place, which support researcher mobility to Russia.

1. At the level of R&D and innovation funding organisations, all three major Russian Funds, RFFI, RGNF and FASIE have established bilateral funding programmes with partner organisations in EU Member States and countries associated to the FP7, in the frame of which mobility of researchers is supported.

2. Dedicated mobility schemes have been established by research organisations, especially between Academies of Sciences. The Russian Academy of Sciences for example has exchange programmes with several partner academies in the EU (e.g. Austria, Hungary, Poland, etc.).[24]

3. Two recently (in 2009 and 2010) introduced programmes of the Ministry of Education and Science have been designed for enhancing mobility.

- The first funding activity targets Russian scientists working abroad (*scientific diaspora*), who shall be attracted for working with research groups in Russia. Two calls for this support scheme were launched in 2009 and 2010 in the frame of the Federal Targeted Programme Scientific and Scientific-Pedagogical Personnel of Innovative Russia for the years 2009-2013. 110 projects were supported in the first call and 125 projects in the second call.
- With the second support scheme, Russia tries to attract leading scientists from Russia and especially from abroad (irrespective of whether they belong to the Russian scientific diaspora), to establish research groups at Russian universities. Leading scientists selected for support have to spend at least four months per year in Russia. This scheme comes with solid funding of approximately €3.5 million per each project for a period of usually two to four years. In the first call 40 scientists were selected for support of their projects, whereby half of the scientists are foreign nationals and only five selected scientists are permanent Russian residents. Most scientists from abroad are from the USA (ten - with four having double Russian and US nationality) and then from Germany (seven) (MON, 2011a). Importantly, foreign experts were also involved in the evaluation of proposals, which underlines the opening up tendencies of Russia in R&D and innovation. A second call in this scheme has been launched in April 2011, the results of which are expected for autumn 2011.

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[24] Funding schemes of funding and research organisations (type 1 and 2) are searchable at a database prepared within the ERA.Net RUS project. See http://www.eranet-rus.eu/en/167.php

4 CONCLUSIONS

4.1 *Effectiveness of the knowledge triangle*

The interactions and exchanges within the knowledge triangle education, research and innovation are not working very well yet in Russia. Research was traditionally performed mostly in research institutes, whereas it was much weaker established in universities and business enterprises. Measures to stimulate interactions within the knowledge triangle were designed by policy makers and introduced: Technology Platforms, Special Economic Zones, the innovation flagship project Skolkovo, the HEI-business cooperation programme shall all create environments for cooperation among education, research and business organisations. Specific support tools for enhancing research within universities were introduced since 2009 with the programmes for selecting and supporting National Research Universities and for attracting leading scientists to Russian universities. Innovation infrastructure at universities was enhanced and spin offs from HEIs and PROs facilitated through a new law. The following table provides a brief overview of Strengths and Weaknesses within the knowledge triangle:

Table 3: Effectiveness of knowledge triangle policies

	Recent policy changes	**Assessment of strengths and weaknesses**
Research policy	Strengthening research at universities	S: opening up to international cooperation, new funding tools introduced for e.g. attracting foreign scientists and Russian scientific diaspora, focus on cooperation with the EU. W: HERD rather low in international comparison, domination of government sector
Innovation policy	Flagship project Skolkovo	S: commitment of policy makers to modernisation and innovation stimulation W: selective activities, without targeting the broader framework (e.g. legal framework); lack of evaluation of measures; weak R&D and innovation funding by business enterprise sector
Education policy	Selecting an elite group of universities and enhancing it with specific funding tools	S: upgrading of equipment and curricula, Bologna process joined and transformation to two cycle system W: streamlining of the university sector necessary
Other policies	Law on spin-offs issued in 2009	S: support tools for small innovative companies provided by FASIE, venture funds through RVK and funding through Rusnano available, framework conditions for spin-offs improved W: industry structure marked by a lack of SMEs

4.2 Comparison with ERA 2020 objectives - a summary

Table 4: Assessment of the national policies/measures which correspond to ERA objectives

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive labour market for male and female researchers	- Funding programme launched in 2010 for attracting leading scientists (especially from abroad) to Russian universities - Simplifications for hiring foreign highly qualified specialists introduced	- Adequate supply for science & engineering, but qualifications not fully matching the market demand - high levels of tertiary education attainment - Overall limited attractiveness of working conditions for researchers: low basic salaries, good RIs only at leading institutions, however, significant improvements over the last years
2	Increase public support for research	- Public budget for R&D decreased in nominal value in 2009, but increased as percentage of GDP to 1.24%	- Overall, medium levels of R&D expenditure, affected by the crisis - in absolute figures significantly increased financial inflows in R&D and innovation over last years - low business financing of GERD
3	Increase coordination and integration of research funding	- Russian participation in ERA.Net RUS project	- ERA.Net RUS calls for R&D and innovation projects implemented - Russian co-funding of EU-Russia coordinated calls within FP7 - R&D spending targets in terms of GERD as a share of GDP set (similar to EU), but not attained
4	Enhance research capacity	- in absolute figures substantially more funding available in Russia over last years	- Salaries of researchers improved over last years - a certain outflow of talented people and researchers abroad continuing
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	- participation in international infrastructures - plans for "Megascience" projects for national infrastructures	- participation in international R&D infrastructure projects (especially in Germany) - financial means for investing in big infrastructures in Russia available after long time

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
			- big infrastructures in Russia outdated - variety of infrastructures discussed, possibly not enough focus on most relevant infrastructures
6	Strengthen research institutions, including notably universities	- stimulation measures for strengthening research at universities introduced	- several new funding tools for university research and related knowledge transfer introduced: attracting leading scientists, HEI-business programme, Federal Universities, National Research Universities - HERD increasing, but still low in international comparison
7	Improve framework conditions for private investment in R&D	- tax incentives introduced	- legal framework still problematic: rigid public procurement law, customs and tax legislation and its application - effectiveness of measures not evaluated yet
8	Promote public-private cooperation and knowledge transfer	- Technology Platforms (TPs) selected in spring 2011	- stimulation tools implemented: FASIE, TPs, Rusnano, Russian Venture Company - results of stimulation measures not verified - limited level of business co-funding in the major R&D funding programmes, the FTPs
9	Enhance knowledge circulation	S&T Cooperation Agreement with the EU since 2000; agreement to develop strategic partnership in R&I with the EU	- Russia is traditionally strongest third country performer in FPs - lifting of visa proposed by Russia to EU
10	Strengthen international cooperation in science and technology	- new inward mobility programmes introduced	- broad and increasing network of international cooperation programmes (through RFFI, RAN , etc.) available - great international interest in programme for attracting leading scientists (mainly from abroad) to Russian universities - hiring of foreign staff in Russia still cumbersome - bureaucratic hurdles (customs, taxation, etc.) for international R&D cooperation

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	- Technology Platforms introduced in 2011	- example of EU TPs taken up - knowledge circulation among knowledge triangle weak
12	Develop and sustain excellence and overall quality of research	- monitoring of some programmes introduced (e.g. National Research University programme)	- output verification and related indicators only recently introduced and only partly applied - discussions on appropriate evaluation indicators ongoing
13	Promote structural change and specialisation towards a more knowledge - intensive economy	- Skolkovo flagship innovation project	- modernisation and innovation taken seriously at top policy maker level - IT industry developing well - focus of the economy on primary goods production and big state-owned players is a weakness
14	Mobilise research to address major societal challenges and contribute to sustainable development	- presidential (thematic) priorities for modernisation issued	- international cooperation on major challenges, e.g. on energy in ITER project - several major challenges (e.g. climate change, sustainability, ageing) not yet taken seriously enough
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	- R&D statistics upgraded	- R&D statistics for Russia included in international databases (OECD, EUROSTAT) - some indicators e.g. on HRST still not available

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List of Abbreviations

BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
CIS	Commonwealth of Independent States
COST	European Cooperation in Science and Technology
CRDF	US Civilian Research and Development Fund
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European regional development fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
FASIE	Foundation for Assistance to Small Innovative Enterprises
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP	Framework Programme
FP7	7th Framework Programme
FTP	Federal Targeted Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and Communication Technologies
INCO	International Cooperation
IncoNet CA/SC	S&T International Cooperation Network for Central Asian and South Caucasus Countries
IncoNet EECA	S&T International Cooperation Network for Eastern European and Central Asian Countries
INFRA	Infrastructures
INTAS	International Association for the Promotion of Co-operation with Scientists from the New Independent States (NIS) of the Former Soviet Union

IP	Intellectual Property
IRSES	International Research Staff Exchange Scheme
MON	Ministry of Education and Science
NATO	North Atlantic Treaty Organisation
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
R&D	Research and development
RAN	Russian Academy of Sciences (RAS)
RFFI	Russian Foundation for Basic Research (RFBR)
RGNF	Russian Foundation for Humanities (RFH)
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
RVK	Russian Venture Company
S&T	Science and technology
SF	Structural Funds
SME	Small and Medium Sized Enterprise
TP	Technology Platform
UIS	UNESCO Institute of Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organization
VC	Venture Capital