Chapter 1

Economic performance and framework conditions for innovation

This chapter provides an overview of Russia's economic performance over the decade preceding the global financial and economic crisis. The severe, though brief downturn of the Russian economy is discussed with a view to drawing some lessons for the future. It highlights some salient features of the country's economy, including its openness to international trade and foreign direct investment (FDI), the structure of production and trade, and patterns of change. It looks at major aspects of the framework conditions for innovation, the improvement of which is a key means of boosting Russia's overall innovation performance. Next, it looks at the relationship between innovation and growth, both globally and in Russia, and explores the particular reasons why innovation policy should be a particular priority for Russia at present. Finally, it provides an overview of Russia's innovation performance and offers some conclusions.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1.1. Economic performance: An overview

1.1.1. Macroeconomic performance in the medium term

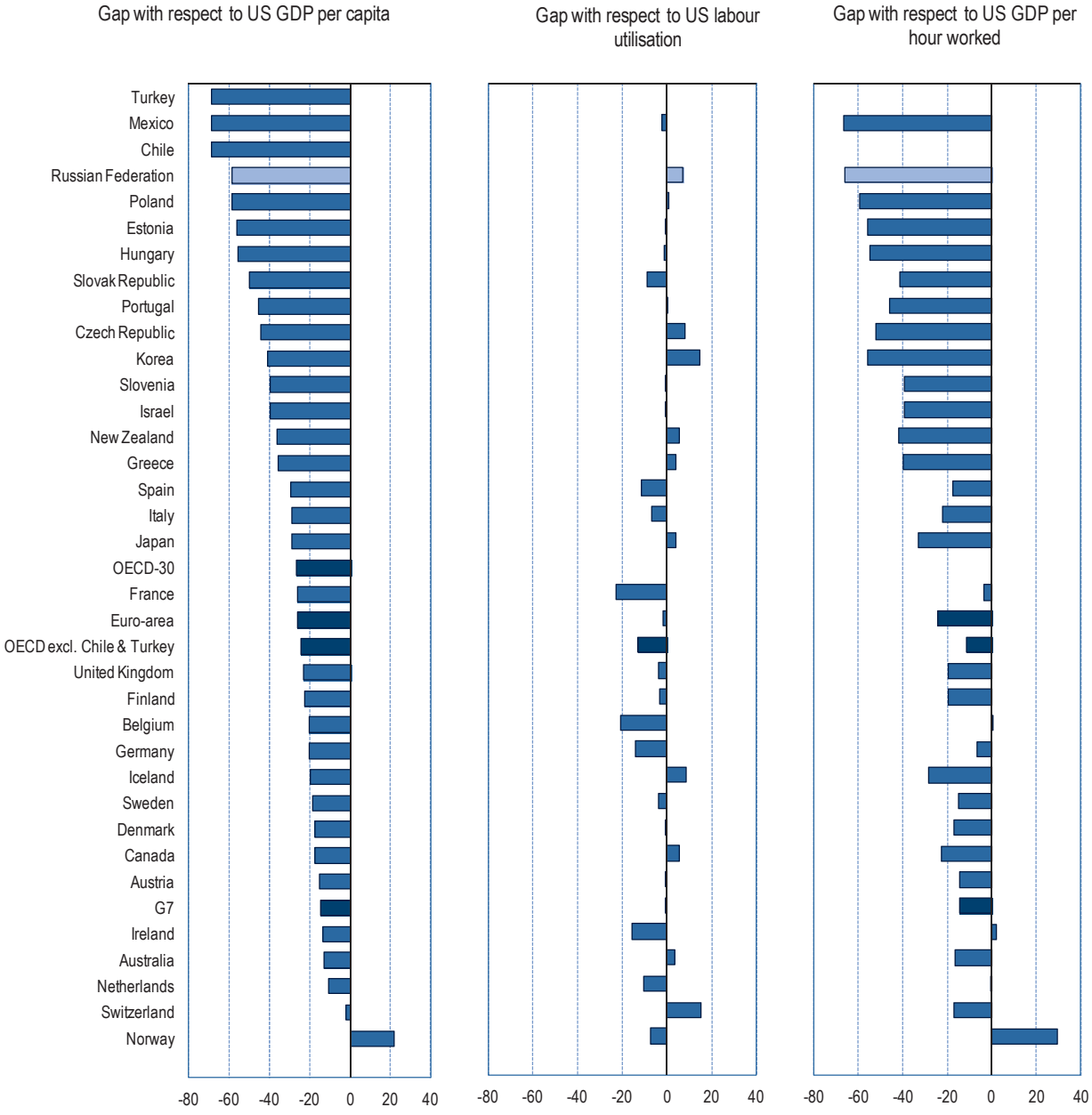
Russia had barely emerged from the transitional downturn of the first half of the 1990s when it was faced with a grave crisis in 1998. In the aftermath of that crisis, however, growth picked up swiftly. Throughout the decade up to the recent global financial and economic crisis, Russia enjoyed unprecedented economic growth. From 1999 to 2008, real GDP expanded at an average of about 7% a year. Owing to a gradual decline in the population, per capita GDP grew even faster. GDP per capita (at purchasing power parity) was converging rapidly towards EU27 and OECD averages. Absolute and relative poverty levels were falling (OECD, 2009a). To some extent, the favourable economic development of Russia's economy during that phase was due to a recovery from the low levels of economic performance in the 1990s. In fact, real per capita income reached the level of the end of the Soviet period only in 2006. In the years before the latest crisis, a sustained surge in commodity prices, especially of oil, was associated with a significant improvement in Russia's terms of trade. As a result "command GDP",which reflects the "real" purchasing power of domestic residents, grew even more rapidly than GDP, at an average 11% a year during 2003-08 (OECD, 2009a; Havlik, 2010). The boom ended rapidly towards the end of 2008. Indeed, the global financial and economic crisis hit the Russian economy particularly hard and made clear the vulnerability of a growth and development model that has been highly dependent on primary commodities, notably oil and gas. The growth pattern of the past will not be sustainable in the long term.

Despite the rapid growth prior to the financial crisis, Russia's GDP per capita still lags behind the OECD average and falls farther behind when benchmarked against leading high-income countries. In 2009, Russia's per capita GDP lagged that of the United States by nearly 60 percentage points (Figure 1.1). The gap in GDP per hour worked, is even wider, despite rapid growth in labour productivity (exceeding 5% a year on average during 2001-07). In fact, the gap in GDP per capita *vis-à-vis* the United States is entirely accounted for by the gap in labour productivity, which even eliminates the positive contribution of Russia's higher labour utilisation. To achieve sustainable growth in income per capita and improve the standard of living of its population in the longer term, Russia needs to boost productivity growth. This is a core task for Russia's economic policy.

A feature of the Russian economy that should be emphasised in a discussion of innovation is the fact that investment as a share of gross domestic product (GDP), although it rose gradually prior to the crisis, has been relatively low by the standards of other fast-growing catch-up economies (Figure 1.2).[1] Raising private sector involvement in research and development (R&D) and innovation more broadly is thus closely linked to the broader issue of raising investment overall. Increased investment would speed up the renewal of the capital stock, potentially boosting the technology content of capital goods. Beyond this, a favourable investment climate would tend to strengthen incentives for investment in R&D.

Figure 1.1. Income and productivity levels, 2009

Percentage point differences with respect to the United States

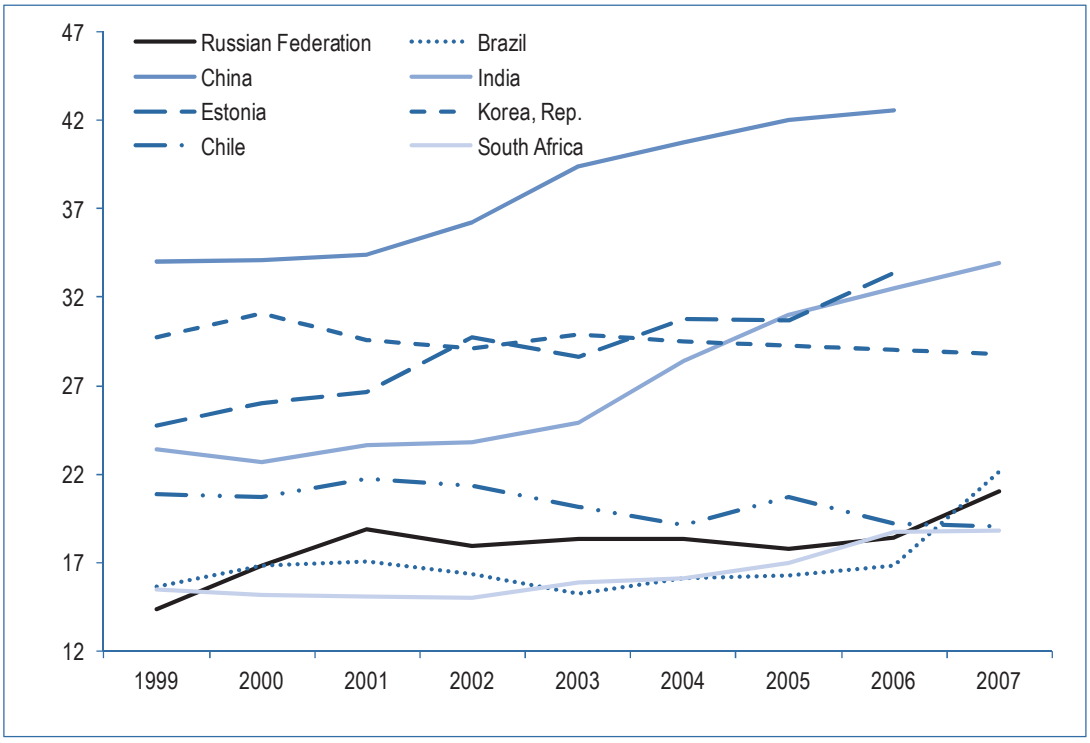


Note: Labour productivity and income levels are calculated using GDP at current prices and converted in US dollars using 2009 purchasing power parities. Labour utilisation is measured as total hours worked per capita. Labour productivity and labour utilisation levels estimates for Israel, Slovenia and the Russian Federation are based on hours worked for 2008. The euro area includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, the Slovak Republic, Slovenia and Spain. France includes overseas departments.

Source: *OECD Productivity Database*, August 2010. Direct link: *www.oecd.org/statistics/productivity*.

Figure 1.2. Gross fixed capital formation

% of GDP



Source: OECD (2009a), *OECD Economic Surveys: Russian Federation*, OECD, Paris.

1.1.2. A severe, although brief, recession 2008-09

The severity of the blow dealt by the global financial crisis to the Russian economy came as a shock to the authorities and to most outside observers. Russia had enjoyed a decade of economic growth that had seen a doubling of real GDP, a threefold rise in real wages and a halving of both the unemployment and poverty rates. To be sure, there was growing concern about the quality and sources of Russian growth during the oil-driven boom of 2003-08, as well as widespread awareness of the structural weaknesses to be addressed. Nonetheless, when the crisis erupted, Russia appeared well placed to weather the global financial turbulence. Its growth momentum was largely unchecked through mid-2008, and the main near-term danger for Russia in the spring of that year appeared to be the risk of overheating. Even after oil prices peaked in the middle of the year and growth began to slow, there was little expectation that the slowdown would turn into a sharp contraction. External and fiscal balances were relatively healthy, and commodity prices, though down from their peaks, remained at relatively high levels by historical standards. The fiscal reserves accumulated during the boom years left the combined assets of the Reserve Fund and the National Welfare Fund at more than RUB 6.6 trillion at the start of 2009 (equivalent to almost 16% of 2008 GDP) and left the authorities plenty of scope for financing anti-crisis measures. Even in the final quarter of 2008, the government continued to express confidence that Russia would remain one of the engines of global growth. The authorities were not alone: the consensus growth forecast for 2009 stood at 2.9% as late as December 2008 and did not turn negative until two months later.[2]

The downturn that followed was as dramatic as it was unexpected. Real GDP growth, which had averaged 7% a year in 1999-2007, turned negative from the third quarter of 2008, culminating in a severe contraction in the first quarter of 2009, when it fell by 9% in (seasonally adjusted) quarter-on-quarter terms. Though sharp, the recession was relatively short-lived. Real GDP fell only marginally in the second quarter, as stronger government consumption and a rebound in inventories almost offset weak consumption and investment, and growth resumed in the third quarter. About half of the 11% peak-to-trough decline in output was recovered in the second half of the year. By May 2010, wages and salaries had surpassed the pre-crisis peak recorded in September 2008. While unemployment was slow to fall, the authorities could take some satisfaction from the fact that the crisis-induced rise in unemployment had been relatively limited, especially as compared with the magnitude of the contraction.

When the crisis first began to affect Russia, the authorities moved quickly to shore up the banking sector, which was initially seen as the point of greatest vulnerability,[3] and they resisted downward pressure on the rouble, allowing enterprises and banks to acquire foreign exchange for debt service without suffering major valuation losses. The government also moved to lighten the tax burden on corporations and adopted a range of fiscal stimulus measures, including a rise in unemployment benefits and a number of measures aimed at assisting major industrial firms under pressure. Like some other countries, Russia succumbed to protectionist pressures, raising tariffs on imported second-hand cars, extending subsidies to domestic enterprises and adopting preferential public procurement practices. While fiscal stimulus clearly played a role in preventing a more protracted downturn, Russia's relatively quick return to growth in 2010 owed much to the recovery of global trade in general and commodity prices in particular. High oil revenues provide an opportunity to address the long-term challenges to be faced by Russia.

1.1.3. Lessons from the downturn – dangers of Russia's continued dependence on natural resources

The crisis and its aftermath have exposed the structural weaknesses of the Russian economy, highlighting the extent to which Russia remains dependent on its hydrocarbons sector. The impact of oil-price movements on the economy goes well beyond the direct contribution of the oil sector to GDP, which has been relatively modest since the growth of output slowed in 2003. The effect of the oil-price cycle is amplified not only by the explicit link between oil and gas prices but also by the very high correlation between oil and metals prices. Ferrous and non-ferrous metal exports constitute the largest non-fuel component of Russia's export bill, and no serious attempt was made to sterilise the windfall metals revenues. Commodity revenues were thus a huge source of the growth of domestic demand and the consumption boom during the period to mid-2008. They contributed to the emergence of real-estate bubbles in some cities and to very rapid accumulation of debt by households and corporates. Increasingly, growth was concentrated in non-tradable sectors, as the extractive sector lost momentum in volume terms and manufacturing struggled to cope with cost pressures. The authorities were well aware of the dangers presented by the spectacular increases in commodity prices in the mid-2000s. They put in place a number of measures aimed at maintaining macroeconomic – particularly fiscal – discipline and insulating the domestic economy from oil-price fluctuations, not least by saving a large proportion of the windfall revenues generated by very high oil and gas prices. However, the scale of fiscal sterilisation failed to keep pace with the flood of windfall revenues into the country. As a result, the non-oil

fiscal balance began to deteriorate from 2005, eventually moving into deficit despite very fast GDP growth, and reached -14.0% of GDP in 2009; the non-oil trade deficit increased almost tenfold over five years to USD 130.4 billion (7.8% of GDP) in 2008.

OECD (2006a) argued that Russian growth was increasingly driven by transitory factors, most notably dramatic terms-of-trade increases, and that the principal challenge to Russian policy makers was to take the steps needed to facilitate the transition to a period of self-sustaining, investment- and innovation-led growth. However, relatively little was done to meet that challenge while external conditions remained favourable (OECD, 2009a). Through mid-2008 the growth model remained broadly the same as in preceding years, as growth in domestic demand continued to accelerate in response to improving terms of trade. This pattern was interrupted with the onset of the global financial crisis. The scale of the shock highlighted the urgency of the challenge, and the ensuing recovery has not diminished it.

While the innovation sector has suffered from the budget cuts that took effect during the crisis (see Box 1.3 below), the tighter fiscal environment may actually lead to an improvement in the quality, if not the scale, of innovation-promotion efforts. The need to put public finances back on a healthier footing implies increased attention to priorities and outcomes. To some extent, fiscal pressures have already begun to compel the authorities to clarify their aims: in the science and innovation sector, as elsewhere, the budget cuts of 2009 fell unevenly across priorities and institutions. Among the least affected were grants and prizes for younger scholars, which were reduced in number but increased in value, and grants to support leading scientific schools. The first of these measures, at least, may be having an effect: the share of researchers aged 30-39 rose in 2008, for first time in over a decade, and the share of under-29s continued to rise gradually despite growing competition for young specialists from large concerns like Rosnano and Rosatom. On the whole, budget cuts seem to have fallen hardest on such expenditure items as equipment, with considerable effort made to protect the financing of measures aimed at retaining qualified personnel (Gaidar Institute, 2010). Similarly, the crisis seems to have intensified the ongoing process of "hierarchisation" of higher education institutions on the basis of research potential, via the designation of specific institutions as "federal universities", "national research universities", and so on.

More recent developments have begun to highlight the potentially positive long-term consequences of the crisis for innovation performance. First, the shock of 2008-09, by throwing the economy's structural weaknesses into sharp relief, led to a renewed sense of urgency about economic reform in general and about fostering innovation and modernisation in particular. There is a general awareness that the current global recovery is very unlikely to allow Russia to sustain rapid growth on the basis of primary exports supported by terms-of-trade gains. Moreover, many other countries have recognised the need to strengthen their innovation performance in order to maintain growth in the tougher conditions of the post-crisis world. In short, the competitive environment is likely to be harsher over the coming years. This makes enhancing Russia's capacity to innovate all the more important. A Presidential Commission for Modernisation and Technological Development was created in 2009 and moved rapidly to identify innovation priorities and advance its first proposals. In February 2010, the government's Commission on High Technologies and Innovation was also upgraded when the prime minister took over as chairman.

These and other initiatives, such as the plan to create a high-technology hub around the business school at Skolkovo, near Moscow (often referred to as a future Russian

"Silicon Valley"), are examined in more detail in the chapters that follow. In general, the renewed emphasis on innovation is to be welcomed. However, there is a risk that the new measures may continue the traditional science-push approach to innovation and that a top-down approach to innovation will prevail at the expense of measures aimed at creating more decentralised and deconcentrated opportunities and incentives to foster innovative activities.[4] That said, some of the top-down initiatives could be beneficial if they generate needed feedback about conditions in knowledge-intensive sectors and the barriers to their growth (Guriev and Zhuravskaya, 2010). What will be crucial is a recognition that such policies complement, rather than substitute for, a vibrant model of private-sector entrepreneurship.

1.2. International trade and foreign direct investment

Openness to trade and foreign direct investment is, for various reasons to be discussed below, a critical aspect of the overall framework conditions for innovation. International trade and FDI are, on the one hand, channels of technology flows; on the other hand, they have a number of indirect effects on the innovation environment and performance, *e.g.* by increasing competition and the associated pressure on companies operating on the domestic market to "innovate their way out".

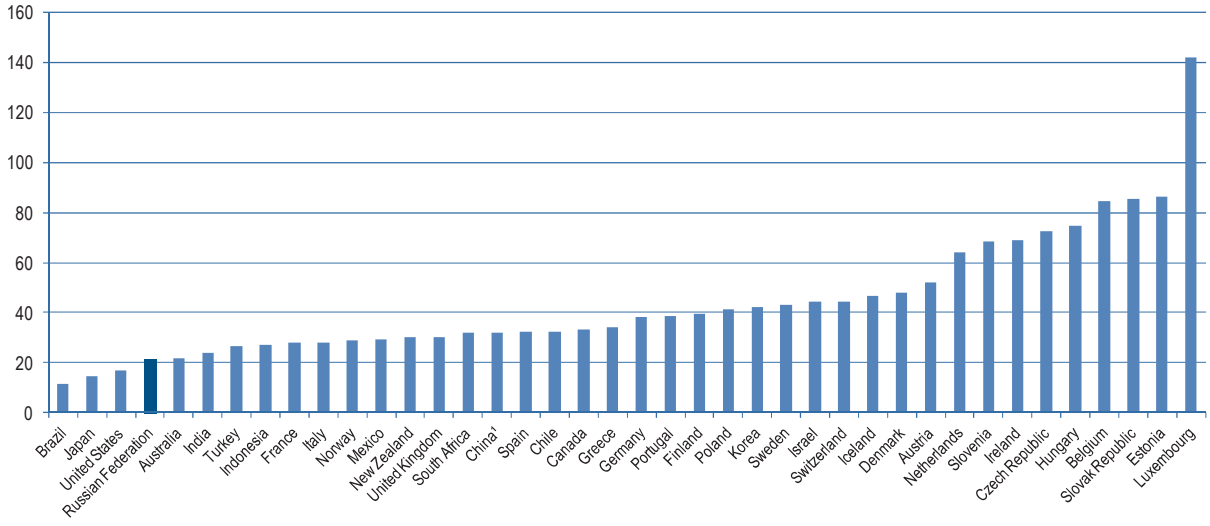
Since the transition to a market-based economy, Russia's integration into the global economy has made great progress along a number of dimensions. Yet, its full potential does not appear to have been realised. For example, according to the KOF Index of Globalisation 2011[5] – which provides a synthetic measure of economic, social and political globalisation – Russia ranks 52nd overall (out of 208 countries), but only 110th on the economic dimension of globalisation, behind large emerging economies such as South Africa, Indonesia, Brazil, Turkey and China.

Progress in negotiations and, eventually, the successful conclusion of Russia's accession to the World Trade Organization (WTO) can be expected to help innovation by removing barriers Russian companies currently face in international markets, including in high-technology areas. WTO accession may also support Russia's innovation agenda in other ways, *e.g.* by safeguarding against the adoption of an overly inward-looking approach to economic development that could eventually stifle innovation. WTO membership would also exercise some leverage for making more progress with competition-enhancing reforms and help advance Russia's innovation agenda (Havlik, 2010).

In some respects, the internationalisation of the Russian economy has progressed significantly. FDI flows and stocks, both inward and outward, have grown significantly over the past decade and a half. The technology balance of payments (TBP), which reflects international transactions involving industrial property and know-how (*e.g.* patent purchase and licensing, transactions involving trademarks, technical services, etc.), has also seen payments and receipts expand rapidly in recent years; this is a sign of a surge in trans-border technology flows (see the section on innovation performance below). In many respects, however, Russia remains a relatively closed economy. Openness to imports, as measured by the ratio of imports of goods and services to GDP, is lower than in most OECD countries and in emerging economies (except Brazil) (Figure 1.3). The development and structure of exports is discussed below.

Figure 1.3. Openness to imports

Imports of goods and services as a share of GDP, 2005-07



1. 2006-06.

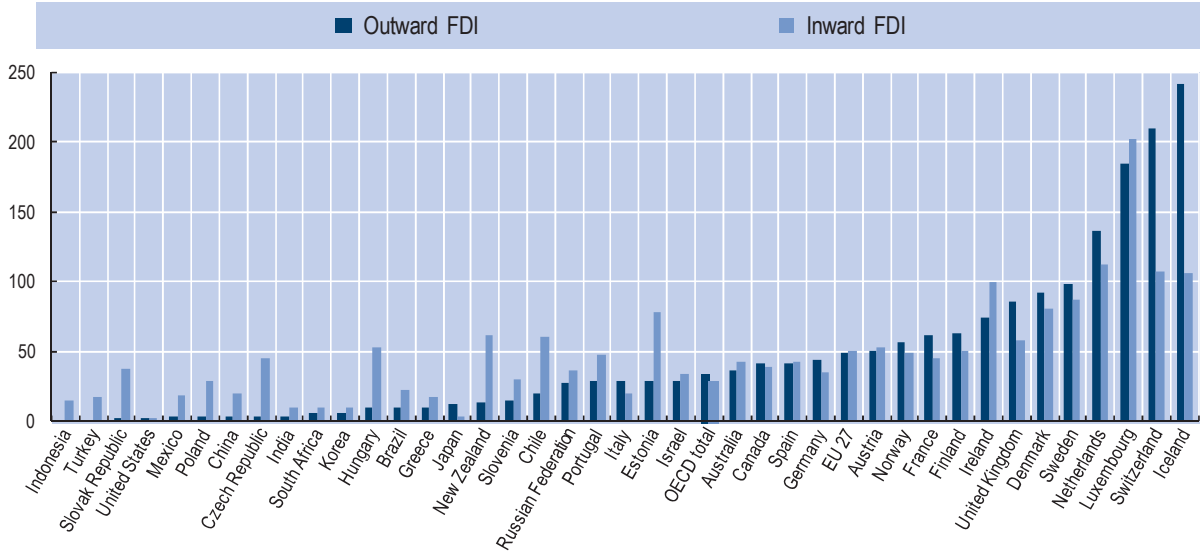
Source: OECD (2009a), *OECD Economic Surveys: Russian Federation*, OECD, Paris.

Russia started with very low stocks of FDI in the 1990s. Given a buoyant economic environment, Russia's international investment position improved strongly in the years before the global financial and economic crisis. Inward FDI has been growing since 2003 and Russia became a net recipient of FDI in 2004 (OECD, 2008a). In the following years, Russia confirmed its strong position in the international investment landscape.[6] In 2007, Russia's stock of inward FDI was 36.4% of GDP, and its outward stock reached 27.4% of GDP (Figure 1.4). These ratios exceed those of many large emerging economies, including Indonesia, Turkey, China, India, South Africa and Brazil. According to UNCTAD (2010), Russia's inward FDI performance, measured by the amount of FDI the country receives relative to the size of the economy, has improved strongly over time (rank 57 among 141 economies in 2009, up from 109 in 2000). Nevertheless, Russia does not seem to realise its potential. On the Inward FDI Potential Index, which measures the potential to attract FDI, Russia ranked 37th in 2000, 7th in 2007 and 9th in 2008.

In the wake of the global crisis FDI flows to Russia "almost halved in 2009, due to sluggish local demand, declining expected returns of ventures related to natural resources, and the drying-up of round-tripping FDI" (UNCTAD, 2010). However, in relative terms, Russia retained a strong position, ranking sixth in UNCTAD's global ranking of top investment locations in 2009. During that year, the Russian Federation, the largest source of outward FDI from Southeast Europe and the Commonwealth of Independent States, became a net outward investor. Russian multinational enterprises continued to look for strategic assets, including in developed countries, particularly in the hydrocarbons sector.

Figure 1.4. FDI stocks

As a percentage of GDP, 2007 or latest available year



Source: OECD Factbook 2010.

Russia is among the world's top outward investors (UNCTAD, 2010). Large Russian enterprises are active in acquiring overseas companies and transforming themselves into multinational enterprises with operations in various locations around the globe. Some of these acquisitions have been directed at accessing particular technologies or acquiring technological capabilities. Joint ventures with foreign companies are also widely used to access technologies and risk sharing. A recent example is the collaboration between Sukhoi and Finmeccanica of Italy on the development of the Superjet 100 airliner.

The patterns of Russia's FDI, both inward and outward, differ markedly from those that have developed in the central and eastern European countries (CEECs) after their transition to market-based economies. The Czech Republic, Hungary and Slovakia have emerged as European manufacturing platforms; this has been facilitated by their proximity to main European markets, and reinforced by their industrial capabilities and open stance towards FDI (OECD, 2008b). As a result, they have received significant flows of inward FDI. In contrast, their outward FDI position, unlike Russia's, remains relatively weak.

In the context of this review it is important to note that Russia hosts many of the world's leading technology-based companies, as the aerospace and information and communication technology (ICT) sectors, for example, seek to access high skills at an internationally competitive price. Like many other countries, Russia has sought to attract FDI through the establishment of various types of special economic zones (SEZ), including the four technology-oriented SEZ in Saint Petersburg, Zelenograd, Dubna and Tomsk. More recently, the government has announced plans to establish an innovation city at Skolkovo, a greenfield site outside of Moscow. Some large high-technology firms, including Cisco and Nokia, have signalled their intention to invest in Skolkovo, and the hope is that many more will follow. In order to increase its attractiveness to investors, the Russian Federation recently amended its Law on Special Economic Zones to reduce the

minimum investment threshold, broaden the list of permitted business activities, and simplify land acquisition and administration procedures (UNCTAD, 2010).

For inward FDI, policies and institutions that facilitate the absorption and diffusion of knowledge are critical to overall innovation performance, notably for countries and sectors that do not operate at the world technological frontier. This underscores the importance of openness to innovation. Indeed, obstacles to (trans-border) absorption and diffusion are likely to reduce the effectiveness of efforts aimed at boosting innovation. Moreover, as such problems may also limit the impact of policy interventions aimed at stimulating innovation, resolving them may be critical to the success of innovation policy. Yet – despite positive examples – this appears to be a Russian weak point, at least in the eyes of business people: one of Russia's lowest ratings in the World Economic Forum's Executive Opinion Survey for 2009 concerned technology absorption and technology transfer, whether via FDI or the licensing of foreign technology (WEF, 2009). This suggests that Russia is missing a major opportunity to facilitate industrial modernisation and restructuring.

"Imports" of foreign know-how via FDI and collaborative R&D and innovation are affected by framework conditions and the regulatory environment.[7] Openness to flows of foreign knowledge can be expected to play an important role in boosting innovation in Russia, since its human capital endowments are well equipped to absorb it. Indeed, given the right framework conditions, this could be one of its major strengths. Erken *et al*. (2005) see the quality and skill of the labour force, together with the quality of knowledge institutions, as a critical factor in attracting foreign R&D.

Despite strong FDI inflows in the years before the crisis, Russia retains comparatively high barriers to foreign ownership, owing in part to the 2008 law on "strategic" industries, which defines 42 sectors in which control by foreign investors requires prior authorisation from a government commission (OECD, 2008a, 2009a). While regulation of investment inflows is arguably more transparent and less problematic than the often informal and *ad hoc* regime that prevailed earlier, its sectoral coverage is unusually broad and notification delays are longer than recommended by the OECD. Recent proposals to lower these barriers and reduce the coverage of the law are thus to be welcomed. However, other problems remain. The dominant position of large state-controlled conglomerates acts as a deterrent to FDI (OECD, 2009a), and foreign investors are likely to find the weakness of formal institutions more of a deterrent than domestic entrepreneurs, since "insiders" embedded in local social networks are likely to manage things better when informal rules and norms often matter as much as formal ones.

As is well known, the importance of FDI cannot be simply inferred from the sums invested but needs to take full account of the positive spillovers to be expected for domestic firms from the international transfer of state-of-the-art managerial expertise, technology and know-how. Savvides and Zachariadis (2005) find that foreign R&D has a particularly strong positive impact on total factor productivity (TFP) and the growth of value added. Moreover, the greatest potential spillovers are likely to occur in manufacturing, an areas in which greenfield FDI is still relatively low. Studies of FDI in Russia suggest that the beneficial spillovers from foreign-owned firms to other firms in the same industry are significant, although the benefits of trade and FDI liberalisation also depend on other policies, including financial sector reform, measures to improve labour mobility and reductions in regional bureaucracy (Bessonova *et al*., 2003). Overall, Russia so far does not appear to fully exploit the potential of FDI; this limits the potential benefits from international spillovers, including from R&D.

1.3. Specialisation and structural features of the Russian economy

Industrial structure and the size of firms tend to influence the level of R&D and the innovation performance of the economy as a whole. The Russian economy's specific features are rooted in its past as a centrally planned economy, in its abundant natural resources and in its geography.

1.3.1. Production and international trade

At 4.9% Russia has a higher share of agriculture in total value added than any OECD country except Turkey (8.5%) and is far above the EU27 average of 1.8%. At 36.1%, the share of industry (including mining and quarrying) is also high by international standards. It is similar to that of other formerly centrally planned central and eastern European economies such as the Slovak Republic and the Czech Republic (both with shares around 38%), but higher than that of other OECD countries, such as Austria (30.7%) and Germany (29.8%), which have shares well above the EU27 average of 26.5%. China's industry share is nearly twice as high (48.6%). The share of services is 59.0%, also close to that of the Czech Republic and Slovak Republic (59.9% and 58.8%, respectively), while the EU27 average is 71.7%.

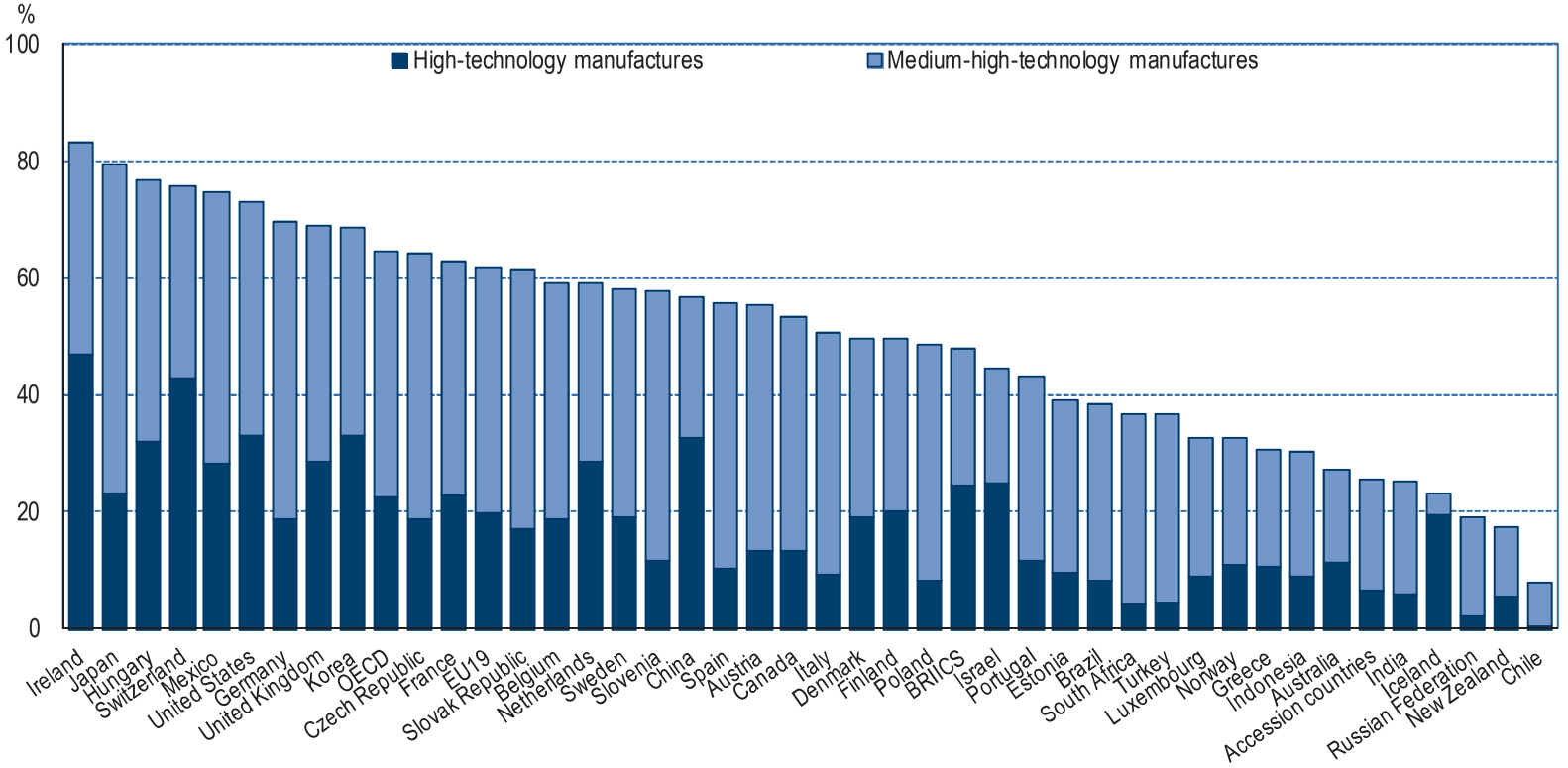
During 2006-08 value added in agriculture grew by an annual 4.7%, faster than in any OECD country except Israel, the Slovak Republic and Sweden. Real value added in industry expanded at a rate of 4.9%, far more rapidly than the EU27 and total OECD (2.3% and 1.8%, respectively). By far the most rapid growth was in the services sector, at 9.3%, faster than in any OECD country. By comparison, the EU27 and OECD averages of 2.7% and 2.6%, respectively, were modest.

Broadly speaking, Russia's export structure has the following features:

- Predominance of raw materials in total exports. Mineral fuels account for a large part of total exports (about two-thirds in 2008).
- A high share of medium-low and low-technology manufacturing exports.
- Relatively weak exports of high- and medium-high technology products, which account for less than one-fifth of total manufacturing exports.
- In the medium term, export specialisation has increased in the medium-low technology segment of manufacturing.

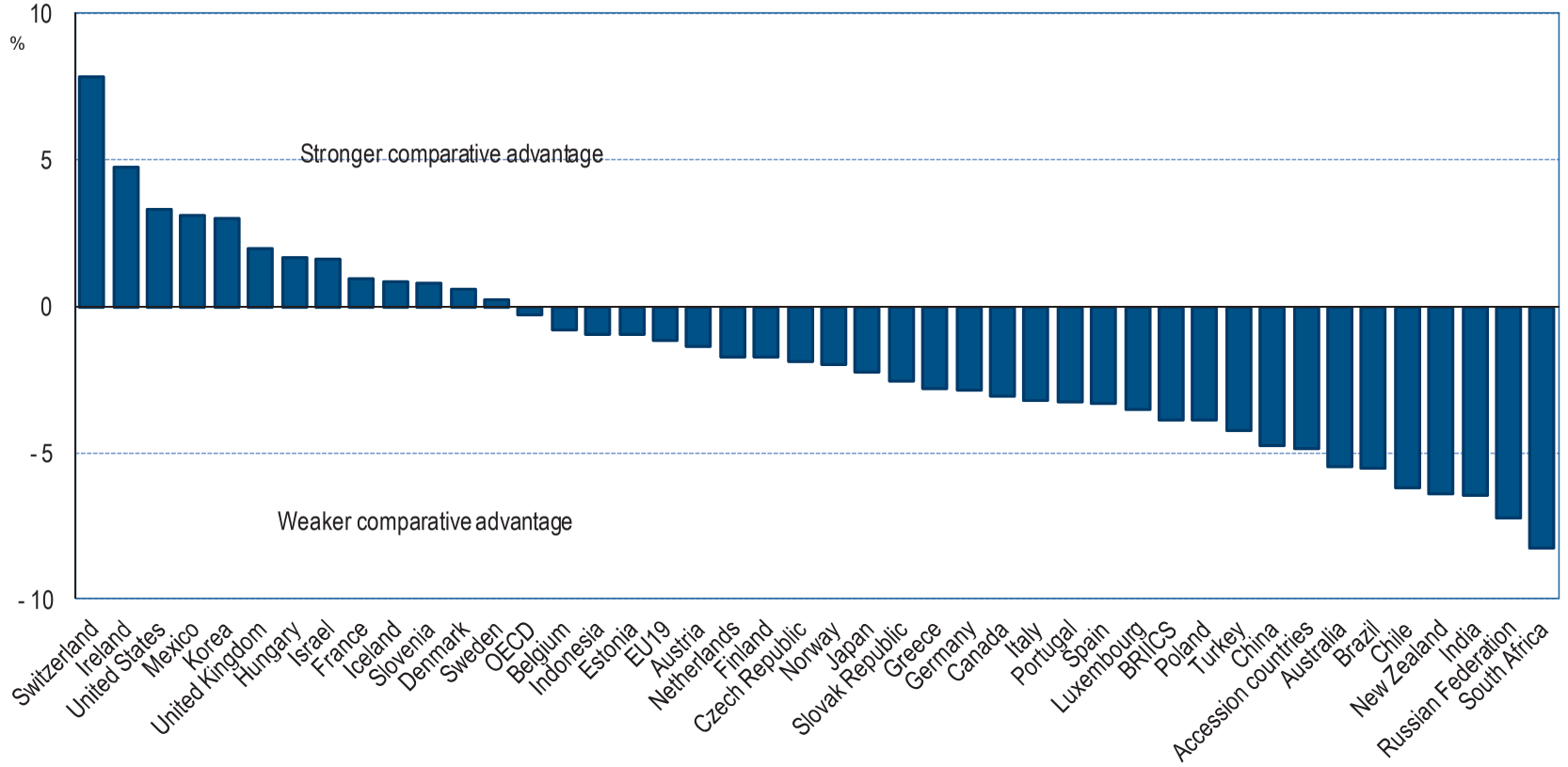
The share of high and medium-high technology in Russia's manufacturing exports is low by international standards and the share of high-technology exports is particularly small. Only two OECD economies, New Zealand and Chile, both resource-based and much smaller than Russia, had lower shares in 2007 (Figure 1.5). Given the structure of exports it is not surprising that the contribution of high-technology industries to Russia's manufacturing trade balance is strongly negative. During 1998-2008, Russian manufacturing exports expanded annually by 19.1% on average, compared to 8.8% for the OECD overall (Figure 1.6). However, high-technology exports grew by just 9.3%, a pace much more in line with the OECD average of 7.8% (Figure 1.7).

Figure 1.5. Shares of high and medium-high technologies in manufacturing exports, 2007



Source: OECD Science, Technology and Industry Scoreboard 2009.

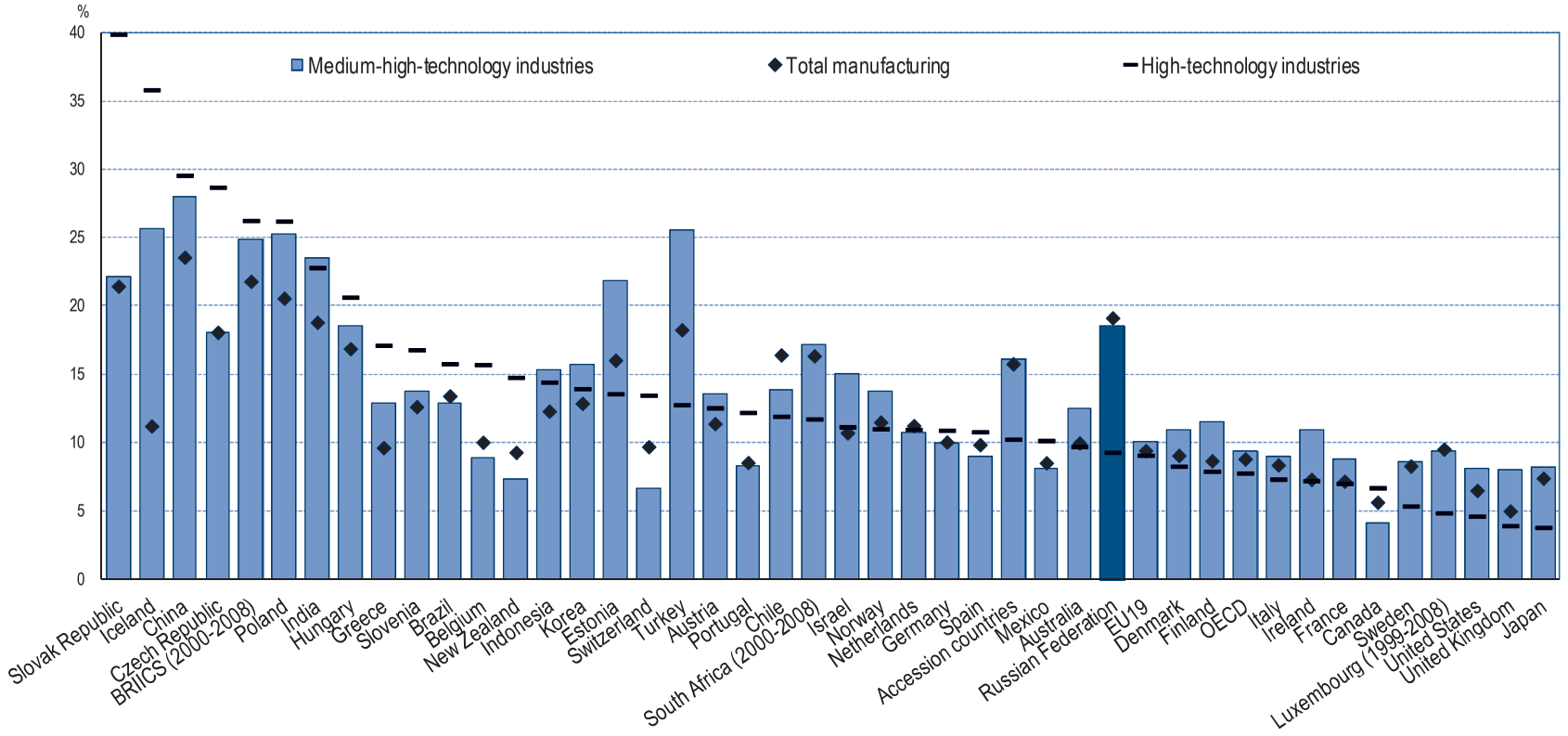
Figure 1.6. Contribution of high-technology industries to the manufacturing trade balance, 2007



Source: OECD Science, Technology and Industry Scoreboard 2009.

Figure 1.7. Growth of high- and medium-high technology exports, 1998-2008

Average annual growth rate



Source: OECD Science, Technology and Industry Outlook 2010.

Between 1995 and 2007, Russia's market share (total exports) has increased most strongly in the medium-low technology range and to a lesser extent in medium-high technology (Table 1.1). Market shares declined in both the high-technology and the low-technology segment of exports. Russia's manufacturing export specialisation, as measured by an index of revealed comparative advantage, has also shifted considerably since the mid-1990s,[8] increasing especially in the medium-low technology segment (to a RCA index value above 3 in 2007) and away from its initial specialisation in the low technology segment. The index for medium-high technology remained almost unchanged. Russia was not specialised in the export of high-technology manufacturing in 1995, but was even less so in 2007.

Table 1.1. Export market shares and revealed comparative advantage (RCA)

	Market share (total exports)		RCA (manufacturing)	
	1995	2007	1995	2007
High technology	0.33	0.16	0.43	0.11
Medium-high technology	0.35	0.74	0.46	0.51
Medium-low technology	1.75	4.41	2.26	3.07
Low technology	1.10	0.81	1.42	0.57

Source: CEPI/OECD.

1.3.2. Size structure of firms

Russia's industrial "ecosystem" is dominated by a few very large players. The 100 largest enterprises accounted for close to 60% of Russia's GDP in 2007. A mix of private financial-industrial groups (FIGs) and state-owned enterprises/state corporations dominate this top 100, which includes Gazprom, Lukoil, Alfa Group, Rosneft, Renova, Severstal, Norilsk Nickel, Evraz Group, Sistema, Rostechnologii, Mechel Steel Group, Tatneft, and Basic Element. The role of these large enterprises as actors in the Russian innovation system is discussed in Chapter 2.

However, Russia's firm ecology also includes a growing population of small and medium-sized enterprises (SMEs). There are about 1.6 million SMEs registered in Russia, and around 4 million individual entrepreneurs (Box 1.1). Their combined turnover in 2009 was USD 660 billion and accounted for around 21% of Russian GDP. They were responsible for employing 16.5 million workers, around 23% of the workforce (Table 1.2). The size of the SME sector is therefore relatively small as compared to OECD countries, but shows robust growth, with the number of firms growing by around 9% in 2009 (Figure 1.8). Around 41% of SMEs are in the wholesale and retail trade sector, 18% in services, 12% in construction, and 11% in manufacturing (OPORA, 2010). The share of small innovative enterprises is believed to be less than 2% of the total SME population, although what counts as an innovative enterprise is unclear and there are discontinuities in the collection of statistics about them.

Box 1.1. The Russian definition of SMEs

General definition

Federal Law No. 209-FZ of 24 July 2007 "On Development of Small and Medium-sized Enterprises" defines small and medium-sized enterprises (SMEs) as business entities (a co-operative, a commercial organisation, except for state and municipal unitary enterprises, or an individual carrying out entrepreneurial activities without establishing a legal entity, or a farm enterprise) which meet the following criteria (Art. 4):

- State and foreign ownership together shall not exceed 25%.
- Ownership by non-SME entities together shall not exceed 25%.
- Headcount does not exceed 250 employees for medium-sized enterprises, 100 for small enterprises and 15 for microenterprises;
- Annual turnover excluding VAT or value of the balance sheet assets does not surpass the threshold set by the government once every five years. The following annual turnover thresholds were set in 2008: RUB 60 million (USD 2 million) for microenterprises, RUB 400 million for small enterprises (USD 13.5 million) and RUB 1 billion (USD 33.5 million) for medium-sized enterprises.

Definition of small innovative companies

The Russian Federation does not yet have an agreed legal definition of innovative SMEs, although the Ministry of Finance is trying to develop one before approving programmes targeted at supporting such firms. In Russia today the term mainly refers only to enterprises that operate in the science and technology sector. Several years ago, innovative SMEs were also those that used high technology, innovation and ICT to add value to their production, but this very broad definition led to confusion.

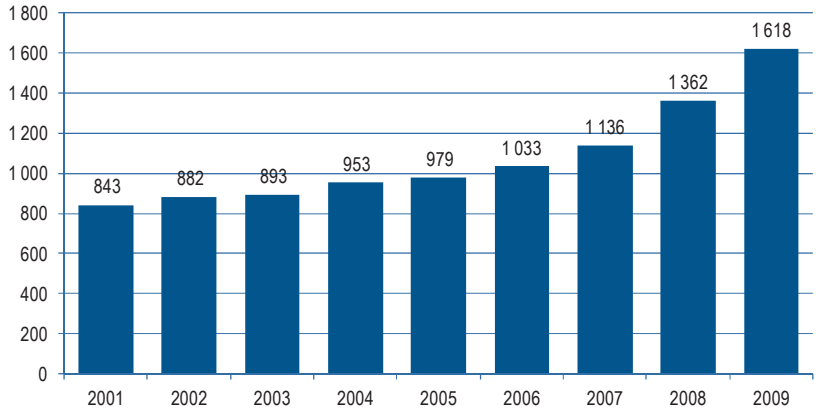
Table 1.2. Number of SMEs and employees, 2009

Firm size	Number of firms	Number of employees
Micro	1 374 777	4 531 400
Small	227 744	5 727 100
Medium	18 012	1 976 300
Total	1 620 533	12 234 800
Individual entrepreneurs	3 985 350	
Overall total	5 605 883	

Source: NISSE (2010), OPORA (2010).

Figure 1.8. Growth in the number of SMEs in the Russian Federation, 2001-09

Thousands



Note: Break in series between 2007 and 2008.

Source: NISSE (2010), OPORA (2010).

The 2008 Global Entrepreneurship Monitoring (GEM) Report for Russia (Verkhovskaya and Dorokhina, 2009) indicated that the level of entrepreneurial activity in Russia increased before the downturn. The government's measures aimed at reducing barriers to market entry and improving access to physical infrastructure may have contributed to this. However, among the 43 GEM countries, Russia still ranks low on this indicator. First-time participation of individuals in entrepreneurial activity is lower than in the other GEM countries. The bulk of new firms are created by an experienced entrepreneur. About 70% of the population see entrepreneurs as having high status in society. However, few people believe their knowledge is sufficient to start a business (17.5%, the second lowest share among GEM countries). In addition, fear of failure is a key obstacle to starting a business for 60% of Russians. According to the GEM Report, a relatively high share (11.5%) of Russian early-stage entrepreneurs define their business or product as innovative. This is in sharp contrast to established business entrepreneurs. Early-stage entrepreneurs are also more active in adopting new technologies than established business entrepreneurs, and 70% of early-stage entrepreneurs and 93.5% of entrepreneurs in established businesses are using technology that is more than five years old.

1.4. Framework conditions for innovation

1.4.1. The importance of good framework conditions for innovation

Good framework conditions are essential for achieving strong innovation performance. They include macroeconomic stability, many aspects of the regulatory regime and the tax system, competitive markets, openness to international trade and foreign direct investment, as well as an intellectual property rights regime which provides incentives for innovators by allowing them to benefit from their innovations while not unduly impeding the diffusion of ideas. It is these framework conditions that allow private innovators – both individuals and firms – to plan ahead and take risks, because they can reap the gains of their innovation effort and also benefit society at large.

Good framework conditions are important because innovation activity, particularly when it involves R&D and more fundamental types of innovation, requires a medium- or long-term horizon and a sufficiently stable environment. Because the rewards from innovation are partially reaped by society, the risk-reward relationship for the innovating entrepreneur is less generous than it is for society or for the non-innovating firm (which do not generate positive externalities). Therefore, conditions that increase the entrepreneur's risks raise the barriers to innovation. Under conditions of economic and political instability and weak institutions, the potential innovator will heavily discount the potential future benefits of any long-term innovative activity and will in fact be unlikely to invest in any activity that does not generate rapid returns. A poor environment for contracts also tends to shorten a potential innovator's time horizons. Moreover, in sectors that are far from the technology frontier, the catch-up process relies heavily on an imitation strategy, for which general framework conditions are critical. International openness and the regulatory framework are of crucial importance for rapid diffusion, and in some cases also for the generation of specific new technologies (as demonstrated by development in telecommunications).

Flawed framework conditions can also constrain and distort policy responses. They can reduce policy makers' room for action and prevent the use of policy tools that have been proven effective in more favourable circumstances. For instance, pervasive corruption can make governments very reluctant to give direct subsidies to business firms. Countries with a weak or ineffective tax system and administration tend to be reluctant to introduce fiscal incentives for R&D or do so very cautiously. In addition, unfavourable framework conditions are likely to reduce the effectiveness of specific policy measures designed to foster innovation.

Cross-country empirical work suggests that sound framework conditions for business are a *sine qua non* condition for boosting private innovative activities. A good deal of research highlights the importance of good framework conditions for R&D activity (Jaumotte and Pain, 2005a; OECD 2006b). It also finds that most innovation policy initiatives are likely to prove ineffective if appropriate framework conditions are lacking. At a minimum, innovative activity requires sound macroeconomic conditions. Analysing cross-country differences, Jaumotte and Pain (2005b) find that robust output growth, low inflation and low real interest rates have a positive influence on the rate of growth of R&D. The micro-level characteristics of the investment environment are also critical: secure property rights, effective enforcement of contracts, low barriers to market entry and a stable institutional environment all have a role to play in fostering innovation. Survey evidence suggests that innovative companies suffer more than other firms from problems with the investment climate (Goldberg, 2006).

Favourable framework conditions are necessary for achieving strong innovation performance, but specific policy measures are also needed to address market or systemic failures that hamper R&D and innovation activities. Targeted innovation policies are an essential complement to sound institutions and healthy framework conditions for entrepreneurship. However, the impact of specific interventions is likely to depend in no small measure on the capacities of the public bodies charged with implementing them and on the quality of the overall institutional environment.[9]

The following sections discuss aspects of the institutional setup, the macroeconomic framework, competition, the intellectual property rights regime, product market regulation, entrepreneurship and the adminstrative burden, insofar as they are relevant for successful innovation, as well as some aspects of financing innovation.

1.4.2. Institutional environment

Progress in reducing corruption, strengthening the rule of law, reducing the "bureaucratic burden" on business and reforming the public administration are vital elements of any policy aimed at fostering innovation. Russia's basic institutional environment still leaves much to be desired. Policy makers from the president on down have repeatedly expressed dissatisfaction with the performance of the public administration, law enforcement agencies and the courts, in terms of efficiency, effectiveness and probity. Despite significant improvements in some areas over the last decade, Russia's scores on all but one of the World Bank's comparative governance indicators in 2008 were in the bottom third of the more than 200 countries rated (Table 1.3). Surveys of executives and entrepreneurs paint a similar picture. The World Economic Forum's *Global Competitiveness Report* ranks Russia 118th out of 139 countries with respect to the quality of public institutions (WEF, 2010). Survey respondents gave particularly low scores to protection of minority shareholders' interests, the security of property rights and intellectual property protection. Corruption is widely reckoned to be endemic, and the evidence suggests that this perception not without foundation (Box 1.2).

Table 1.3. Selected governance indicators, 1996-2008

Indicator	1996	2000	2004	2008
Voice and accountability				
Estimate (-2.5 to +2.5)	-0.43	-0.46	-0.58	-0.97
Percentile rank (0-100)	34.9	33.7	31.3	21.6
Political stability				
Estimate (-2.5 to +2.5)	-1.04	-0.72	-1.00	-0.62
Percentile rank (0-100)	15.4	23.1	17.8	23.9
Government effectiveness				
Estimate (-2.5 to +2.5)	-0.51	-0.58	-0.28	-0.32
Percentile rank (0-100)	34.6	33.2	47.4	45.0
Regulatory quality				
Estimate (-2.5 to +2.5)	-0.39	-0.78	-0.24	-0.56
Percentile rank (0-100)	28.3	19.0	47.3	31.4
Rule of law				
Estimate (-2.5 to +2.5)	-0.67	-1.06	-0.82	-0.91
Percentile rank (0-100)	28.6	14.8	21.4	19.6
Control of corruption				
Estimate (-2.5 to +2.5)	-0.80	-0.99	-0.75	-0.98
Percentile rank (0-100)	23.3	13.6	25.7	15.5

Source: World Bank Governance Research Indicator Country Snapshots (2009).

Box 1.2. Combating corruption

Evaluations of the Russian business environment continue to highlight corruption as a major problem. While it is clearly not possible to measure the scale of corrupt activity with precision, the available evidence gives grounds for concern. It is by a wide margin the most problematic factor for doing business cited by respondents to the WEF's 2009 Executive Opinion Survey, and Russia ranked 146th among 180 countries in Transparency International's (TI) 2009 Corruption Perceptions Index, on a par with Ukraine and well behind its western neighbours. To be sure, assessments based on *perceptions* of corruption should not be confused with direct evidence of its extent, although perceptions alone can have an impact on investor sentiment. Perception indexes can be a misleading indicator of corruption levels (as, for example, when a single high-profile case has a big impact on outsiders' perceptions), but only up to a point. Countries with a reputation for corruption generally have serious problems.[1]

This view finds some confirmation in a survey conducted for the 2009 Global Corruption Barometer, which asks respondents directly about their experience with official corruption. In Russia, around one respondent household in three had paid a bribe in the preceding 12 months. Russian respondents overwhelmingly identified public officials, rather than parliamentarians, judges or the police, as the group most affected by corruption, though all of these institutions were believed to have serious problems with corruption. Using enterprise surveys taken between 2000 and 2008, Frye (2010) concludes that corruption actually increased over the past decade, a conclusion reinforced by Russia's steady decline in international comparisons, such as those undertaken by TI, WEF and the World Bank.

The authorities are well aware of the problem, which has been the focus of increasing attention in recent years, and an anti-corruption committee headed by the President has been created. Tackling corruption will take time and will require a multi-faceted approach – there is no simple solution. Measures to increase the transparency and accountability of public institutions would help, as would regulatory reforms that reduce bureaucrats' opportunities to extract bribes from private-sector firms, the introduction of stricter conflict-of-interest laws and the imposition of more effective sanctions. Judicial and civil service reforms are needed to increase the fairness, transparency and efficiency with which laws and regulations are administered.

1. See Olken (2009) for a recent overview of this literature; see also Mocan (2004).

1.4.3. Macroeconomic environment

A stable and predictable macroeconomic framework is of key importance for a country's innovation performance. High and stable rates of output growth in particular provide favourable conditions for business firms to pursue their medium- to long-term strategies. A medium- to long-term time horizon is needed for R&D investment and for the more demanding types of product, process and organisational innovation. A sound macroeconomic framework may also encourage investment in R&D and innovation through low and stable rates of inflation and lower and less volatile real interest rates (Jaumotte and Pain, 2005b). While the recent temporary downturn of the Russian economy had a dampening effect on the funding of R&D and innovation activity (Box 1.3), the preceding period of sustained high growth provided a good environment for stabilising and expanding innovation activity in the public and the business sectors.

Box 1.3. Impact of the crisis on innovation acivity in the Russian Federation

Both the crisis and the policy response have had a significant – and mixed – impact on Russia's innovation system. The negative impacts stem largely from firms' response to the shock and from government measures adopted in response to the rapid deterioration of public finances:

- The private sector sharply curtailed its investment in innovation-related activities. According to the Federal Agency for Science and Innovation (Rosnauka), by September 2009, the share of enterprises engaged in innovative activity was down one-third on the level of 2005. The number of small innovative enterprises was down by half. Many of these enterprises were small firms working under contract to large firms that had outsourced R&D activities and cut their R&D spending in the wake of the recession (Gaidar Institute, 2010). Companies also began to default on their obligations under government contracts concluded under the federal targeted programme for R&D for 2007-12. The National Association for Innovation and the Development of Information Technologies (NAIRIT) estimated in late 2008 that private firms' expenditure on innovation projects had been cut by almost 80% and venture-fund activity by 40% (Mel'nik, 2008).
- The (limited) available evidence also suggests that private firms that cut their R&D spending did not, for the most part, offset this with greater co-operation with public sector bodies; in general, private firms continue to find it difficult to work with the state research bodies or higher education institutions. In addition to complaints about the speed and efficiency of public sector R&D organisations, there remain concerns about intellectual property rights when the public and private sectors collaborate (Gaidar Institute, 2010).
- Budgetary expenditure on R&D was also cut by around 30% in 2009, though the severity of the cuts varied widely across programmes and institutions. In some instances, current-year allocations were withheld at very short notice (Gaidar Institute, 2010). The 2010 budget included further cuts from the levels of 2009. Whereas fiscal stimulus packages allowed many OECD countries to increase R&D spending and spending on fundamental science (OECD, 2009b), innovation-related priorities did not figure prominently in Russia's anti-crisis measures. Extra-budgetary public expenditure was also affected, not least because of the failure of enterprises to meet their commitments under the federal targeted programme mentioned above; the Ministry of Education and Science estimates that only about 60-70% of planned off-budget expenditure under that and related programmes was executed (Gaidar Institute, 2010).
- Funding cuts led to the departure of researchers. The number employed fell by an estimated 4.2% in 2008. Total employment in the R&D sector fell by around 5% (IPRAN, 2009). Moreover, the decline took place chiefly in response to private-sector adjustment; it does not include the impact of subsequent budget cuts, imposed in 2009.

1.4.4. Product market regulation, competition and entrepreneurship

The 2008 Product Market Regulation (PMR) Assessment of the Russian Federation (OECD, 2009a) shows that, despite liberalisation in a number of areas, the regulatory system is generally still highly restrictive. Using the OECD PMR indicators system (see Box 1.4), Russia tops the list of the most restrictive countries covered (Figure 1.9). In addition, all three of the high-level sub-components of the overall PMR index mentioned in Box 1.4 are higher than those of comparator countries, but "state control" and "barriers to international trade and investment" stand out as particularly restrictive. Some of the barriers are discussed further in the section on competition in Russian product markets.

Box 1.4. The OECD product market indicators system

The OECD's PMR indicators assess the extent to which the regulatory environment promotes or inhibits competition in markets in which technology and market conditions make competition viable. These indicators have been used extensively over the last decade to benchmark regulatory frameworks in OECD and other countries and have proven useful in encouraging countries to implement structural reforms that enhance economic performance.

The PMR indicator system summarises a large number of formal rules and regulations that have a bearing on competition. The regulatory data cover most of the important aspects of general regulatory practice as well as a range of features of industry-specific regulatory policy, particularly in the network sectors. This regulatory information feeds into 18 low-level indicators that form the base of the PMR indicator system. These low-level indicators are progressively aggregated into three broad regulatory areas: *i)* state control; *ii)* barriers to entrepreneurship; and *iii)* barriers to international trade and investment. At the top of the structure, the overall PMR indicator serves as a summary statistic on the general stance of product market regulation.

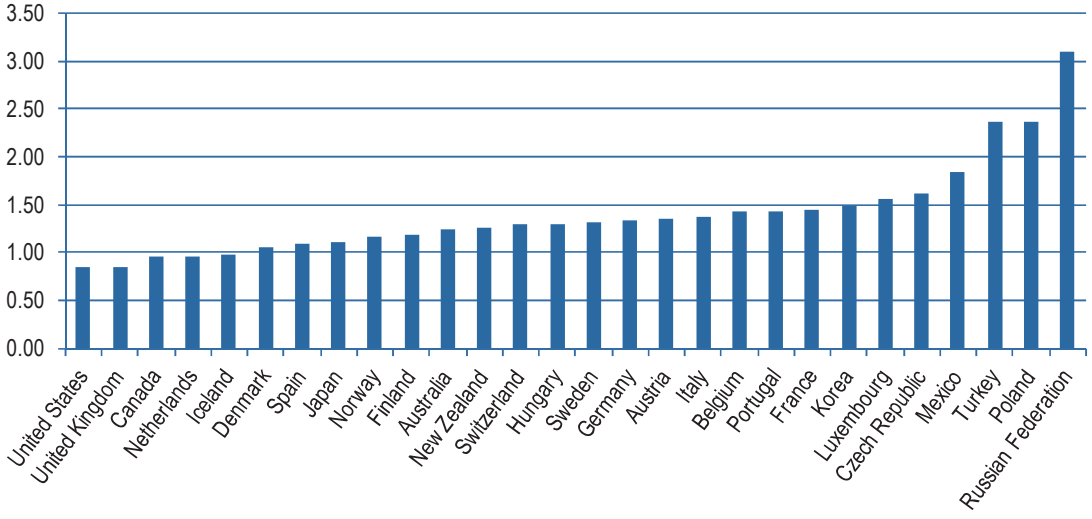
The PMR indicators have a number of characteristics that differentiate them from other indicators of the business environment. First, in principle, the low-level indicators only record "objective" information about rules and regulations, as opposed to "subjective" assessments of market participants as in indicators based on opinion surveys. This isolates the indicators from context-specific assessments and makes them comparable across time and countries. Second, the PMR indicators follow a bottom-up approach, in which indicator values can be related to specific underlying policies. One of the advantages of this system is that the values of higher-level indicators can be traced with an increasing degree of detail to the values of the more disaggregated indicators and, eventually, to specific data points in the regulation database. This is not possible with indicator systems based on opinion surveys, which can identify perceived areas of policy weakness, but are less able to relate these to specific policy settings.

Source: OECD (2009a).

The World Bank's Doing Business surveys shed some additional light on the obstacles and barriers encountered by businesses.[10] In the most recent of these international comparisons, Russia ranks 123rd among 183 economies (Table 1.4), ahead of India (rank 134) and Brazil (127) but behind China (79). The country fared worst in "Dealing with construction permits" (rank 182), "Trading across borders" (162, compared to 114 for Brazil, 100 for India and 50 for China) and "Starting a business" (108). It appears that while starting a business is difficult it may be even more challenging to operate it.

The World Bank (2011b) compares Russia with a number of country groupings, such as the OECD, the G20, the upper-middle income countries, the BRICs (Brazil, Russia, India and China) and ECA (Eastern Europe and Central Asia). Russia, for example, ranks lowest overall in comparison to OECD countries. It has a rather low overall rank (38th) among 46 upper-middle income countries, with a few bright spots (such as "enforcing contracts"), and it ranks 2nd overall among the four BRICs.

Figure 1.9. Overall indicator of product market regulation, 2008



Source: OECD (2009a), *OECD Economic Surveys: Russian Federation*, OECD, Paris.

Table 1.4. Russia's ranking in Doing Business, 2011

	Rank 123 (out of 183 economies)
Ease of doing business	**123**
Starting a business	108
Dealing with construction permits	182
Registering property	51
Getting credit	89
Protecting investors	93
Paying taxes	105
Trading across borders	162
Enforcing contracts	18
Closing a business	103

Source: World Bank (2011a).

Overall, Russia could increase its economic performance by further improving its regulatory framework. For example, there is empirical evidence (OECD, 2007a, based on Conway *et al.* 2006) that competition-restraining regulations slow the rate of catch-up with the technological frontier, where labour productivity is the highest. Countries with the most restrictive product market regulation, or those with the lowest productivity and hence the greatest scope to move towards the frontier, are likely to achieve the greatest improvement in productivity growth. There is evidence that better product market regulation is also associated with increased foreign investment inflows (Nicoletti *et al*., 2003) which in turn provides opportunities to benefit from international technology spillovers.

The importance of competition for innovation

Product market competition is a driver of productivity growth (Baumol, 2002) by spurring innovation either directly or indirectly, through what Joseph Schumpeter termed processes of "creative destruction". Yet the effect of competition in product markets on innovation activity that is predicted by economic theory is somewhat ambiguous: competition among incumbents can stimulate innovation, but the possibility of gaining a certain degree of market power may also provide a strong incentive to innovate (the so-called Schumpeterian effect). Nonetheless, most empirical research has found evidence of a positive correlation between innovation and competition.[11] Recent work by Aghion *et al.* (2005) suggests however that the relationship is a concave ("inverted-U") one, with the Schumpeterian effect dominating at higher levels of competition.

In Russia, the empirical evidence suggests that openness to foreign competition boosts domestic productivity growth (Aghion and Bessonova, 2006; OECD, 2009a). The effect is found to be stronger for firms close to the technological frontier. For less productive firms, the threat of entry may create a disincentive to innovate by reducing their "life expectancy" and thus shortening their time horizons. The incentive to innovate to escape competition from new entrants appears to predominate, so an increase in threat of entry usually appears growth-enhancing overall (Aghion *et al*., 2002; Aghion and Bessonova, 2006). Kozlov and Yudaeva (2004) find that competition from both foreign and domestic competitors has an inverted-U effect on the innovation efforts of Russian producers. However, they conclude that most Russian firms are located on the upward-sloping part of the curve, where innovation activity increases with competition. This result is reinforced by survey data showing that Russian firms in more competitive environments spend significantly more on R&D and also innovate more than firms facing less competitive pressure.[12] Firms with greater market power innovate less, and monopolistic firms innovate least of all (Goldberg, 2006).

The conclusion is similar for the impact of competition on the outcomes of innovation activity rather than the inputs. Recent empirical work points to a negative correlation between growth in total factor productivity and concentration (Gianella and Tompson, 2007; Aghion and Bessonova, 2006). The effect is found to be stronger for import-competing industries.[13] Finally, the incentive to innovate also increases with the degree of similarity between firms in a given sector (the degree of "neck-and-neckness" in terms of their distance from the technological frontier).

Competition in Russian product markets

The question that naturally arises from the foregoing discussion is whether or not product markets in Russia are sufficiently competitive. OECD (2009a) finds that, in general, they are not. The share of highly concentrated markets in Russia increased from 43% to 47% between 2001 and 2007.[14] Although differences in methodology and sectoral coverage make comparison difficult, this is high compared to OECD countries; it is also consistent with OECD (2006a), which found that Russian product markets were unusually concentrated, particularly at the regional level. It is also consonant with the views expressed in the WEF's Executive Opinion Survey, which consistently suggest that Russian executives believe competition in most markets to be weak, market dominance common and anti-monopoly policy ineffective (WEF, 2010). The perceived inefficiency of state institutions is matched by the perceived inefficiency of markets. OECD (2009a) cites some evidence that the trend towards large-firm dominance has been checked since

2005. However, when measured by the share of total net profits or market capitalisation, large firms still loom larger in the Russian economy than in many OECD and other countries. Sales data likewise confirm the dominance of large firms, with the total sales of the 10 and 50 largest firms equivalent to almost 30% and 50% of GDP, respectively.

In markets characterised by a small number of large firms, the challenge of ensuring effective competition and preventing cartels is particularly significant, and the Federal Antimonopoly Service considers cartel formation one of the major threats to competition in Russia. It estimates that as many as one in five industries may be prone to cartel activity (Federal Antimonopoly Service, 2008). In many regional markets, a few incumbent firms co-operate closely with regional or local officials. While this is often a sign of corruption and rent-seeking behaviour, such arrangements also arise as a result of the limited fiscal autonomy of sub-national authorities. Regional governments and municipalities often pursue their social objectives through more or less informal arrangements with large incumbent enterprises operating in their territory. These typically translate into effective barriers to entry from outside competition (OECD, 2009a).

While in some sectors consolidation is probably the result of a healthy shake-out, in others it is due to the ability of large incumbents created in the Soviet era to limit entry, often by relying on political support at regional or national level. Competition is also diluted by Russian firms' marked preference for dealing with familiar counterparts and a reluctance to change suppliers, attitudes which are understandable given the difficulties of enforcing contracts. In surveys conducted by the Gaidar Institute, managers regularly cite established relations between producers and consumers as a major obstacle to competition. A weak contracting environment also gives firms a greater incentive than elsewhere to control customers and suppliers through the vertical integration of supply chains (Bessonova, 2009). Finally, political support has allowed large conglomerates to expand into new markets by acquiring non-core assets and diversifying product lines, especially in the case of some state-owned enterprises (OECD, 2006a; Tompson, 2010).

OECD (2009a) underscores the extent to which overly restrictive product-market regulation effectively limits competition. This raises the question of regulatory obstacles to business development. Anti-competitive barriers are now perceived to be one of the major problems for businesses, along with corruption and frequent changes in the law.[15] According to the Federal Antimonopoly Service, entry barriers are a particular problem when regional authorities seek to protect local markets from outside penetration: the service has seen a sustained increase in violations of competition law by regional and municipal authorities.[16] If lowering barriers to entry and improving the predictability of state policy for business would benefit the business community in general, it would likely have an even greater effect on innovation.[17]

While serious problems remain, this is an area in which there appears to have been real improvement over the last decade. In an effort to monitor the impact of the government drive, launched in 2001, to reduce the bureaucratic burden on small firms, the Centre for Economic and Financial Research undertook seven rounds of enterprise surveys in 20 provinces over 2001-07. The results showed that many principles enshrined in the law were still violated by officials at the end of the period. Inspections, for example, were more frequent than allowed by law and documentation requirements for different procedures were often more extensive than allowed under the new legislation. However, each successive round did provide evidence of improvement, particularly in the areas of registration, inspections and licensing. At the same time, the importance that respondents attached to the level of competition as a factor affecting business

development increased in each round, suggesting that small entrepreneurs were increasingly concerned with "normal" business problems.

According to the OECD 2008 Product Market Regulation Assessment, Russia performs rather well on barriers that affect the entry of private-sector firms and vertical integration in network sectors (gas, electricity, rail, air transport, postal services and telecommunications). On this indicator, barriers are only slightly higher than the average in OECD countries. However, they vary widely. The mobile telecommunications market is fairly well regulated, with low barriers to entry. In contrast, the fixed-line market is still controlled by a state-owned, vertically integrated incumbent, Svyazinvest (OECD, 2009a). In terms of innovation, the telecommunications sector is of particular interest, as it is not just a major actor in innovation in its own right but is also a provider of infrastructure of critical importance for innovation throughout the economy. A lack of competition in this area can adversely affect consumer welfare and downstream producers and have a detrimental effect on innovation. In many instances, a lack of competition has a negative effect on the diffusion of some ICT applications.

1.4.5. Intellectual property rights[18]

Protection of intellectual property rights (IPR), through patents or in other ways (trademarks, copyright, etc.), stimulates research by enabling successful innovators to reap rewards and by preventing free riding. The related publication requirements also contribute to the dissemination of scientific and technological knowledge and help prevent costly duplication of research efforts. However, the benefits have to be weighed against the social cost arising from the delayed diffusion and thus reduced use of the invention over the lifetime of the patent, the administrative costs, etc. While the relationship between IPR and innovation is complex (Jaumotte and Pain, 2005c) the adoption and implementation of modern IPR legislation is an essential part of the overall framework conditions for innovation.

Russia's IPR regime provides protection for copyright and related rights, trademarks, geographical indications, patents, industrial designs, topographies of integrated circuits and computer programmes. The regulations are administrated by the Russian Federal Service for Intellectual Property, Patents and Trademarks (ROSPATENT).[19] Part IV of the Civil Code, which was voted in December 2006 and entered into force on 1 January 2008, replaced all previous IPR legislation and combined all Russian IP laws into a single legal instrument. The new legislation introduced a number of improvements aimed at making progress towards WTO accession; however, several additional draft amendments remain.

The Russian Federation succeeded the former Soviet Union as a party to a number of international treaties which include the World Intellectual Property Organization (WIPO) Convention, the Patent Cooperation Treaty (PCT) and the Paris Convention. In 1992, Russia began negotiations for accession to the WTO, which incorporates a number of IPR-related disciplines. Since then, Russia has adhered to several additional international treaties.[20] The development of Russian IPR legislation has also been influenced by bilateral treaties concluded by the Russian Federation, notably the bilateral market access agreement signed in November 2006 with the United States, which includes a binding IPR agreement on a number of critical IPR issues such as optical disc piracy, Internet piracy, protection of pharmaceutical test data, etc.[21] However, negotiations on accession to the WTO are still ongoing, and IPR protection remains an outstanding issue.

Russian legislation provides for enforcement under the Civil Code, the Administrative Code, the Criminal Code and the Customs Code. A number of recent reforms have improved IPR enforcement, including the amendment of the Criminal Procedure Code in 2006, which provided police with powers to initiate criminal investigations (the power was previously reserved to prosecutors); the amendment of the Criminal Code in 2007, which increased the maximum penalty and redefined "serious" crimes; a number of amendments to Part IV of the Civil Code in 2008; and accession to the WIPO Internet Treaties on 5 February 2009.

While the international business community has acknowledged some progress in the reforms of laws and institutions, the strength of intellectual property provisions and the enforcement of IPR protection are still problems. Significant areas for progress concern the level of piracy,[22] in particular massive online piracy, which is a serious and growing problem, and the protection of test data submitted to the government to obtain product approvals for the biopharmaceutical, agriculture and agrochemicals sectors, according to the Business and Industry Advisory Committee to the OECD.

According to the Ministry of Economic Development of the Russian Federation (2009), a number of further legal reforms are under way to bring Russian legislation into conformity with the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement and other international treaties on IPR protection.[23] It is also suggested that a number of further reforms to Part IV of the Civil Code will likely be necessary to further strengthen IPR protection.[24]

With regard to IPR policy in the public research sector, Federal Law 217 (August 2009) provides the possibility for public research institutions (PRIs) and universities to establish businesses to commercialise and transfer the IPR produced from public research. Based on this legislation, PRIs and universities own the IPR arising from federally funded public research and can formulate their own policy regarding the distribution of proceeds from its commercialisation. However, as of 2010, the majority of PRIs and universities had not adopted IPR policies, owing to a relative lack of interest in commercialisation.

In summary, Russia has taken steps to strengthen its system of intellectual property rights and to comply with its international obligations by bringing its legal framework for intellectual property to international standards. However, the evidence indicates that significant deficiencies remain, especially in the area of enforcement.

1.4.6. Financing innovation

A well-developed financial system, which reduces the cost of external financing, is an important catalyst of innovation activities (Jaumotte and Pain, 2005b). Russia's financial system, despite the rapid expansion of recent years, is still relatively underdeveloped, with considerable scope for financial deepening to further long-term growth. A large majority of Russian firms rely on retained earnings to finance investment and innovation, and enterprise surveys almost always report the shortage of own funds and the cost of borrowing as the principal barriers to investment and innovation. This points to the importance of strengthening the banking sector (see OECD, 2009a, for specific proposals) and non-bank financial institutions.

Funds devoted to innovation and risk financing are scarce in Russia, partly owing to the dearth of venture capital. Jaumotte and Pain (2005d) find that the development of venture capital in OECD countries is negatively correlated with enterprises' assessment

of the difficulty of securing external finance, and a similar situation appears to obtain in Russia. In Russia, however, the development of risk capital markets is still impeded by the overall underdevelopment of financial markets. A lack of venture capital, an important resource for innovative businesses, notably in their early stages, can hinder the rejuvenation of the economy through the activities of dynamic entrepreneurs and innovative start-ups.

1.5. The role of innovation in Russia's future economic development

1.5.1. Innovation and long-run growth

The challenge of diversifying Russia's economic structure and reducing its reliance on natural resource sectors has loomed large on the policy agenda for well over a decade.[25] Even during the boom years before 2008, there was widespread awareness that growth was being driven by transitory factors and that steps were needed to facilitate Russia's transition to self-sustaining, investment- and innovation-led growth.[26] Since late 2008, the global financial and economic crisis has underscored the importance of this challenge. Russia was far more seriously affected by the global crisis than the authorities or most other observers had anticipated. Although the contraction in Russia was relatively short, it was extremely sharp, and the ensuing recovery has so far been fairly restrained. The shock of 2008-09 highlighted once again just how reliant Russia remains on primary commodities, particularly oil and gas. It is highly unlikely that an economic model based on exports of primary commodities can deliver a return to the very high growth rates seen in the years before the crisis. Increasing attention has therefore been focused on modernisation and, in particular, innovation, as the keys to Russia's successful long-term economic growth (Box 1.5).

The challenges are enormous, and it is easy to be sceptical of Russia's capacity to bring about such a transformation. However, such a shift would not be unprecedented: few observers in the 1950s or early 1960s would have anticipated the innovative dynamism that drove the growth of countries such as Finland or Korea, that India would emerge as a major player in software development and that China would be on the way to becoming a major power in global R&D. These countries' experience, and that of others, demonstrates the potential of even developing economies to generate step changes in their innovation performance in a comparatively short time. Of course, Russia, or any other country, cannot simply copy the policy mixes or growth trajectories of a Finland or a Korea. Reform strategies and innovation policy must reflect a country's specific institutional and economic context. Even when common problems can be identified, simple "transplants" of policies and institutions from one environment to another rarely take root. Some degree of adaptation is usually required. Nevertheless, the experience of OECD countries in a wide variety of policy domains, including knowledge-creation and innovation, points to considerable potential for policy learning across countries.

Box 1.5. The role of innovation in driving long-term economic growth

Modern economic growth is ultimately founded on innovation (OECD, 2010a). For more than a half-century, it has been clear that innovative activity is the single most important driver of long-term growth. Pioneering studies as long ago as the late 1950s sought to determine the extent to which long-run performance could be explained in terms of increasing inputs of capital and labour. Despite differences in methodology and data coverage, they consistently found that the measured growth of inputs could account for no more than 15-20% of actual output growth over periods of a century or more (Abramowitz, 1956; Solow, 1957; Kendrick, 1962). The balance came from increases in total factor productivity (TFP) – increases in the output generated by a given volume of inputs. This finding, which has been broadly confirmed by a large body of subsequent research (for an overview, see Rosenberg, 2003), points to the overriding importance of innovation – not only technological, but also organisational, financial and institutional – for long-run growth (Donselaar *et al*., 2004; Keller, 2004).

Of course, the large share of TFP in such "growth accounting" exercises is a residual result: it tells us how much growth *cannot* be explained in terms of the growth of inputs of labour and capital. By inference, the balance reflects the greater efficiency with which inputs are employed, but problems for measuring innovative activity make it difficult to quantify the precise contributions of various forms of innovation to overall growth. In general, empirical assessments must rely on indirect or highly imperfect indicators of innovation, such as patent data or R&D spending. Nevertheless, a large and growing body of research in recent years has underscored the link between indicators of knowledge creation and growth. The positive relationship between R&D activity and TFP growth, for example, has been confirmed by numerous studies using both panel and cross-sectional data (Scherer, 1982; Griliches and Lichtenberg, 1984; Aghion and Howitt, 1998; Frantzen, 2000; Griffith *et al*., 2004; Zachariadis, 2003). Science infrastructure and foreign knowledge both enhance productivity growth in developed and developing economies alike (Coe *et al*., 1997; Guellec and van Pottelsberghe, 2001; World Bank, 2006). Although some evidence suggests that the link between domestic R&D investment and innovation is far stronger in large developed economies (Ulku, 2004), there is good evidence that R&D spillovers from developed countries have positive effects on the TFP growth of developing and transition economies (Coe *et al*., 1997; Griffith *et al*., 2004).

Studies on the determinants of growth (OECD, 2001, 2003a) highlight the role of investment in ICT and human capital, combined with more efficient and innovative ways of producing goods and services. The development of ICT spurs innovation and economy-wide productivity growth via three main channels: growth of both output and productivity in ICT-producing sectors; greater use of ICT in the production of other goods and services; and spillover effects arising as a result of complementary innovations (*e.g.* organisational innovation) in conjunction with increased use of ICT (OECD, 2003b; Hempell, 2002; Van der Wiel, 2001).

Many countries, particularly those engaged in rapid "catch-up", have at times sustained high growth rates for relatively long periods through factor mobilisation rather than growth along the TFP-dominated trajectory described above (Krugman, 1994). As is well known, the Soviet Union followed such a path. While Soviet planners succeeded for quite some time in sustaining growth via labour mobilisation and capital accumulation, Soviet performance in respect of TFP growth appears to have been consistently low. As the Soviet system matured, it became ever harder to identify and mobilise new reservoirs of labour. Since nothing could be done about growth of the labour force except in the very long term, there was an acute need to substitute capital for labour and to raise TFP growth. Easterly and Fischer (1994) argue that the inability to do this was the Achilles' heel of the Soviet economy. Indeed, they find that, controlling for investment and human capital, Soviet growth during 1960–89 was the worst in the world and that its relative performance worsened over time. In other words, ever higher rates of investment were required to sustain declining rates of growth. Ofer (1987) estimates that TFP growth actually turned negative from 1970, reflecting both poor resource allocation and the system's inability to stimulate innovation.

Post-Soviet Russia passed through a phase of relatively easy "recovery growth". For a number of years after the transitional recession that lasted until 1998, enterprises were able to raise output and productivity very rapidly, on the basis of little investment or innovation, by drawing on existing under-employed stocks of capital and labour. The economic reforms of the 1990s and early 2000s made an important contribution, as the efficiency of capital, labour and product markets increased dramatically. Such a growth trajectory, however, was only possible for a limited period.[27] Enterprise surveys suggest that capacity constraints began to bite in many sectors by 2005. By 2006 or so, the most efficient enterprises had also largely shed their excess labour, so the scope for further "cheap" TFP growth was limited (OECD, 2009a). Finally, although the economic reform agenda remained substantial, the "easiest" gains from market-oriented reforms had been realised by the mid-2000s: for all its structural weaknesses and problems, Russia had become a market economy. If it is to sustain strong growth over the longer term and to diversify its production and export structure away from reliance on raw materials, Russia must generate higher returns from investments in human capital and ICT and by fostering knowledge creation.

This conclusion is reinforced by the comparative analysis of Sala-i-Martin *et al*. (2010), who argue that, as countries grow richer, the determinants of their competitiveness change. Initially, they compete primarily on the basis of factor endowments, before moving to an efficiency-driven stage of development, in which the key factors include the country's human capital, the efficiency of its financial, labour and product markets, and the quality of its institutions. Finally, the most advanced countries come to depend on their ability to generate commercially useful new knowledge and thus to produce new and unique processes, products and services. They, like others, identify Russia as one of the countries that now face the challenge of making the transition to an innovation-driven growth model. The problem is that there is still a great deal of unfinished business at the second stage – in terms of quality of institutions and market efficiency – that will make the transition to the third stage particularly difficult.

1.5.2. Russia's innovation imperative

In addition to the foregoing general considerations on the role of innovation as a driver of economic growth, there are a number of specific reasons why Russia might benefit from improved innovation performance. These include the need to diversify the structure of production and exports, demographic challenges and the need for cleaner, more energy-efficient growth.

Innovation could facilitate diversification and help Russia build on its strengths

It is well known that Russia's economy is heavily dependent on a limited range of natural resource sectors. In 2008, primary products accounted for 85.4% of total exports, of which oil and natural gas constituted the largest share (69.7%), followed by metals and precious stones (13.2%). Machinery, equipment and vehicles accounted for just under 5%. Russia's export performance in most other sectors is disappointing. Overall, its global market shares in pharmaceuticals, electronics and office machinery/computers were all below 1% in 2008. The corresponding figures for aerospace and instruments were around 3-4%. Resource sectors loom far larger in Russia's export structure than they do in the structure of GDP or employment – the oil and gas sector together account for around 20% of GDP and roughly 1% of employment – but they have been crucial to growth since the end of Russia's recession in 1999. Oil-price movements alone are estimated to account for as much as half of Russia's growth during the decade between

the crises of 1998 and 2008 (Guriev and Zhuravskaya, 2010). Movements of other commodity prices were also important. This is not to deny the very real contribution of the economic reforms of the 1990s (Ahrend and Tompson, 2005), but it does suggest that, without the oil boom, Russia's performance in the early 2000s would have been rather lacklustre by the standards of large emerging markets. Moreover, while the large share of hydrocarbons in GDP owes something to movements in international prices, a recent assessment based on physical volumes (output of primary energy per unit of GDP at PPP exchange rates) shows that the relative weight of energy production in Russia's economy is roughly six times the OECD average and eleven times the average of the EU27. It is in fact rather closer to the OPEC average (IEA, 2009).

This energy dependence raises a number of problems. A growing body of empirical research suggests that countries endowed with great natural resource wealth tend to lag behind comparable countries in terms of long-run real GDP growth, a finding that has given rise to widespread debate about a so-called "resource curse" or a "paradox of plenty".[28] Explanations focus on a wide range of economic and political factors. The most prominent lines of argument emphasise the impact on the competitiveness of other tradables ("Dutch disease"); the impact of commodity-price volatility, particularly on fiscal revenues; and the interaction of commodity-price volatility with financial market imperfections, which can lead to inefficient specialisation.[29] Resource dependence also looms large in any discussion of structural reforms, as resource-dependent development can complicate efforts to build new institutions (Tompson, 2006). The Russian authorities have long been aware of these dangers, but despite their efforts to use fiscal policy to shield the domestic economy from the consequences of commodity-price movements, the Russian economy showed many signs of succumbing to these economic pathologies prior to the crisis. As noted above, growth was increasingly linked to oil prices, and by 2008 the fuel and energy sector's share of federal budget revenues had reached 43%.[30] OECD (2009a) drew attention to the emergence of real estate bubbles and other undesirable secondary effects of the oil boom.

This structure of growth can hardly be maintained over the long term, particularly because the resource sector's contribution to growth has in recent years been driven more by price increases than by rising production volumes (OECD, 2006a, 2009a). This makes Russia very vulnerable to fluctuations in commodity prices. While the prices of oil and other commodities remain high by historical standards, even following the crisis,[31] it is important to recognise that it is changes to the terms of trade that affect economic growth rather than their level. To be sure, the impact of such changes may be felt over time (the impact of oil-price changes in one period may still be felt in subsequent periods), but a price-driven growth pattern requires continually rising prices, hardly a realistic expectation. If prices stabilise, even at very high levels, the growth effect will eventually dissipate, as the economy adjusts to the new terms of trade. Moreover, in terms of production volume, given the current state of producing fields and existing depletion rates, Russia will need innovation and technical modernisation to sustain, let alone to increase, oil and gas output over the long run (Ahrend and Tompson, 2006; UNDP, 2010). While often seen as a very "traditional" industrial sector, the oil and gas industry is increasingly "high-tech", owing to the growing need to tap unconventional sources and to develop fields in very difficult environments. Russia will thus need innovation not only to develop new economic strengths but also to make the most of those it already has. There is no contradiction between an innovation/diversification agenda and the desire to continue to develop Russia's hydrocarbon resources. The example of Norway has shown that innovation capability developed around the hydrocarbon sector can be a springbooard for the development of new products and services (OECD, 2007b).

Finally, common sense suggests that, given Russia's population and human capital endowments, a flourishing non-resource urban sector is likely to be crucial to long-term social and political stability. As Sutela (2005) observes, Russia can never become a northerly Kuwait. Its resource sectors alone will never be able to provide an acceptable standard of living for the great mass of the population, even under extreme assumptions about future resource prices and Russia's ability to increase resource extraction. This points to the need for diversification in directions that will create more high-productivity employment.

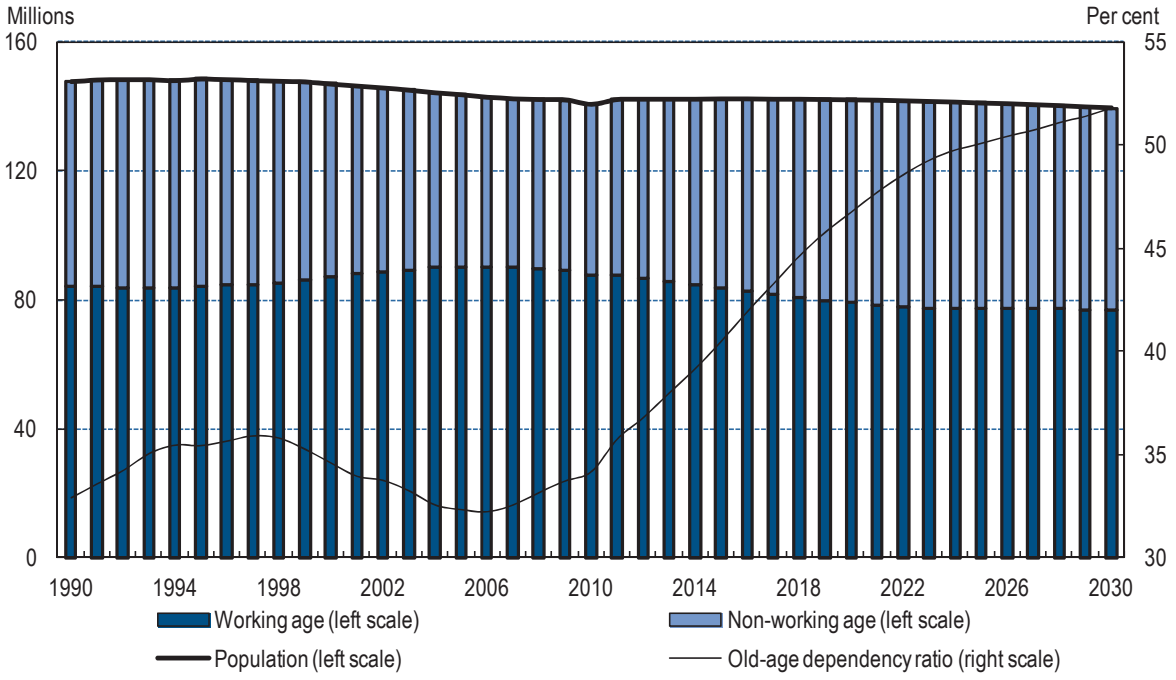
Demographic trends point to the need for sustained strong productivity growth

The second reason why Russia needs to shift to a more innovation-oriented development track stems from its demographic challenges. In many respects, it has a particularly problematic combination of demographic trends that are typical of both developed and developing countries.

- Russian women, like their counterparts in the developed countries, are bearing far fewer children than a generation ago: the total fertility ratio (TFR) fell from 2.0-2.2 in the 1980s to 1.16 in 1999, before recovering to an estimated 1.49 in 2008.[32] While the rise in the TFR over the last decade is welcome news, it is not expected to rise much further. The very sharp drop in the 1990s that was associated with the trauma of Russia's transitional recession is now in the past, and official demographic projections are based on the belief that Russian households have shifted towards long-term fertility patterns characteristic of most other European countries and will not return to the levels of fertility seen in the late Soviet era.
- Russian mortality rates, by contrast, are typical of countries with far lower levels of *per capita* income. They remain extremely high by the standards of both regional peers and OECD countries. Despite some improvement in recent years, mortality rates in 2008 were still more than 30% above the levels of 1990; while cohort effects account for some of this rise,[33] the official data show that mortality rates were higher in 2008 than in 1990 – in some cases, substantially higher – for men in all age groups between 20 and 70, and for women between 20 and 60. The share of deaths from infectious diseases, which are traditionally related to living standards, is also high for a country at Russia's level of *per capita* income, and the incidence of tuberculosis and other "poverty-related illnesses" remains high, although viral hepatitis infection rates have fallen.

The combination of these two trends has led to a declining population and falling life expectancy. Despite significant immigration, the total population decreased by around 6.4 million between 1991 and 2010. The baseline scenario of Rosstat's demographic forecast envisages a further decline of around 3 million by 2030 and its "low-growth" variant, which closely matches the UN projection for Russia, envisages a drop of up to 14.5 million.[34] Life expectancy at birth has recovered from the very low levels of the mid-1990s, but it remains very low by the standards of both regional peers and OECD countries: 61.8 years for men and 71.6 years for women in 2008, as compared with OECD averages of 76.2 and 81.8 years, respectively. It is not only average life expectancy that is exceptionally low for a country at Russia's level of development: healthy life expectancy, as estimated by the World Health Organization (WHO), is very low as well, compared to the regional average. The gap is particularly large for Russian women. Their average life expectancy at any given age is higher than that of Russian men, but they also tend to spend much more of their lives in ill health.[35]

Figure 1.10. Demographic trends, 1990-2030



Note: Figures for 1990-2010 are actual. Figures for 2011-30 are projections.
Source: Federal Service for State Statistics, OECD calculations.

This is not to suggest that there has been no improvement in recent years. While life expectancy overall has not yet risen much from the lows of the 1990s, there has been a significant rise in the average life expectancy of persons diagnosed with chronic illnesses over the last decade; this suggests that the economic recovery and rising health-care expenditure have had a positive impact. Nevertheless, on current projections, labour-force growth will remain negative for the foreseeable future: the working-age population is set to decline by almost 14 percentage points by 2030. On Rosstat's baseline scenario, the old-age dependency ratio will rise by 19 percentage points and the overall dependency ratio (children as well as the elderly) will rise by nearly 24 percentage points (Figure 1.10). Both average hours worked and participation rates are already comparable to OECD levels, so the potential for increasing the labour supply through these channels is limited. More promising would be to extend Russians' working lives, by raising the retirement age from its current level of 55/60 for women/men: as OECD (2004) argues, this will be necessary in any case, if pension replacement rates are to be maintained at acceptable levels.[36] A gradual increase in retirement ages would make it easier to raise replacement rates without greatly increasing the burden on the working population. However, even if such a policy led to the activation of half of the elderly population – a change that would also depend on raising healthy life expectancy substantially – the labour force would shrink by around 10 million, and the old-age dependency ratio would continue to rise.

Given the limited room for manoeuvre with respect to the labour supply, therefore, sustaining strong productivity growth will be crucial for rapid catch-up and for ensuring the sustainability of the pension system. This will require a combination of capital deepening and increases in TFP. The key to the former lies in raising Russia's investment

rate, which is low by the standards of the advanced OECD economies, and spurring innovation.

Innovation is necessary to improve environmental performance and energy efficiency

The environmental challenges facing Russia constitute another important reason to raise innovation performance. A recent Russian analysis highlights a number of long-term environmental challenges over the next two decades (Safonov, 2008). These include:

- Rising energy consumption. On current trends, rising consumption will imply substantial growth in coal-fired heat and power generation, in an environment with few incentives to install pollution-reduction equipment or modern technologies.
- Growing pollution from industrial sources, especially in urban areas. At present, atmospheric pollution is estimated to cause up to 40 000 deaths annually among the urban population (UNDP, 2010).
- Increasing greenhouse gas emissions.
- Water-pollution. Safonov (2008) cites evidence that the quality of drinking water could deteriorate if action is not taken.
- Threats to biodiversity as a result of economic development.
- Questions about the sustainability of forest resources.

The Russian authorities are aware of these challenges, and, in March 2010, the Security Council asked the government to draft measures for adaptation to global climate change, which has now been identified as an issue of national security. Yet the green growth/innovation nexus involves more than addressing threats: there are also opportunities to be seized. Its role as a major producer of hydrocarbons notwithstanding, Russia has considerable potential in the field of renewable energy, which is now seen as a major source of long-term innovative development (UNDP, 2010). Renewables could represent a particularly important development opportunity for rural areas, especially in the far east and the north, which have suffered from poor economic performance and large-scale out-migration since the 1980s.

Closely linked to the question of climate change and environmental quality is the issue of energy efficiency. Russia has in recent years made great progress in eliminating artificially low energy tariffs for households and businesses, possibly the most important step that can be taken to reduce wasteful use of energy.[37] It also reduced the energy-intensity of GDP (energy consumed per unit of output) by around 2.5% a year during 1990-2007, a far faster rate than in the leading OECD economies (OECD/IEA, 2009). Nevertheless, there is more to be done. The energy intensity of GDP in Russia in 2008 was estimated to be somewhat more than double the world average (in PPP terms) and triple the European average (Charap and Safonov, 2010). The improvement since 1990 appears primarily to reflect structural change, rather than improvements in technical efficiency: the industrial capital stock inherited from the Soviet era is highly energy-inefficient, and buildings in Russia typically consume 50-100% more energy per square metre than buildings in similar climates in the OECD area.[38] The government estimates that the country could reduce energy consumption per unit of output by a further 40-50% from the levels of 2000 ("Energeticheskaya strategiya", 2003; World Bank, 2008; OECD/IEA, 2009). In November 2009, a new law on energy efficiency reached the statute books, with a strategy to encourage energy saving over the period to 2020. There

is an obvious link between increased energy efficiency and reduced greenhouse gas emissions. Policies creating significant incentives for enterprises to invest in cleaner, more energy-efficient technologies could thus pay substantial dividends. However, their ability to do so successfully will depend on the creation of conditions that favour technology transfer and innovation.

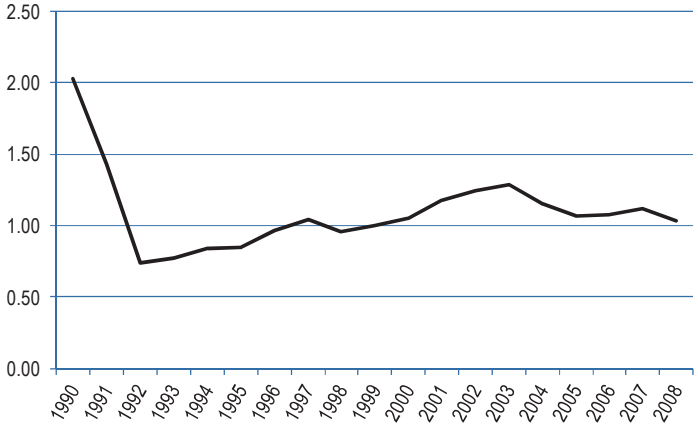
1.6. Innovation performance

This section provides an overview of the performance of the Russian innovation system, outlining major trends and developments. As far as possible, it allows comparing Russian innovation performance to that of OECD (and occasionally other non-member) countries. It covers indicators of the main innovation inputs – including R&D spending, human resources and ICT investments – followed by an assessment of innovation outputs, including scientific publications and patents. It finishes with a brief overview of the regional distribution of R&D and innovation activities.

1.6.1. Gross domestic expenditure on R&D

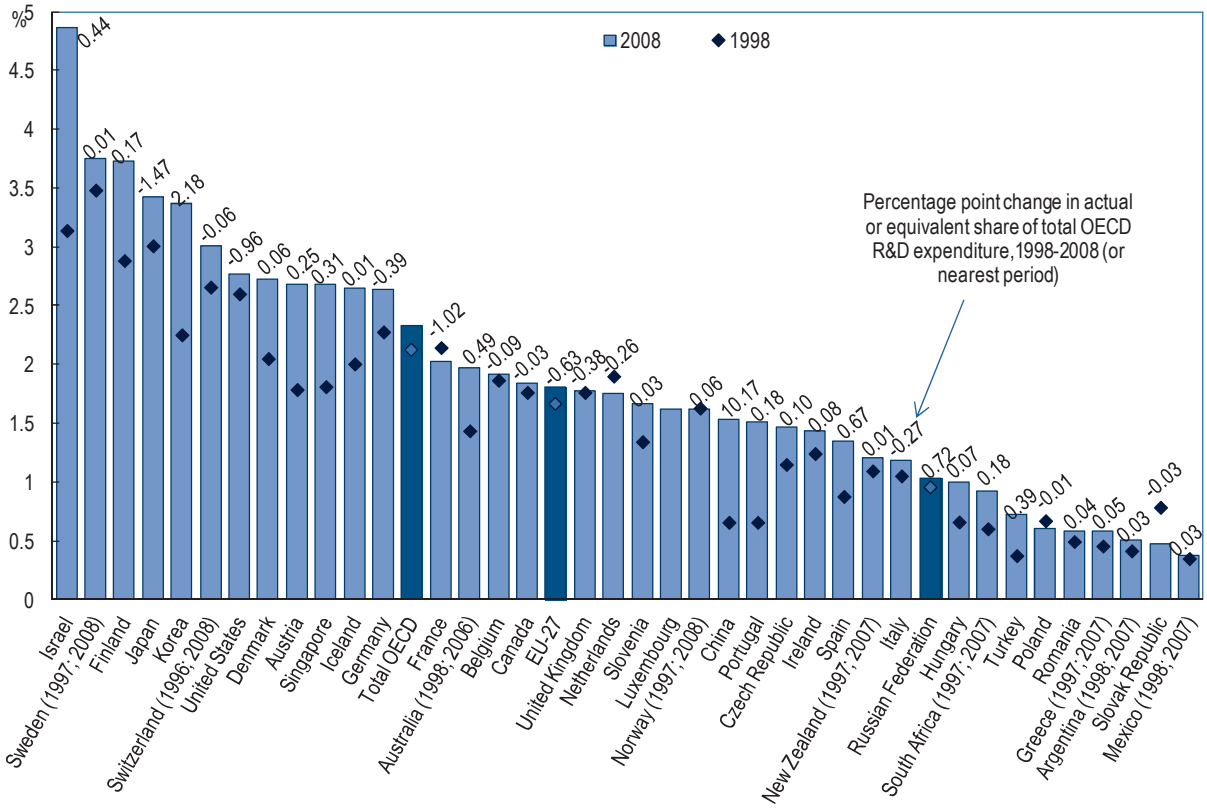
The level of gross domestic expenditure on R&D (GERD) as a percentage of GDP has climbed slowly after the initial shock of the early 1990s (Figure 1.11). In 2008, GERD accounted for 1.03% of GDP, down from more than 2% during the late Soviet period. It has also fallen more recently from a 2003 peak of 1.28%. This recent decline can be explained by robust growth in GDP, which has tended to outstrip growth in GERD, rather than by decreased spending on R&D. Indeed, among OECD countries, only Korea had a larger percentage point increase in its share of total OECD R&D expenditure over the ten-year period to 2008 (Figure 1.12). Nevertheless, the Russian GERD/GDP ratio is well below levels seen across the OECD, where the average stands at 2.33%.[39] This reflects both Russia's emerging economy status (more developed economies tend to be more R&D-intensive so as to remain at technological frontiers) and its industrial structure, which is dominated by extraction industries with traditionally low R&D intensities.

Figure 1.11. Evolution of gross domestic expenditure on R&D as a percentage of gross domestic product



Source: *OECD Main Science and Technology Indicators 2010/1*.

Figure 1.12. Gross domestic expenditure on R&D as a percentage of gross domestic product in selected countries



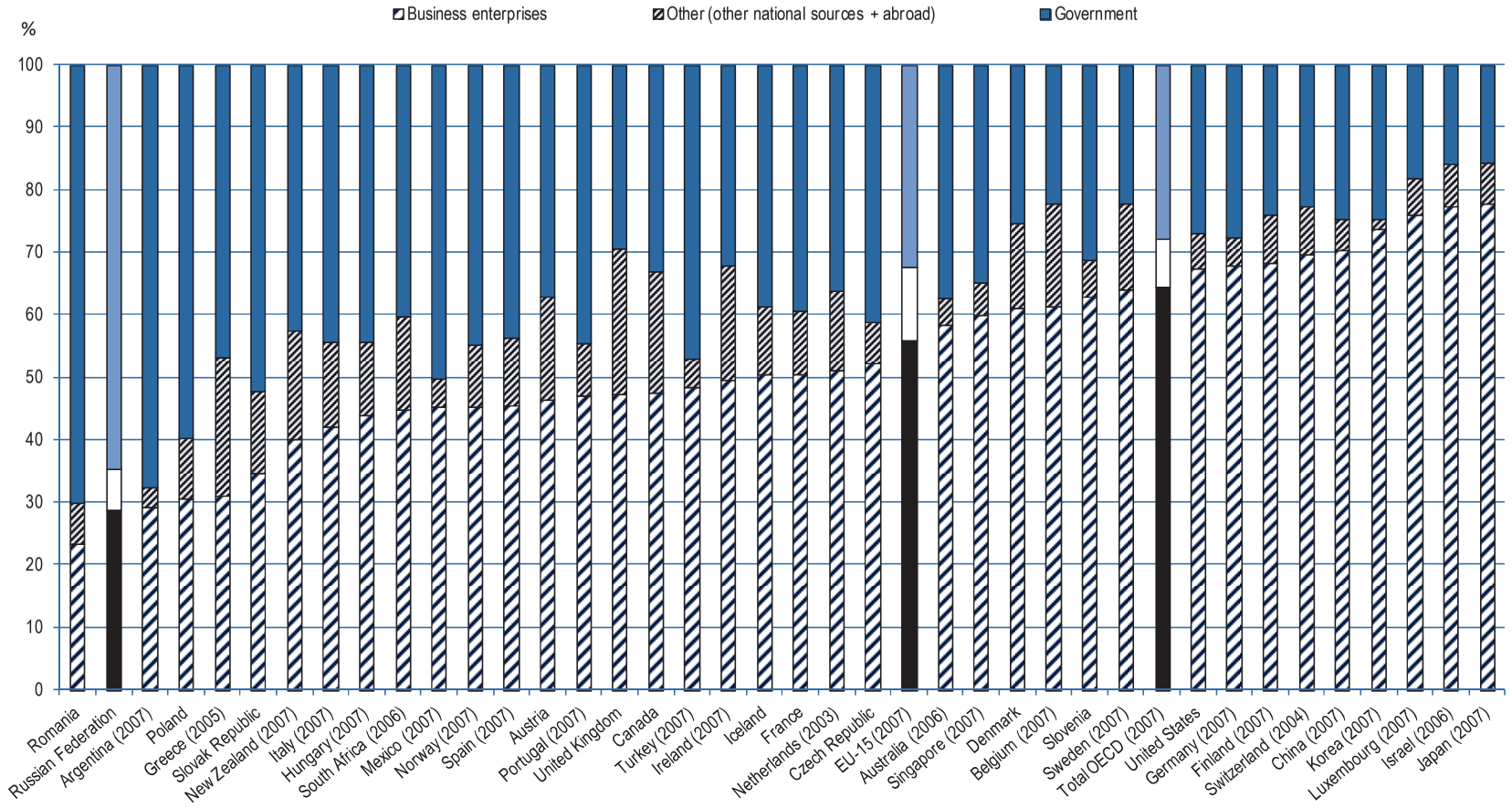
Note: In Israel, defence R&D is not covered. Furthermore, humanities and law are only partially covered in the higher education sector. Owing to the lack of a comprehensive business register for South Africa, R&D expenditure may be underestimated by 10% to 15%.

Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

Another major contributing factor to Russia's low R&D intensity is the low level of financing by the business sector. As Figure 1.13 shows, the government contributed approximately two-thirds of GERD in 2008, the percentage contributed by the business sector on average in OECD countries. This pattern has changed little over the last 15 years, except during the 1998-99 crisis, when the proportion of government funding fell dramatically (Figure 1.14). Since then, the proportion of government's contribution to GERD has increased steadily. In 2008, it surpassed the 1994 level to reach 65% as a result of recent increases in budget expenditures on R&D. The business sector is the second highest contributor to GERD, but the proportion of its contribution has declined steadily over the last 15 years (Figure 1.15) to around 29% in 2008, a figure well below the OECD average of 65%. The proportion of funding from abroad, the third most important contributor to GERD, increased sharply during the 1990s but then fell back and stabilised in the 2000s to a level close to the OECD average (Figure 1.16).

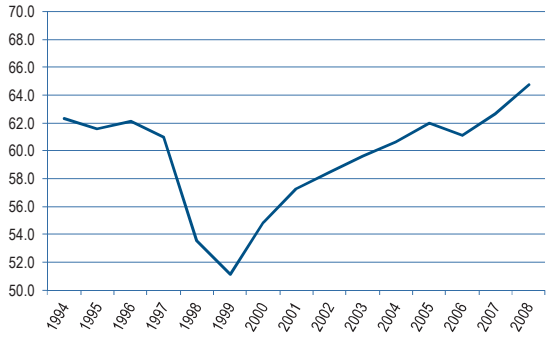
While source of funding is one useful way to analyse GERD, another is to examine the sectors in which R&D is actually performed. Although it is by far the largest funder of R&D, the government sector is not the main performer of R&D. The business sector carried out 63% of Russia's R&D in 2008. The government sector performed 30% of Russian GERD and higher education institutions around 7% (Figure 1.17).

Figure 1.13. R&D expenditure by source of financing in selected countries (2008)



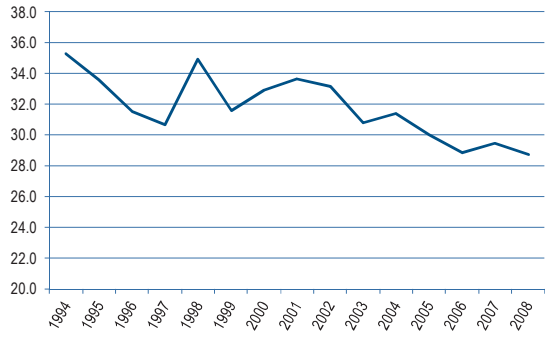
Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

Figure 1.14. Percentage of GERD financed by government



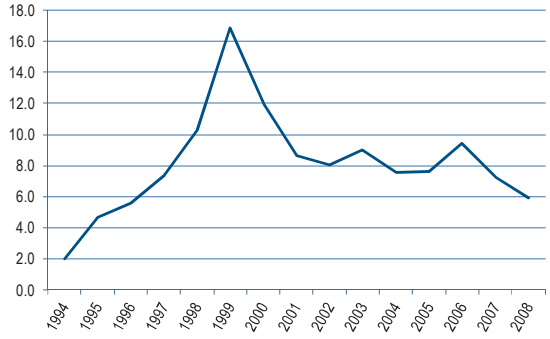
Source: OECD Main Science and Technology Indicators 2010/1.

Figure 1.15. Percentage of GERD financed by business



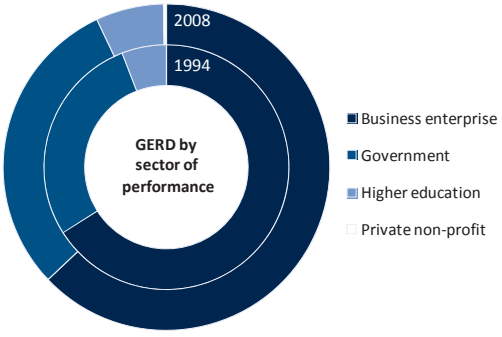
Source: OECD Main Science and Technology Indicators 2010/1.

Figure 1.16. Percentage of GERD financed from abroad



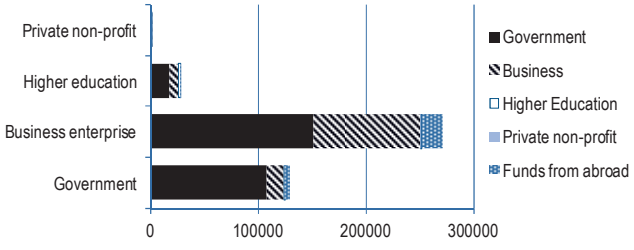
Source: OECD Main Science and Technology Indicators 2010/1.

Figure 1.17. GERD by sector of performance



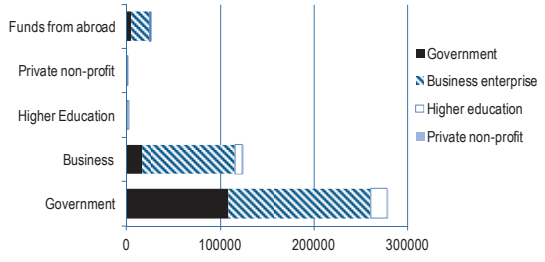
Source: OECD Main Science and Technology Indicators 2010/1.

Figure 1.18. Target sectors of R&D financing from different sources (million RUB), 2008



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.19. Sources of finance for R&D in different sectors of performance (million RUB), 2008



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

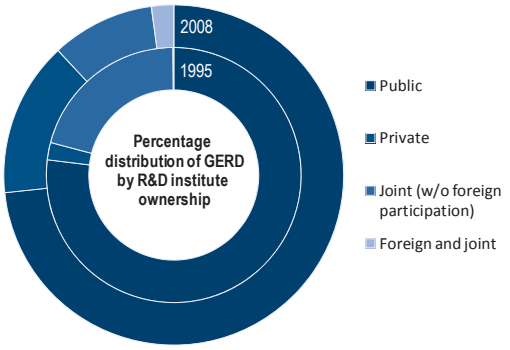
This unusual, almost inverse, relationship between R&D funding and performance is mostly accounted for by the large share of government funding spent in the business sector (Figure 1.18). In 2008, some 54% of government funding was spent in this way, while 39% went to the government sector and just 6% to higher education institutions. Unsurprisingly, the vast majority (80%) of the business sector's funding remained within the sector, while 13% went to the government sector and 7% to higher education institutions. Similarly, 76% of funds from abroad were spent in the business sector, 20% in the government sector and just 3% in higher education institutions.

Taking each of the main sectors in turn (Figure 1.19), in 2008, 56% of expenditure on R&D in the business enterprise sector (BERD) came from government sources, 37% from the business sector and 7% from abroad; 83% of government intramural expenditure on R&D (GOVERD) came from the government, 12% from business and 4% from abroad; and 62% of expenditure on R&D in the higher education sector (HERD) came from government sources, 29% from business, 6% from own resources and just 3% from abroad. In all three main performing sectors, the government is the largest funder of R&D.

The large contribution of government funding to BERD appears to be particularly anomalous when compared to the situation in OECD countries, where the vast majority of BERD is funded by the business sector. The explanation lies in the ownership of R&D institutes and assets. Public ownership extends to almost three-quarters of R&D institutes (Figure 1.20),[40] 86% of R&D machines and equipment (Figure 1.21) and 88% of R&D fixed assets (Figure 1.22). This is evidence that much of the R&D capacity in the Russian business sector is in fact publicly owned and still largely supported by direct government funding. This highly unusual arrangement – at least by OECD country standards – is a legacy of the Soviet science system and its relation to industrial production. During that period, R&D was organisationally segmented according to fundamental, applied and developmental research and was largely separate from production (the arrangements are discussed more fully in Chapter 2). More specifically, various research institutes – working on both fundamental and applied research – were (and remain) the main type of R&D performer. They were joined, along a projected linear path of development, by R&D-performing design organisations, construction project and exploration organisations, experimental enterprises, and industrial (production) enterprises.[41]

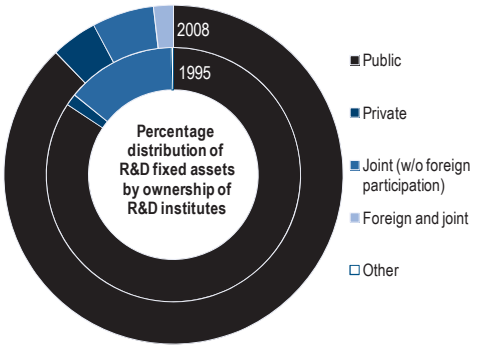
The proportions of the different types of R&D institutes have changed significantly since the Soviet era (Figure 1.23). In 1991, for example, there were 4 564 R&D institutes, of which 40% were research institutes (essentially institutes of the various academies of science and the so-called "branch" institutes of various government departments and agencies), 20% were design organisations, 12% construction project and exploration organisations, 10% higher education institutions and 9% industrial enterprises. The 1990s saw an overall decrease of 10% in the number of R&D institutes, but some types fared much worse than others. Those closer to the end of the "pipeline" decreased drastically: the number of design organisations decreased by two-thirds, construction project and exploration organisations by 85%, and industrial enterprise R&D institutes by almost one-third. As Figure 1.24 shows, much of the decline occurred during the chaos of the early transition years.

Figure 1.20. Percentage distribution of GERD by ownership of performing institutes



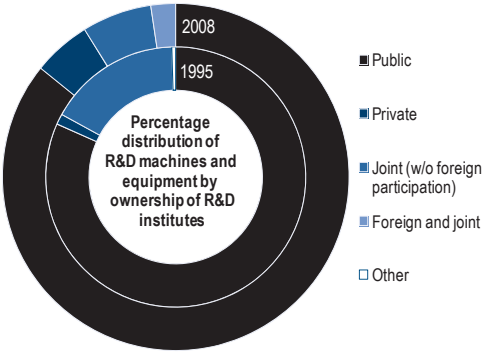
Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.21. Percentage distribution of R&D fixed assets by ownership of R&D institutes



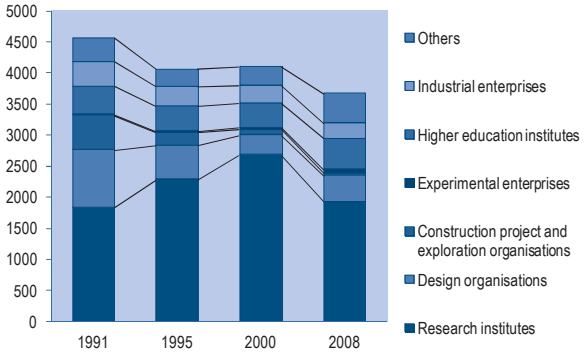
Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.22. Percentage distribution of R&D machines and equipment by ownership of R&D institutes



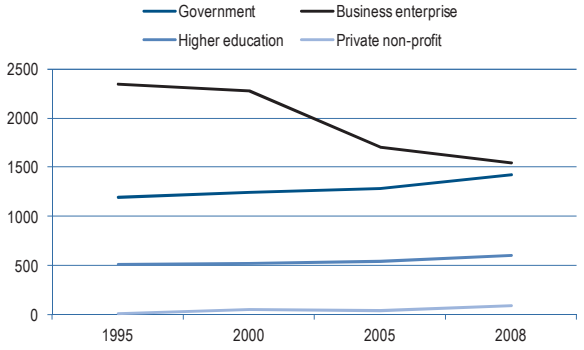
Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.23. Number of R&D institutes by type



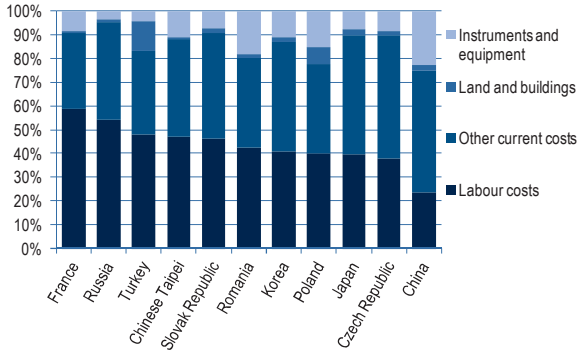
Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.24. Number of R&D institutes by sector of performance



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.25. GERD by type of costs in selected countries (2008 or nearest year)

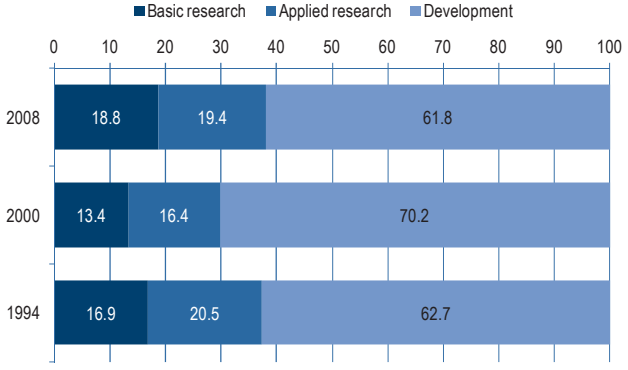


Source: OECD.Stat. *http://stats.oecd.org*

By contrast, the number of research institutes increased during the 1990s – by 47% – and constituted around two-thirds of all R&D institutes by the turn of the millennium. This was the result of the partial reorganisation and fragmentation of research institutes, particularly among the branch institutes. At the same time, the number of research institutes of the various academies of science remained relatively stable, owing to the academies' successful preservation strategies. However, over the 2000-08 period, the number of research institutes fell by 28% to account for just over half of all R&D institutes by 2008. Again, the number of research institutes of the various academies of science remained relatively stable. Much of the decrease can be ascribed to shrinkage and consolidation among branch institutes and the re-designation of several as design organisations, which explains the growth in number of the latter (Figure 1.24). The number of industrial enterprise R&D institutes has continued to decrease, though at a slower rate than in the 1990s; they represented 7% of the total in 2008. The number of higher education institutions engaging in R&D increased by 29% over the period to more than 500 in 2008, for 14% of the total.

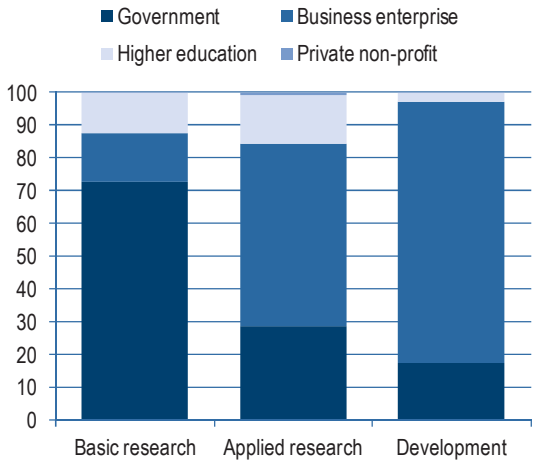
In 2008, more than half of Russian GERD went towards paying direct labour costs and another 40% to other current costs (Figure 1.25). Just 3.4% was invested in instruments and equipment, the lowest level among the selection of countries shown in Figure 1.25.[42] These figures are indicative of a general lack of investment in R&D infrastructure over the last couple of decades; equipment has consequently become worn out and/or obsolete. As Chapter 3 points out, the government is currently seeking to rectify this long-standing neglect of spending on infrastructure but has a long way to go to modernise its thousands of facilities.

Figure 1.26. Percentage distribution of intramural current expenditure on R&D by type of activity



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.27. Percentage distribution of intramural current expenditure on R&D by type of activity and sector of performance (2008)



Source: CSRS (2010), *Russian Science and Technology at a Glance*, Centre for Science Research and Statistics, Moscow.

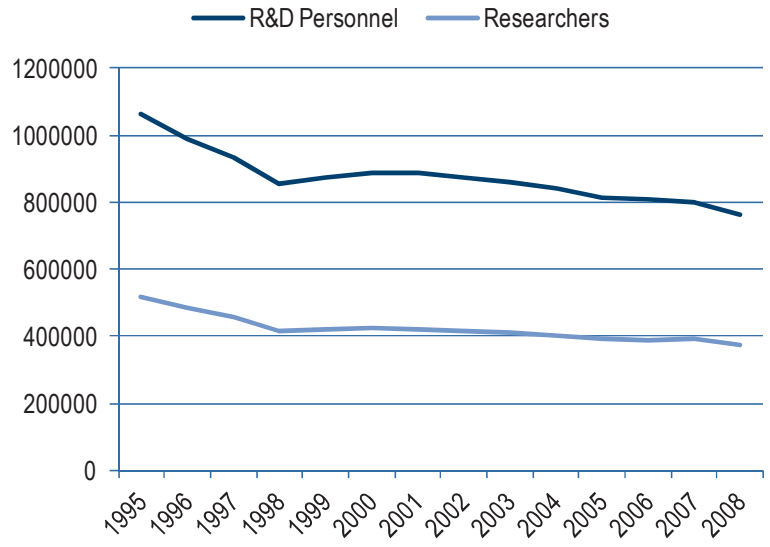
The proportion of GERD going to basic research, applied research and experimental development is broadly similar to the ratios in many large OECD countries. The proportions have fluctuated slightly over the last 15 years or so, with a relative decline in basic research during the 1990s when many R&D institutes sought to compete in more near-market development activities (Figure 1.26). The proportion of basic research

funding has since recovered and currently stands at around 19% of GERD, more than 70% is carried out in the government sector, mostly by the various academies of science (Figure 1.27). It is noteworthy that the business sector is responsible for a larger share of basic research (15%) than the higher education sector (12%), owing to the still weak role of the latter as research performer. As expected, the business sector is by far the largest performer of applied research and development – much of which is carried out in the branch institutes and design bureaus – but the government sector is also a major performer of these types of R&D.

1.6.2. R&D personnel

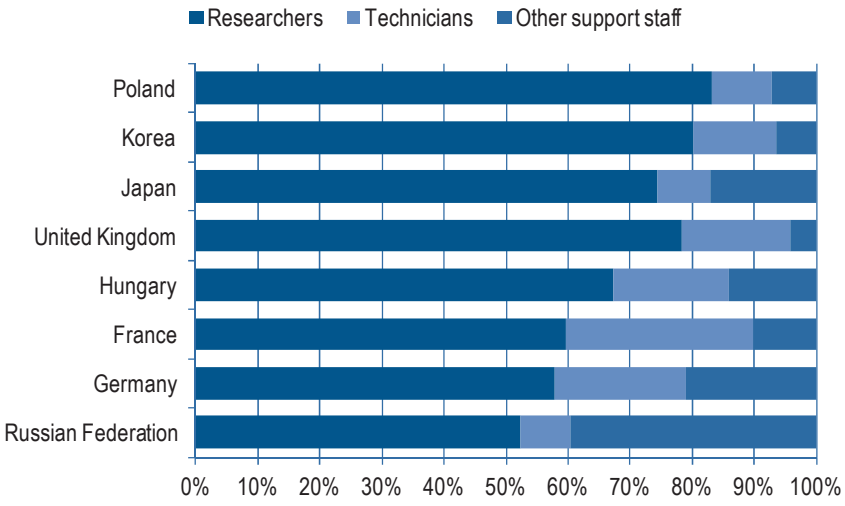
Perhaps more than changes in the number and sectoral distribution of R&D institutes, changes in R&D personnel provide a dynamic picture of the scale and nature of R&D activity. As Figure 1.28 shows, the number of R&D personnel has continued to decline, to 761 252 in 2008. Of these, around one-half were researchers. Figure 1.29 shows this to be a rather low proportion by international standards. Moreover, the proportion of support staff, at almost 40% of total R&D personnel, is much higher than in other countries. The reasons for this are not altogether clear but it is suggestive of a system laden with too many administrators. Russia had 6.4 researchers per thousand total employment in 2008, close to an OECD average of 7.6 and higher than several countries that spend significantly more of their GDP on R&D, *e.g.* the Netherlands and Switzerland (Figure 1.30). This finding can be interpreted in various ways, but a likely explanation is that many R&D personnel in Russia remain under-utilised.

Figure 1.28. Total R&D personnel (headcount)



Source: HSE (2010) *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.29. R&D personnel by occupation in selected countries (percentage)



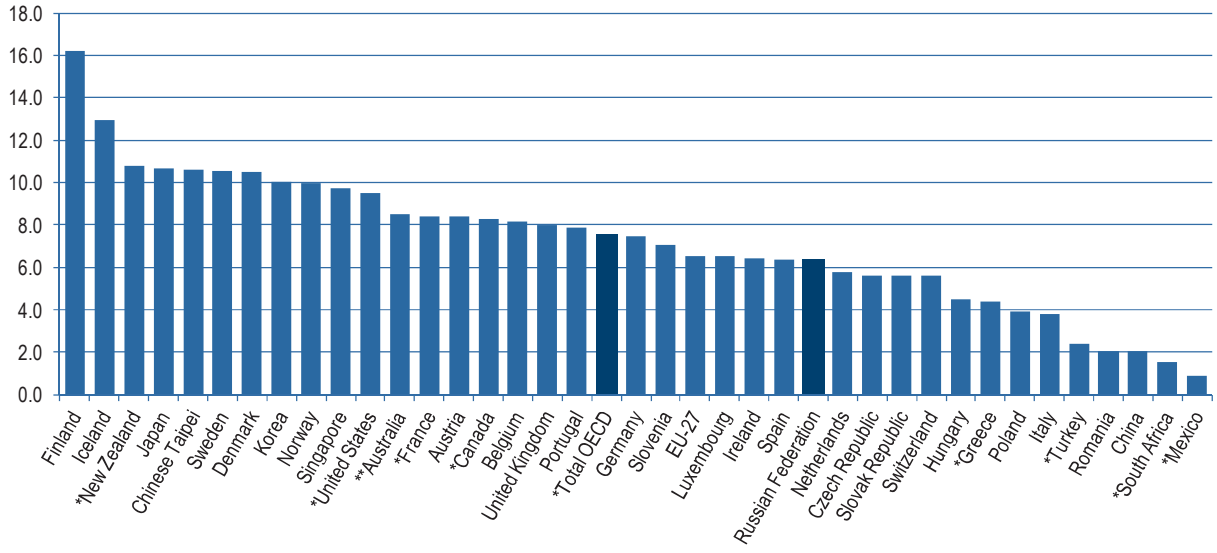
Note: 2008 data for France, Germany, Japan and Korea; 2009 data for the Russian Federation, Hungary and Poland; 2010 data for the United Kingdom.

Source: OECD MSTI 2010/1.

The distribution of R&D personnel across sectors of performance broadly aligns with the distribution of R&D expenditures by sector, though the data show some shift over the last 15 years or so (Figure 1.31). The proportion of R&D personnel in the business sector declined by almost 10% to 59% of the total in 2008, while those in the government sector grew by almost the same amount to 34% of the total. This reflects the relative decline of the branch and other business-oriented R&D institutes, as noted above. The proportion of R&D personnel employed in the higher education sector remains small by OECD standards at just 6.3% in 2008, though this represents an increase from 4.9% in 1995, owing to the government's recent attempts to strengthen the R&D capabilities of universities.

Similarly, the distribution of R&D personnel by ownership of R&D institutes is broadly aligned with the distribution of R&D expenditures by ownership (Figure 1.32). The only important shift over the last 15 years or so has been the decline in the proportion of R&D personnel employed in joint public-private institutes as a result of full privatisation. Nevertheless, at a little under 10% of the total, the private sector remained a relatively minor employer of R&D personnel in 2008.

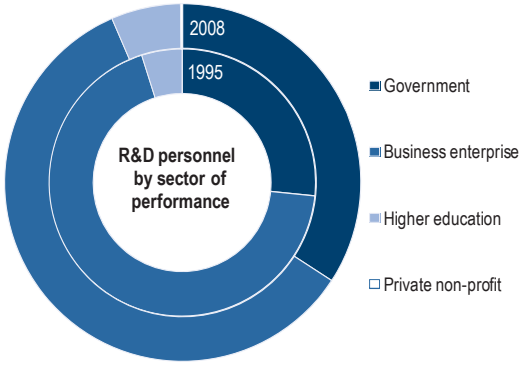
Figure 1.30. Total researchers (full-time equivalent) per thousand total employment in selected economies (2008)



*2007 data. **2006 data.

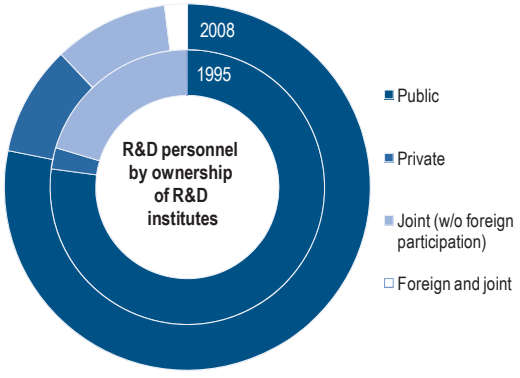
Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

Figure 1.31. R&D personnel by sector of performance



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

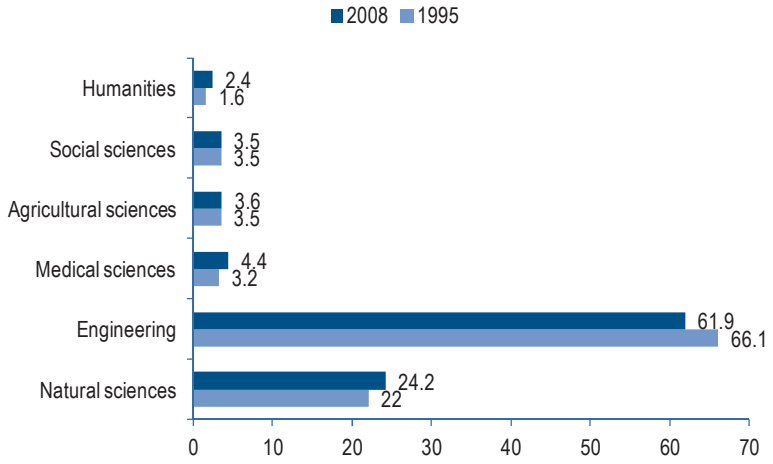
Figure 1.32. R&D personnel by ownership of R&D institutes



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

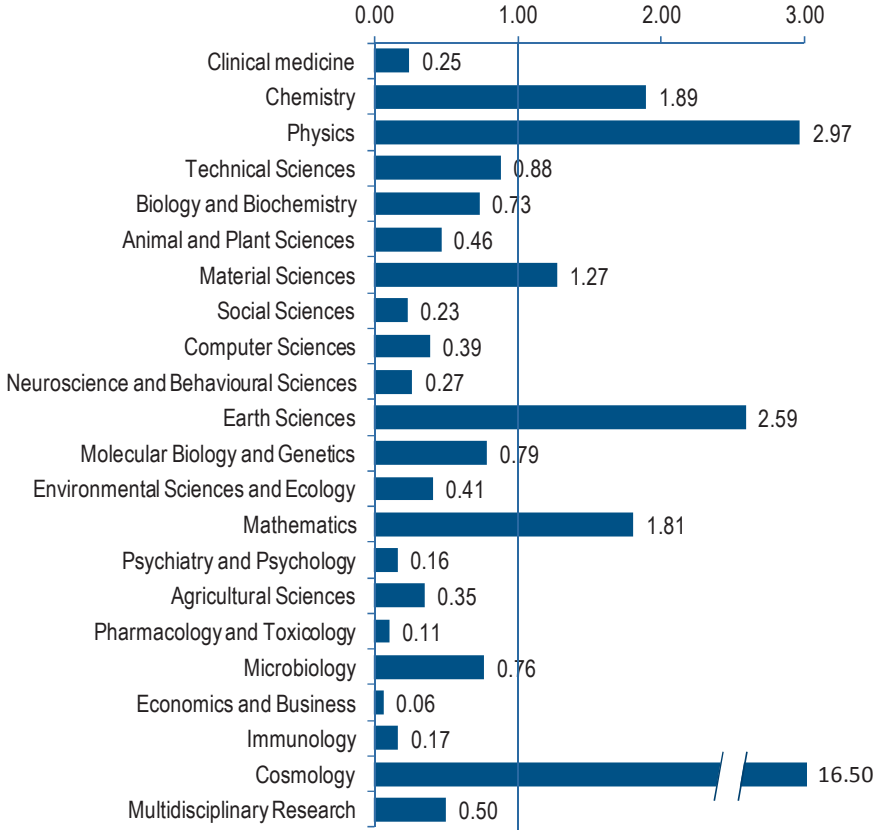
Around 62% of researchers in Russia worked in the engineering field in 2008, a slight drop since 1995 (Figure 1.33) on account of the relative decline of the industrial R&D institutes. Natural sciences account for about one-quarter of researchers, owing to a slight increase over the last 15 years. The dominance of engineering reflects the specialisation of the Russian economy and the Soviet legacy of a research system geared to the needs of the military-industrial complex. Scientific publication data by disciplinary field confirm a strong bias towards the physical sciences (physics, chemistry and Earth sciences) and mathematics and a relatively weak presence in biological, medical and social sciences (Figure 1.34).

Figure 1.33. Percentage of researchers by fields of study



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Figure 1.34. Research specialisation index

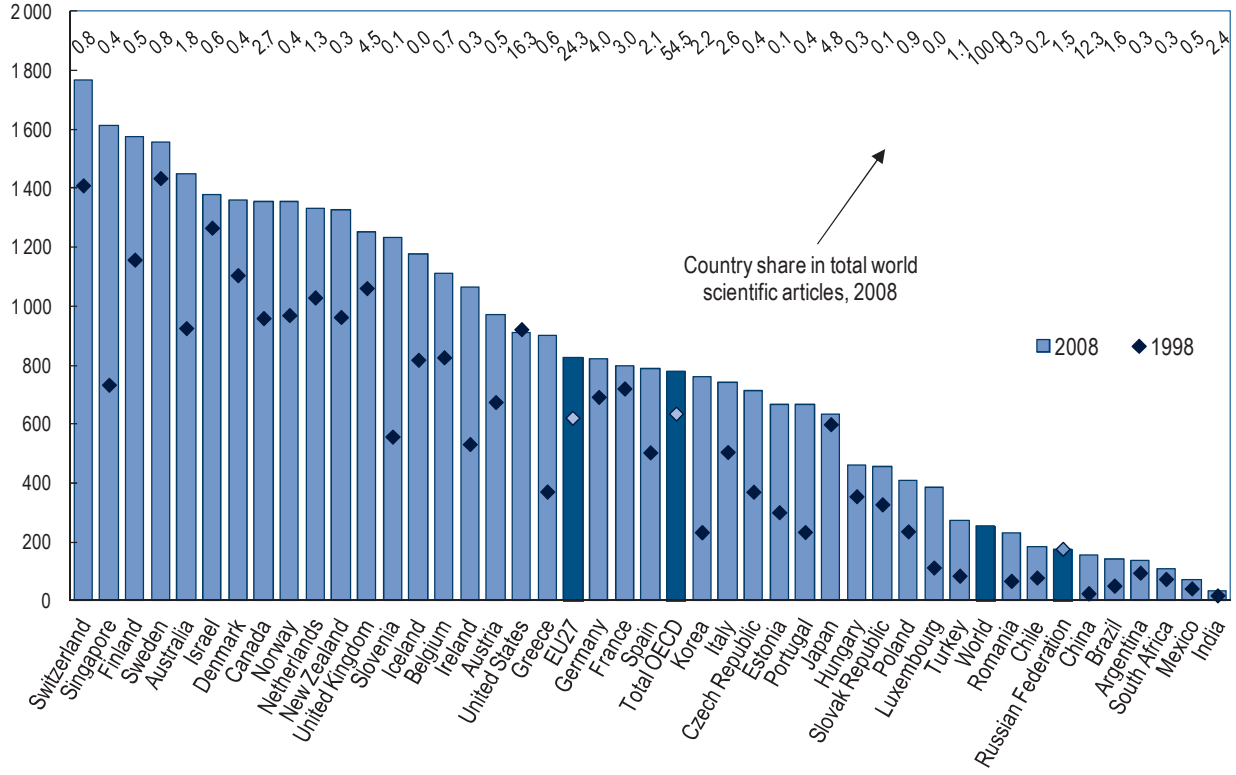


Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

1.6.3. Indicators of science, technology and innovation outputs

The outputs of science, technology and innovation activities are multiple and often difficult to capture quantitatively. A couple of commonly used, although limited, indicators focus on outputs of scientific articles and patents. Figure 1.35 shows that Russia published 176 articles per million population in 2008, a very slight increase on its 174 articles per million population in 1998. This figure is rather low by OECD standards and amounts to just 1.5% of world scientific articles. It also represents a relative decline. Figure 1.36 shows that the number of articles published by Russian researchers has stagnated over the last decade while almost all major scientific publishing countries have seen some, often significant, increases. The figure also shows that Russian researchers are less strongly networked internationally than their counterparts in most other countries, although the situation seems to have improved over the last decade.

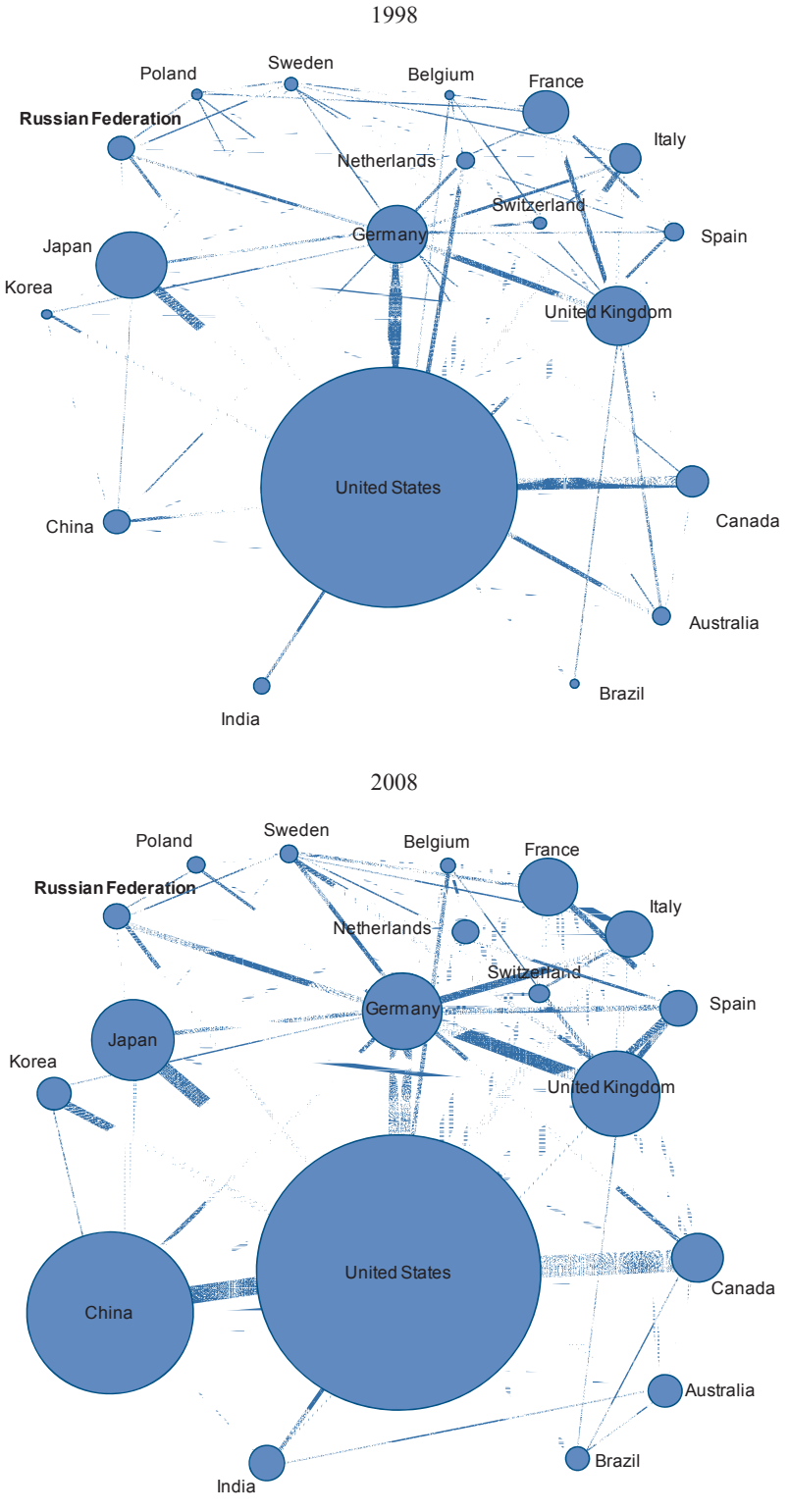
Figure 1.35. Number of scientific articles per million population for selected countries



Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

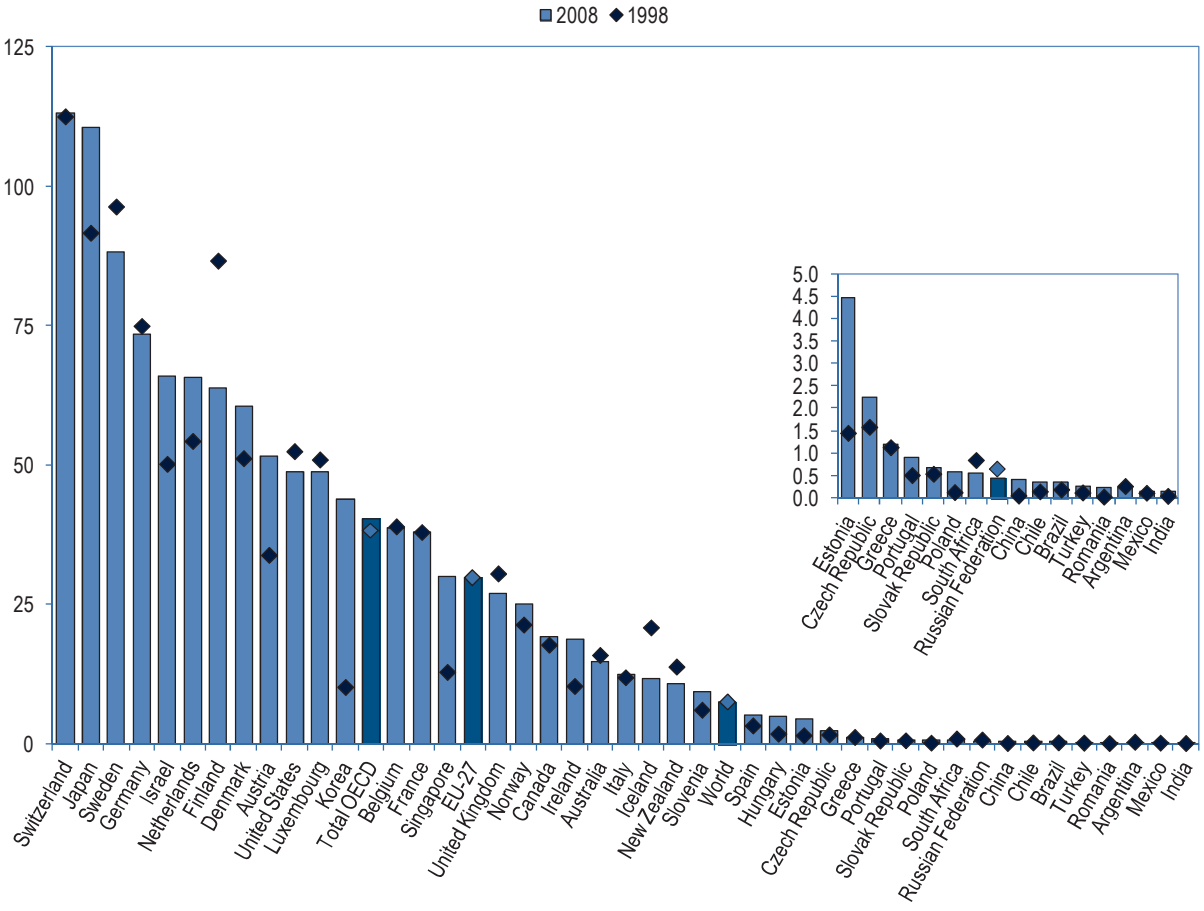
In terms of patents, the other commonly used indicator of STI outputs, the number of triadic patent families per million population is very small and has decreased over the last decade (Figure 1.37) to 0.45 in 2008, down from 0.65 in 1998. The OECD average in 2008 was 40.22. While this indicator has some well-known biases which are unfavourable to Russia, it nevertheless points to the country's generally weak innovation performance.

Figure 1.36. Scientific publications and co-authored articles, 1998 and 2008



Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

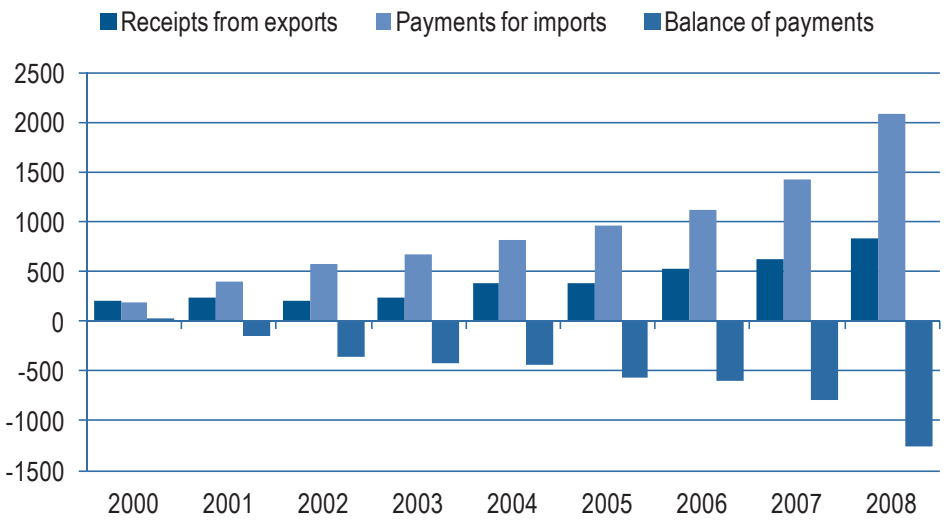
Figure 1.37. Triadic patent families per million population



Source: OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD, Paris.

Technology balance of payments (TBP) data, which register the international flow of industrial property and know-how (*e.g.* through patent purchases and licensing, trademarks, technical services, etc.), show a rapid increase in payments and receipts in recent years, an indication of the growing internationalisation of Russian industry (Figure 1.38). Russia runs a sizeable TBP deficit with the rest of the world and payments were about 2.5 times receipts in 2008 (Table 1.5). Engineering services are the most traded, representing 59% of receipts and 55% of payments and accounting for 53% of the TBP deficit. Transactions involving trademarks represented 19% of payments in 2008 and accounted for 31% of the TBP deficit. Figure 1.39 shows that almost 80% of payments were made to OECD countries. By contrast, OECD countries accounted for just over 40% of receipts, with the majority coming from other CIS and middle-income/emerging economies. This would seem to confirm Russia's intermediate technological position: most of its technology imports arrive from more technologically advanced countries and most of its technology exports go to those that are less technologically advanced. The main exception is R&D, which represented 18% of receipts and ran a surplus of more than USD 120 million in 2008 as a result of the off-shoring of R&D services to Russia by multinational enterprises. It indicates Russia's strong comparative advantage in R&D.

Figure 1.38. Technology balance of payments



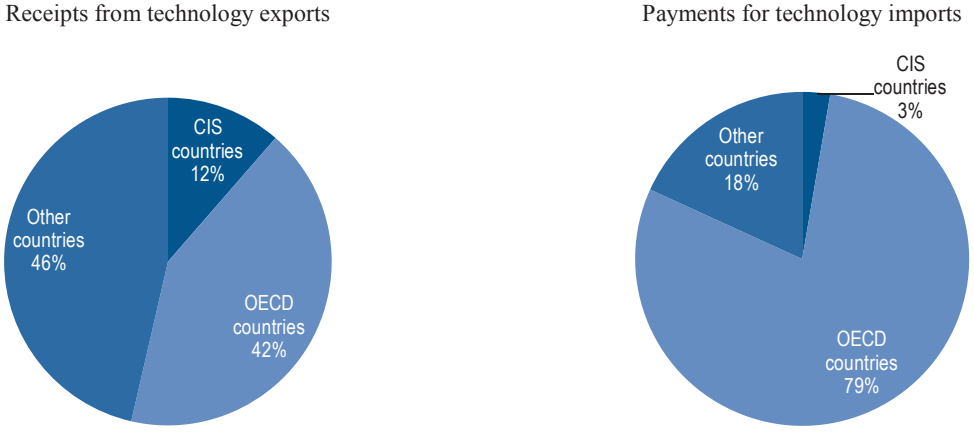
Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

Table 1.5. Technology balance of payments by category of contracts, 2008 (million USD)

Category of contract	Receipts from exports	Payments for imports	Balance of payments
Patents	0.1	10.7	-10.6
Non-patent inventions	–	0.02	-0.02
Patent licences	5.2	63.0	-57.9
Utility models	3.8	0.7	3.1
Know-how	9.7	43.3	-33.6
Trademarks	17.7	408.3	-390.7
Industrial designs	3.8	–	3.8
Engineering services	491.7	1156.8	-665.2
R&D	151.5	31.0	120.4
Others	149.8	373.1	-223.3
Total	**833.2**	**2087.1**	**-1253.9**

Source: CSRS (2010), *Russian Science and Technology at a Glance*, Centre for Science Research and Statistics, Moscow.

Figure 1.39. Percentage distribution of technology exports and imports in Russia by country groups, 2008



Source: HSE (2010), *Science and Technology Indicators in the Russian Federation*, Higher School of Economics, Moscow.

1.6.4. The regional dimension of R&D

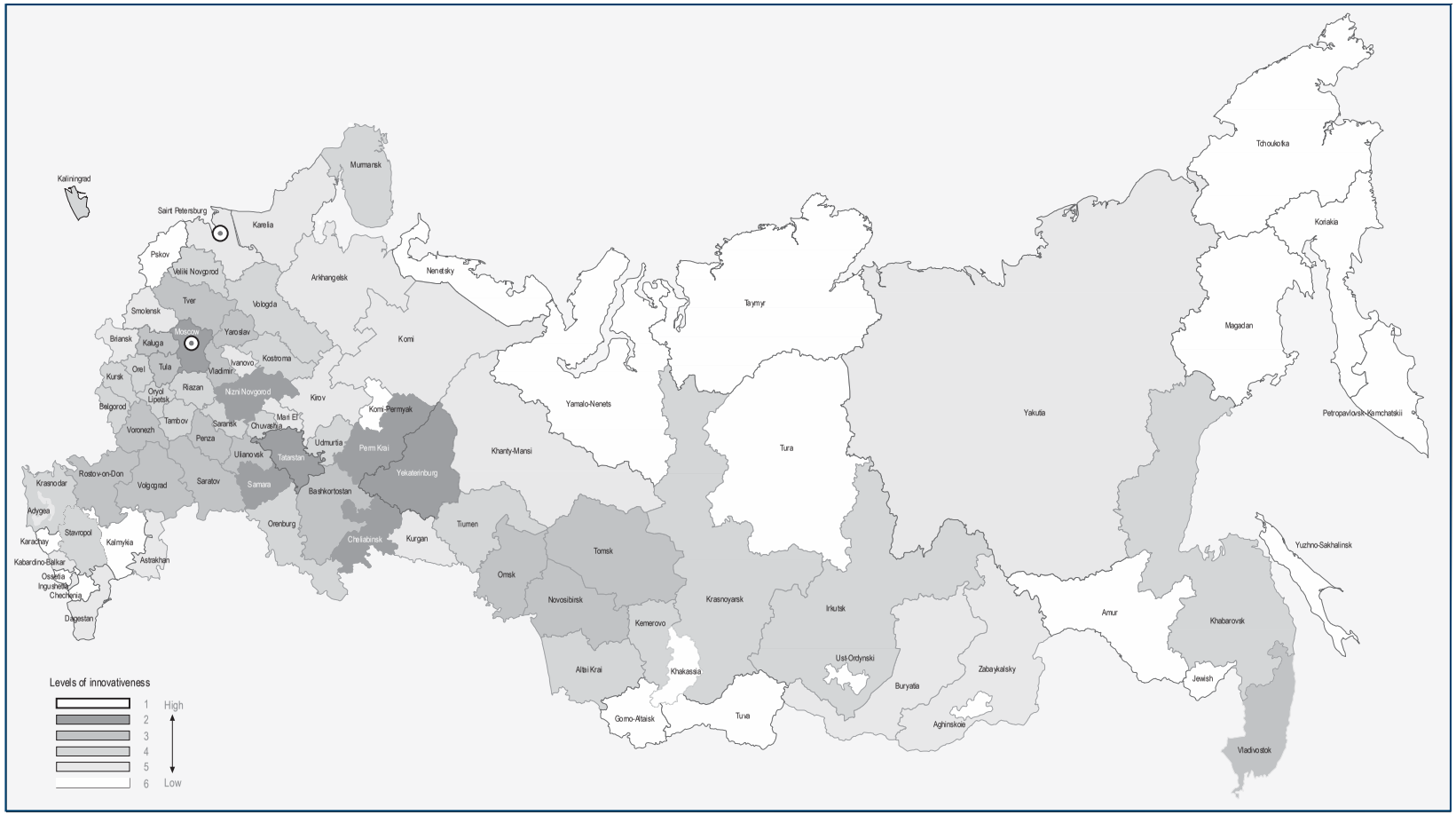
Russian innovation and research activities are geographically concentrated around the main population centres of Moscow, Saint Petersburg and the Volga District, which account for 57.4% of Russia's population and perform 82.3% of its GERD (Figure 1.40). The dominant position of the Central District, which includes Moscow, explains much of this disparity. This region alone accounts for more than half of Russia's GERD and R&D personnel and almost half of its patent applications. There are 208 R&D personnel per 10 000 population in this region, a much higher proportion than anywhere else, particularly in the less developed Southern and Far Eastern Districts, where proportions are less than one-fifth of that in the Central District. Figure 1.41 provides both a more aggregate and finer picture of innovation in the 80 regions of Russia using a composite 'innovation index'.[43]

Figure 1.40. Regional innovation statistics

Federal districts	Higher education				R&D				Patents
	Population (% of total, 2002)	Enrolments (thousands, 2008-09)	Graduates (thousands, 2008)	Enrolments in doctoral studies (2008)	Number of R&D institutions (2008)	R&D personnel (2008)	R&D personnel per 10 000 employment (2008)	Gross domestic R&D expenditures (million roubles, 2008)	N° of applications by residents (2008)
1. Central	26.2	2 380	432	1 486	1 445	396 272	208	238 762	13 377
(of which Moscow)	*n.a.*	*(1 313)*	*(243)*	*(996)*	*(787)*	*(246 612)*	*(n.a.)*	*(165 775)*	*(8 700)*
2. North-Western	9.7	761	139	669	533	99 556	146	58 586	2 420
(of which St. Petersburg)	*n.a.*	*(459)*	*(85)*	*(595)*	*(361)*	*(81 654)*	*(n.a.)*	*(48 686)*	*(1 895)*
3. Southern	15.7	993	187	506	321	33 633	36	13 582	2 904
4. Volga	21.5	1 488	271	666	549	120 644	82	57 149	4 279
5. Ural	8.6	622	107	199	220	43 695	72	24 654	1 537
6. Siberian	13.7	953	168	625	429	53 956	59	28 690	2 647
7. Far-Eastern	4.6	316	55	91	169	13 496	41	9 650	539
Total Russia	100.0	7 513	1 359	4 242	3 666	761252	n.a.	431 073	27 712

Source: CSRS (2010), *Russian Science and Technology at a Glance*, Centre for Science Research and Statistics, Moscow.

Figure 1.41. Levels of innovativeness of the regions of the Russian Federation



Source: Ministry of Education and Science of the Russian Federation (2009), "Background Report prepared for the OECD Review of the Russian Innovation System and Policy", Moscow.

1.7. Conclusion

Over the past two decades, Russia has made significant progress along various dimensions of socio-economic development. Most importantly, it has succeeded in making the transition towards a market-based economy and has made important progress in managing and stabilising the macroeconomy. In the years before the recent economic crisis, Russia enjoyed high and sustained growth. The recession that followed has exposed the weaknesses of Russia's growth model – notably its continued dependence on natural resources – and the need to shift towards a more innovation-driven growth trajectory. Important shortcomings need to be addressed if Russia wants to effect such a transition. These shortcomings include, among others, exceptions to the rule of law, corruption, overly restrictive regulations, a lack of competition in many parts of the economy, underdeveloped supporting institutions, for example for financing innovation. Taken together, adverse framework conditions create an environment in which incentive structures do not encourage long-term and inherently risky productive activities such as business investment in R&D and innovation.

Although the country has a substantial science base and a well developed education system in science and technology, indicators of actual innovation activity indicate modest performance. Russia performs best on international comparative innovation indices when they are weighted towards inputs into R&D; it performs less well on indices that emphasise revealed technical achievement; and it ranks worst of all on indices emphasising economic incentives.[44] Overall, there is an imbalance between the public resources devoted to knowledge creation and outputs in terms of innovation. Closing this gap constitutes one of the primary challenges for Russian innovation policy. The other is to stimulate greater private-sector involvement in R&D.[45]

In this context, the emphasis on spurring innovation that has been evident in Russia over the last couple of years is to be welcomed. The country's innovation potential is unusually great for a country at its level of per capita GDP but it needs to be developed to become a significant source of growth. Achieving this potential should undoubtedly be a major emphasis of government policy. Innovation can act as a driver of productivity and economic growth, and an improvement in Russia's innovation performance can also help to meet the need to diversify the structure of production and exports, the demographic challenges that confront the country, and the need for cleaner, more energy-efficient growth.

In order to boost innovation, the government will have to ensure macroeconomic stability and, more broadly, strengthen framework conditions for innovation through policies that facilitate innovation and enhance overall economic performance. Indeed, sound framework conditions should be seen as the *sine qua non* condition for success, since innovation promotion efforts will almost certainly fail if the overall business environment is not conducive to long-term investment in new activities. The potential gains from improvements in framework conditions appear to be high, exceeding those of most OECD countries.

At the same time, creating favourable framework conditions will not suffice to turn Russia into a leading innovator. There is a clear need and scope for policies to address market and systemic failures that hamper innovation. The following chapters – focusing on the main actors of the Russian innovation system, their interlinkages and the role of government in fostering innovation – will discuss, among others, current capabilities, policy orientations, and the mix of policies and instruments in place. They will shed light on areas in which specific innovation policy initiatives may be warranted and existing policy could be improved.

Notes

1. It is important to note that this partly reflected differences in the evolution of various price deflators: OECD (2009a) notes that investment grew by 12% a year in real terms from 1999 through 2008, far faster than GDP, but the relatively slow increase in the investment deflator compared to the deflators for other components of GDP (especially export prices) left the investment-to-GDP ratio little changed.
2. The forecasts included those of the OECD, the EBRD, the IMF, UBS, Citigroup, Renaissance Capital, Merrill Lynch, the Vienna Institute WIIW, HIS Global Insight, Troika Dialog, the Economist Intelligence Unit, Kopint-Tarki, UniCredit MIB, Dresdner Bank, Raffeisen Zentralbank, JP Morgan and Goldman Sachs; in December 2008, all but JP Morgan (with a 0.0 forecast) anticipated growth in 2009.
3. Measures aimed at bolstering trust in banks included raising deposit insurance ceilings, guaranteeing interbank loans to smaller banks and bringing several small banks into state ownership.
4. Such concerns are reinforced, among other things, by the presidential commission's consideration of mandatory R&D expenditure targets for state companies and its emphasis on further expansion of innovation infrastructure (more business incubators, more R&D centres, etc).
5. The data are available on the KOF (Swiss Economic Institute) Index of Globalization website: *http://globalization.kof.ethz.ch*. For a more detailed description, see Dreher *et al.* (2008).
6. It should be recognised however, that it is increasingly difficult to distinguish between "foreign" and "local" investment in the context of global capital markets and given the existence of Russia's large round-tripping flows (OECD, 2008a). Round-tripping refers to the channelling of funds abroad, with the purpose of subsequently returning them as FDI to the domestic economy (Filippov, 2008). Russian companies, seeking to circumvent domestic regulatory restrictions, often use offshore locations in Europe or other regions as a base for re-investment to Russia. The position of some major partner countries reflects their role as a source of round-tripping flows (OECD, 2008a).
7. Several studies have emphasised the positive impact of foreign-performed R&D and FDI on domestic total factor productivity (Guellec and van Pottelsberghe, 2001; EBRD, 2005; Hemmings, 2005), and FDI restrictions are found to have a negative impact on patenting (OECD, 2006b). See also the survey on FDI spillovers by Crespo and Fontoura (2007).
8. Values of the RCA index above 1 indicate a comparative advantage, values below 1 a comparative disadvantage. When the RCA index is above 1 the country is said to be specialised in the industry concerned.
9. For example, improved patent protection only works in the official economy. While strengthening such protection may, at the margin, increase incentives for firms to operate in the formal sector, it is likely to achieve little if the state is otherwise acting in ways that encourage businesses to retreat into the shadow economy. Likewise, the impact of policies aimed at assisting innovation-oriented start-ups will depend in part on the conditions for establishing new businesses in any sphere.
10. As noted by the World Bank (2011a), the Doing Business methodology has some limitations. Among others, these are the scope of factors that are important to business and covered in the survey. For reasons of international comparability, the indicators refer to a specific type of business, generally a local limited liability company operating in the largest business city.
11. The degree of concentration usually serves as a proxy for competition. See Nickell (1996) and Blundell *et al.* (1999).

12. Interestingly, the survey also highlights huge variance in firm productivity. This gap reflects in particular different attitudes towards innovation and the restructuring of production.

13. Import-competing industries are defined as industries in which the share of imports exceeds 30%.

14. Calculated on the basis of 119 markets, for which data from Rosstat are available for both 2001 and 2007. Concentration ratios are calculated using the HHI and CR3 methodologies. A highly concentrated industry is defined as one in which the Herfindahl-Hirschmann Index (HHI) is greater than 2000.

15. See CEFIR (2007) for details of the sixth round of the joint World Bank/CEFIR monitoring of the administrative burden on small business.

16. Discriminatory procedures for procurement/tenders are especially common. Given the potential role of public procurement in stimulating demand for innovation, this must be viewed as a problem.

17. Russia is hardly unique in this respect: Jaumotte and Pain (2005a) confirm the adverse effect of rigid regulations on business sector R&D expenditure and on the level of patenting in OECD countries.

18. This section was prepared in consultation with the OECD Trade and Agriculture Directorate.

19. More information on the structure and function of Rospatent can be found at (as of 21 March 2011): *www1.fips.ru/wps/wcm/connect/content_en/en/about_rospatent/*.

20. These include the Berne Convention and the Geneva Convention in 1995, the Madrid Protocol in 1997, the Trademark Law Treaty in 1998 and the Rome Convention in 2003. In February 2009, Russian membership in the so called WIPO Internet Treaties, the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty, which a number of OECD members have ratified, entered into force. Russia also ratified the Singapore Treaty on the Law of Trademarks in 2009.

21. However, implementation of some of the commitments has been slow, and discussions between the US and Russian governments to ensure the full implementation of this agreement are still under way.

22. Estimates put the piracy rate in business software in Russia at 73% in 2007 (BSA, 2007).

23. These include: a law on data exclusivity to bring domestic legislation in line with international practice under the WTO TRIPS Agreement concerning the protection of pharmaceutical data; a law on business licences establishing the right of ownership over optical disc manufacturing equipment, which makes it possible for a court decision to revoke such a licence; amendments to Part IV of the Civil Code to bring it into conformity with the TRIPS Agreement and the Singapore Treaty, which for example addresses an issue relating to registered domain names blocking registration of trademarks; and amendments to the Customs Code providing *ex officio* authority to the customs.

24. Part IV of the Civil Code has a number of deficiencies which may hamper the ability of enterprises to protect trademarks even on paper. These deficiencies may have also enabled various forms of registration piracy. Amendments to the legislation on trademarks remain necessary to bring Russia into conformity with the TRIPS Agreement and the Singapore Treaty. These amendments include both those already proposed and in the legislative process and those suggested by international organisations.

25. It is worth noting that this was one of the priority tasks set out in the programme of Russia's first post-Soviet government in 1992.

26. For recent discussions of this issue, and Russia's limited progress in moving away from resource-dependent growth, see OECD (2006a, 2009a) and Kuboniwa (2009).

27. In fact, the overall capacity utilisation rate is almost certainly higher, perhaps by as much as 20 percentage points (OECD, 2006a; Åslund *et al*., 2010), than that usually presented (*e.g.* OECD, 2009a), as enterprises in many sectors retain on their books fixed assets inherited from the Soviet era that it will probably never again be profitable to employ.

28. See the classic statement of the resource curse hypothesis by Sachs and Warner (2001); on the paradox of plenty, see Karl (1999).

29. For an overview of these explanations, with particular emphasis on the issue of weak financial markets, see Hausmann and Rigobon (2003).

30. Oil and gas revenues include the natural resource extraction tax and export duties for oil, oil products and natural gas, as well as corporate income taxes, value added tax (VAT), excise fees and other charges paid by companies in the sector.

31. Baffes and Haniotis (2010) estimate that international energy prices in early 2010 were somewhat more than 250% of the levels in 2000, despite the impact of the global downturn.

32. Birth rates have been somewhat more volatile and have attracted far more attention in public discussions. However, birth rates are extremely sensitive to cohort effects; it is the total fertility ratio that really matters.

33. The population is ageing, which implies, *ceteris paribus*, a rise in the mortality rates.

34. Even on the "high-growth" scenario, the natural rate of change (via births and deaths) is expected to remain negative; it is higher immigration that might allow for overall population growth.

35. Healthy life expectancy for Russian women is actually *lower* at age 65 than it is for men, even though their life expectancy at that age is almost four years longer.

36. Although life expectancy at birth is much lower in Russia than in most European countries, this reflects higher mortality rates in every decade of life. The gap thus shrinks with age, and life expectancy at retirement is not much lower than in central Europe.

37. Phasing out implicit energy subsidies is a only a first, albeit critical, step; there may still be scope for interventions to tackle environmental externalities associated with industrial production directly.

38. Such high ratios of energy consumption to output are also in part the product of factors such as geography, climate and the structure of industrial production. These factors were compounded by the sharp drop in GDP during the 1990s: output fell far faster than energy consumption. Consequently, the growth of recent years has tended to reduce the energy intensity of GDP.

39. The OECD average of 2.33% is pulled up by the high R&D intensities of the few top countries; many countries have intensities below the OECD average. The median R&D intensity for OECD countries is approximately 1.76% of GDP (a value between that of the Netherlands and the United Kingdom).

40. This proportion has changed little since the mid-1990s, although the proportion of wholly privately owned R&D institutes has increased from around 2% of the total in 1995 to around 15% in 2008. This is on account of the full privatisation of around half of the R&D institutes that were still jointly owned by the public and private sectors in 1995 (Figure 1.20).

41. Unlike in many OECD countries, higher education institutions performed little R&D and focused mostly on education.

42. The level of GERD invested in instruments and equipment by many other former communist countries, perhaps benefiting from EC funds, is considerably higher, *e.g.* Slovak Republic, 7.3%; Romania, 18.2%; Poland, 15.3%; and Czech Republic, 8.7%.

The level of GERD invested in instruments and equipment by China in 2007 was higher still, at 22.8% (Figure 1.25).

43. The innovation index was compiled by the Center for Strategic Research "North-West" and reported in the background report prepared in support of this review. It is a composite index combining indicators of human resources for science and technology, new knowledge creation, knowledge diffusion and application, and marketing of innovative products.

44. This observation is borne out by a comparison of different innovation indices in the annex to World Bank (2006) and by the findings of the Executive Opinion Survey reported in WEF (2009). Russia scores well on indicators of innovation potential (R&D spending, quality and quantity of research institutions) but rather less well on indicators of outcomes. The World Economic Forum (WEF, 2010), using the Global Competitiveness Index (GCI), ranked Russia 63rd among 139 countries. Russia occupies rank 69 for its technological readiness and 57 for innovation. The Global Competitiveness Index used by the World Economic Forum (*www.weforum.org*) attempts to provide an overview of factors considered as critical drivers of productivity and competitiveness (institutions, infra-structure, macroeconomy, health and primary education, higher education and training, market efficiency, technological readiness, business sophistication, innovation).

45. There would appear to be potential spillovers with respect to human capital accumulation, since incentives to train workers and incentives to innovate are related. Enterprise surveys suggest that innovative firms train workers more than non-innovators (Goldberg, 2006).

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