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Bridging the Innovation Gap in Russia

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Bridging the Innovation Gap in Russia

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

Government officials, scientists and business people from Russia and several OECD Member and observer countries – Canada, France, Germany, the United Kingdom, Hungary, Italy, Korea, the United States and Israel – as well as from countries of the Newly Independent States (NIS), met in Helsinki on 1-2 March 2001 to examine the climate for innovation in Russia and discuss what lessons can be drawn from the institutional reforms and recent policy initiatives in OECD countries to enhance the contribution of science and technology to innovation and growth.

The Helsinki Seminar on Innovation Policy and the Valorisation of Science and Technology in Russia was co-organised under the auspices of the OECD Working Group on Innovation and Technology Policy, together with the Ministry of Trade and Industry of Finland, the United States Civilian R&D Foundation and INTAS (International Association for the Promotion of Co-operation with Scientists from the New Independent States of the former Soviet Union), in Co-operation with Ministry of Industry, Science and Technologies of the Russian Federation (MinIST). The Seminar, which was chaired by Irina Osokina, Vice-Minister of the Russian Ministry of Industry, Science and Technologies, and Reijo Vihko, President of the Academy of Finland, follows on long-standing co-operation in science and technology between the OECD and the Russian Federation and is part of the programme of co-operation between the OECD and Russia, managed by the CCNM.

This publication contains a summary report of the presentations and discussions held at the Seminar. It has been prepared by the Rapporteurs, Jack Martens, a consultant based in the United States, and Alexander Dynkin, Deputy Director of the Institute of World Economy and International Relations (IMEMO) in Moscow. It also includes a background document prepared by the Russian Ministry of Industry, Science and Technologies on the role of the state in creating a favourable environment for innovation. The reports show that, in spite of considerable achievements in the recent past in building the groundwork for Russia's innovation system, the innovation climate still needs drastic improvements. Comprehensive institutional reforms are required, including in areas outside the remit of policy makers in technology and

innovation. A lot can be learned, in that respect, from the experience of other countries.

The opinions expressed in this publication do not necessarily reflect the official views of the OECD or of the co-organisers. This publication is published in English and Russian on the responsibility of the Secretary-General of the OECD and the co-sponsors of the Seminar.

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INTRODUCTION

Russia's science and engineering community has experienced considerable economic upheaval following the shift to a market-based economic system. The profound transformation shocks of the 1990s have brought the market equilibrium to a very low level, one that does not correspond to Russia's accumulated intellectual capital, manpower resources or fixed assets. The major target for Russia's S&T officials is to support policies that increase the demand for innovations and that help match this increased demand with supply from domestic sources.

The joint Seminar on Innovation Policy and the Valorisation of Science and Technology in Russia brought together officials from governments and international organisations, members of the business community and academics from Russia, Ukraine, Eastern Europe and developed industrial countries to discuss the major challenges facing Russia's national innovation system. The discussions reviewed a wide range of topics, including the experience of OECD countries in adapting their policy frameworks to encourage innovation, and specific problems related to business practices, intellectual property rights and human resource policies.

A number of presentations pointed to the fact that the Russian innovation system is developing in a piecemeal fashion. Russia's emerging private sector remains insufficiently connected to the main performers of public R&D, and the country continues to suffer from institutional rigidities as well as inefficient and distorted patterns of R&D funding. The traditional manufacturing and natural resource-based industries have few incentives to invest in innovation and generate little domestic demand for Russia's emerging innovative firms, forcing them to rely primarily on export markets. Building the internal market for innovations will require comprehensive institutional reforms, in areas inside and outside the remit of policy makers in technology and innovation.

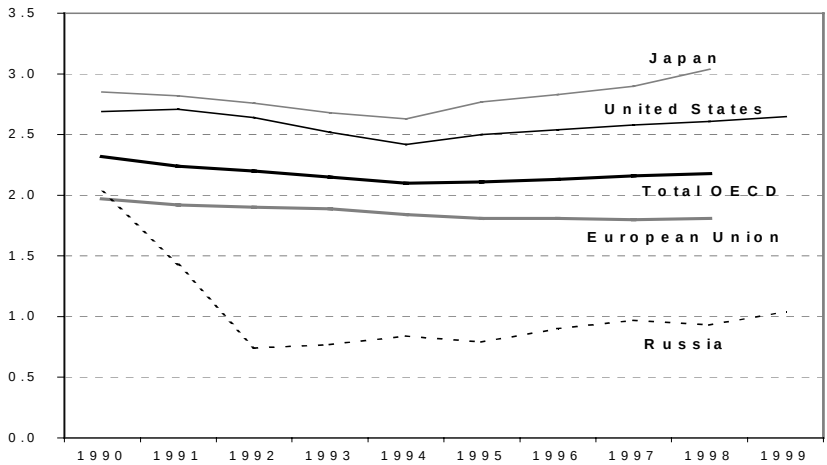
Presentations from representatives of the developed industrial countries revealed that these countries' national innovation systems are characterised by intensive and high-quality linkages among the public and private institutions involved in the generation, diffusion and exploitation of knowledge. Since innovation is essentially a market-driven process, such systems require economic, regulatory and financial conditions that provide market-efficient incentives to undertake knowledge transactions and innovate.

CURRENT STATUS OF RUSSIA'S INNOVATIVE ACTIVITY AND INNOVATION CLIMATE

The background report, "The Role of the State in Creating a Favourable Innovation Climate in Russia", presented by the Ministry of Industry, Science and Technologies of the Russian Federation (MinIST), outlined the current situation and explained the country's difficulties in developing a coherent innovation policy within the present macroeconomic conditions and existing legal and institutional framework. Participants generally agreed that the report provides an excellent analysis of the imperfections of Russia's national innovation system and identifies the key problem areas and bottlenecks.

Carefully drawing on recent statistical information, the background report noted that in 1998 only 6% of Russian enterprises were engaged in innovative activities. Most of this activity was in fact related to the purchase of domestically or CIS-produced equipment (48.1%), while actual R&D accounted for only 18.3%. Self-finance remains the source of most innovation-related expenditures. Russia's national gross expenditures for R&D (GERD) at the end of the 1990s represented only 1% of GDP (Figure 1). In spite of its declining role, the federal budget remains the major source of funding for R&D (53.6%) (Table 1).

Figure 1. **Global R&D expenditures as a percentage of GDP, 1990-99**



Source: Daniel Malkin (2001), "Science and Technology in Russia", *Economic Trends* (Helsinki, Finland), No. 1; data from OECD, MSTI and non-member S&T databases, 2001.

Table 1. **Global R&D expenditures, by main sources of funds, 1995 and 1999[1]**

As a percentage of total funds[2] (%)

	Industry funding		Government funding		Funding from abroad	
	1995	1999[1]	1995	1999[1]	1995	1999[1]
United States	60.4	66.8	35.6	29.2	-	-
Japan	72.3	72.6	20.9	19.3	0.1	0.3
Korea	76.3	72.5	19.0	22.9	0.0	0.1
Finland	59.5	63.9	35.1	30.0	4.5	5.1
France	48.3	50.3	41.9	40.2	8.0	7.9
Germany	61.1	63.5	36.8	33.8	1.8	2.3
United Kingdom	48.0	47.3	33.2	31.1	14.4	16.8
Russia	**33.6**	**34.9**	**61.5**	**53.6**	**4.6**	**10.3**
Total OECD	59.9	62.5	33.8	30.7	-	-
European Union	52.6	54.8	38.9	36.0	6.7	7.4

1. Or latest year available.
2. Remaining percentages to 100 include funds from other national sources (private non-profit and higher education sectors).
Source: Daniel Malkin (2001), "Science and Technology in Russia", *Economic Trends* (Helsinki, Finland), No. 1; data from OECD, MSTI and non-member S&T databases, 2001.

This situation is in stark contrast with the prevailing tendency in most OECD countries – with the notable exception of some of the least advanced economies such as Mexico or Portugal. The business share of R&D financing remains insufficient (17.3%). Basic research funding has increased, but financing for applied research has declined. The unfavourable innovation climate in Russia cannot be viewed in isolation from the general problems affecting investment activity, the institutional and legal framework, the environment for competition, and the industrial structure which remains oriented towards natural resources.

Russian companies criticised the lack of equity capital, insufficient support by the state and high costs as the main factors hampering innovation (cited by 74% of firms). Healthier national financial institutions are required to improve this situation. The financial collapse of 1998 left Russia's banks very weak: only five banks have a capitalisation greater than USD 250 million, while 85% of all banks have less than USD 1 million. Banks remain net borrowers from the non-financial sector and act as creditors for non-residents. Institutional investors such as insurance companies and pension funds have little or no role in financing innovation. The stock market serves as a speculative instrument and

means of property redistribution rather than as a source of investments. The lack of transparency in property rights, including intellectual property and lack of risk insurance, also acts as a brake on investment in innovation.

The background report noted other ways in which Russia departs from the trends observed in many advanced OECD countries. For example, Russia's higher education sector makes only a minimal contribution to overall R&D performance. Furthermore, the patented technology dependency ratio (resident over non-resident patent applications) increased from 0.5% in 1992 to 2.18% in 1997.

In such an unfavourable macroeconomic and legal environment, the MinIST's policy efforts are directed towards the key issue of improving the national innovation system. The background report described an impressive set of new legislation and recent policy directives. It noted considerable achievements in building the groundwork for Russia's innovation system. Specifically, a system of State Science Centres has been set up; work is underway to create a series of Federal Science and Hi-tech Centres in strategic science and technology areas; a network of Innovative Technology Centres (ITC) has been established; and Innovative Production Complexes (IPC) are being set up. There is a Foundation for Small Business Support in Science and Technology, a Federal Foundation for Small Business Development and a system of extra-budgetary funds aimed at financing technological developments. The MinSTP has also initiated the creation of a new information system – a computerised information network that links the innovation centres and complexes, technology pools and innovation-oriented organisations in science, technology and production.

Despite these efforts, the background report concluded that Russia's innovation climate is in need of drastic reform. Guidelines for future policies are set out in Part II of the background report.

Mr. A. Bocharov (Deputy Head, Department of Innovation and Commercialisation of Technologies, MinIST, Russia) noted, in an oral follow-up to the background report, that recent institutional initiatives for supporting innovation, *i.e.* the Innovation-Technological Centres (ITC) and Innovation-Industrial Complexes (IIC), have targeted further development of the country's innovation capacity. The ITCs provide strong independent research centres, either industrial or academic, with the capacity to take ideas from research into production. There are currently 36 ITCs in Russia, 22 of which recently formed an alliance to promote the development of a favourable legal and financial environment. The IIC is a more recent development, linking research centres to a significant production capacity.

Mr. Bocharov asserted that the August 1998 crisis constituted a watershed in the story of Russia's transition to a market-based economy. GDP grew by a record 7.6% in 2000 (compared with only 3.5% in 1999). Paradoxically, the energy sectors recorded little to no growth during this recovery (oil extraction, 4%; electricity, 3%; and gas, 0%), while the machine-building and light industries grew strongly (at 16% and 26%, respectively). The new macroeconomic conditions stemmed from the abolition of internal borrowings, a negative real interest rate, and an undervalued rouble exchange rate, all of which served to stimulate investment.

In this new economic environment, MinIST sought to do more than simply redistribute its very limited budgetary resources. It attempted to develop the key elements of its national innovation system: innovation-technological centres (ITC), innovation-industrial complexes (IPC), regional innovation clusters and programmes, and educational establishments for training innovation. Simultaneously, the state's efforts to improve the innovation infrastructure concentrated on developing venture financing, IPR protection and international harmonisation of the legal framework. Mr. Bocharov outlined MinIST's efforts to develop interagency co-operation in innovation policy, working with seven other Federal Ministries and 22 Regional Administrations and raising their awareness of how their decisions influence the country's innovation climate. MinIST also elaborated draft policies for CIS innovation co-operation.

Mr. V. Bespalov (General Director, Alliance of the Innovative and Technological Centres of Russia) explained that the Alliance's policy aimed to spur the growth of ITCs, develop the co-operative use of their equipment, improve legislation and establish links between innovative SMEs and the regional and local authorities. Currently, 22 of the 36 ITCs have joined the Alliance. They comprise 300 innovative enterprises, concentrated in electronics (25%), telecommunications and information science (20%), and healthcare (18%). Mr. Bespalov emphasised that the further development of the ITCs calls for closer co-operation with experimental and full-scale production facilities as well as assistance in attracting capital through venture and mutual funds, consolidated banking credits and investment risk insurance.

The US Civilian Research Development Fund (CRDF) and the EU's International Association for the Promotion of Co-operation with Scientists from the NIS (INTAS) have accumulated significant experience in working with Russian scientific institutions. Officials from these two organisations briefly presented their views on the current challenges facing the development of a Russian innovation system. *Mr. G. Sher (President and Executive Director, CRDF, United States)* observed that Russia's innovation system was hampered by the conflicting interests of more traditional organisations, such as the big

scientific R&D establishments and industrial branch ministries, and the new dynamic structures, such as those found in the ITCs, technoparks, technological incubators, innovative SMEs, etc. To lessen these conflicts, he recommended restructuring the traditional organisations, improving the system of tax incentives, and better enforcing intellectual property rights. He also noted that the experience of the OECD countries shows that the achievement of personnel mobility among the different sectors and organisations of the national innovation system lessens conflicts and helps to promote the cross-fertilisation of ideas.

Mr. R. Burger (INTAS, European Commission) noted an important change in the current focus of the debate, *i.e*. a switch away from agonising over how seriously the economic crisis has undermined Russia's science and technological potential to investigating how innovations could contribute to economic growth. He believes that with such remarkable reversal of attitudes, similarities between the problems faced by the European Union and Russia have suddenly become clear. These include a brain drain to the United States, limited co-operation between industry, public research institutions and universities, and an insufficiently mobile labour force. The EU's experience in developing economically stagnant regions through the use of special programmes for SMEs and the upgrading of labour skills could be useful for Russia's "monocities" (*i.e*. cities that are economically dependant on a single enterprise).

THE ROLE OF GOVERNMENT

The role of government in developing national innovation systems was the underlying focus of several of the Seminar sessions. Participants from Finland, France and the United States presented their national experiences in establishing institutional and policy frameworks for promoting innovation. Each approach targeted a particular national need: in Finland, to diversify its economy; in France, to create more small technology companies; and in the United States, to help local economies restructure. As a result, each approach differed considerably in its focus and in the role played by the government.

Institutional and policy frameworks

Mr. T. Kekkonen (Director General of the Technology Department, Finnish Ministry of Trade and Industry) described *Finland's* innovation environment and the S&T policy promoted by the government. He noted that over the past 20 years, the Finnish Government has carefully orchestrated co-operation among the major players interested in achieving a shift from a semi-industrialised to a knowledge-based economy. This shift was largely guided by the Science and Technology Council, chaired by the Prime Minister, which includes members from industry, academic organisations, and several government agencies (the Ministries of Finance, Trade and Industry, and Education). The Council perceived that its major policy challenges would be to:

- Create an innovation environment.
- Increase spending for research, technology and development.
- Maintain a leading position in specific fields.
- Ensure a competent workforce.
- Spread knowledge-based growth throughout the regions.

Mr. Kekkonen noted that the increased share of high-technology products in Finland's exports bears witness to the programme's success. Moreover, while the government increased spending on S&T, the private sector's expenditures on S&T overwhelmed their expectations. Total spending on S&T now equals 3.3% of GDP. He attributed this resounding success to the high-level governmental commitment, the atmosphere of co-operation, a carefully conceived international element and the creation of an effective innovation system.

In *France*, only about half of R&D investment is private, placing France below the OECD average. *Mr. Didier Coulomb (Deputy Director for Technology Development, Ministry of Research, France)* described how the French Government, in the belief that many valuable ideas from government-funded research remain under-utilised, took action. A key element in the government's action plan was the passage of the 1999 Innovation and Research Act. The law contained measures to develop co-operation between public and private entities, such as tax credits for R&D and subsidies for SMEs. Perhaps most importantly, it created a more flexible legal environment for civil servants, allowing them to set up or work in firms that exploit their research without jeopardising their civil-servant status. There are now 200 such companies in

France. The law has spurred universities to establish departments specialised in the development and marketing of university-created technologies.

Since the *United States* is a federal system, both the federal government and the individual state governments have developed policies to stimulate innovation. A report prepared by *Mr. W. Plosila (Vice-President for Public Technology Management Practice, Battelle Memorial Institute, United States)*, outlined how several US state governments have established programmes to promote innovation and thereby cushion the shocks suffered by the state economies as they shift from durable goods production towards new technologies and services. These state strategies usually involve making significant investments in higher education, establishing R&D centres of excellence and supporting a variety of technology incubators. Examples of successful programmes include Michigan's Life Sciences Research Corridor, Indiana's 21st Century Research and Technology Development Fund, and Pennsylvania's Technology Investment Authority. State governments appear to be best suited to developing partnerships with local higher educational institutions, supporting them in talent and workforce development. Such partnerships have helped states retain or create jobs in a rapidly changing economic environment.

In reviewing the variety of foreign governmental approaches to promoting innovation, *Mr. A. Povolotsky (Director, Institute of the National Economy and Economic Security Studies)* noted that adapting them to Russian conditions is complicated since foreign experience is strongly influenced by its own economic and social systems. He asserted that Russia has yet to establish an innovation policy and proposed that attention be paid to linking Russia's separate elements in a unified system, one that is part of a policy for general economic development. Moreover, he believed that the awareness of the importance of a national innovation policy to general economic growth needed to be increased among high-level Russian policy makers.

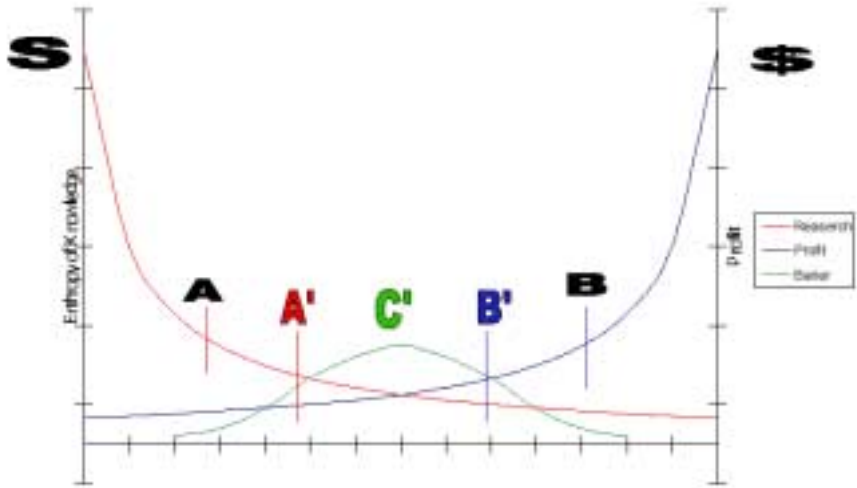
Best practices

Considerable efforts have been made to examine good practices in government programmes in support of innovation. Of particular interest is how and whether such practices can be adapted to the innovation systems of other countries. Panel discussions drew on the national experiences of Israel, Korea, Estonia and Hungary.

Successful government intervention based on clear policy benchmarks, reflects *Israel's* experience in developing its fast-growing hi-tech sector, according to *Mr. B. Raz (Science Counsellor, Embassy of Israel in the United*

Kingdom). Mr. Raz emphasised that in market economies the task for governments is straightforward; namely, to diminish the innovation risk for the concerned parties. His study of other countries has led him to conclude that governments must use market forces to stimulate innovation. In so doing, they reduce the likelihood of technical and commercial failure in the innovation process and increase the rewards for all involved, typically academia and industry. Mr. Raz highlighted the fact that academics and businessmen have different interests in the innovation process. Academic scientists generally have no resources, no stimuli to continue research beyond the point at which it is reasonable to expect publication in a scientific journal. However, this stage of the research process is fraught with risks for industry since the knowledge available at this point is too remote from the market to be assessed in commercial terms, *i.e.* it is not yet possible to calculate the returns on the probable necessary investments. As Mr. Raz illustrated with the following diagram, bridging this gap is government's primary task (Figure 2).

Figure 2. **The innovation barrier: government intervention**



The knowledge, or research curve, descends over time from point A, at which the scientist has interesting results that merit publication, to under point B, at which the knowledge has been developed to a point of being able to be turned into profit for the entrepreneur. Expenditures rise from under point A, at which the costs of producing interesting scientific knowledge are relatively low, to point B, at which profits are assured and investments are being made for production. The scientist is generally most interested in point A; the

businessman, point B. Points A' and B' represent the moments of greatest risk to innovation, where funds are needed to take knowledge further to investigate the commercial potential of research. The barrier to innovation curve rises to C' and then descends as the commercial viability becomes better known. Thus, the greatest risks to innovation occur along the barrier between points A' and B', which represents the appropriate time for government support.

A variety of national policies aim to solve this problem. According to Mr. Raz, such policies should seek to broker the "marriage" of the two parties. Government should stimulate academia to move further towards the applied stage and industry to start picking up earlier the "fruits" of academic research. In Mr. Raz's view, overcoming the innovation barrier means diminishing the knowledge entropy on one side and the fear of losses on the other side.

In this context, the Israeli Government has simultaneously elaborated a number of support mechanisms. Direct tools include encouraging innovation via market invasion, structuring the industrial sector, and influencing the organisation and management of individual firms. Indirect mechanisms include influencing the availability, utilisation and mobility of managerial and technical manpower; assisting institutions in the generation and utilisation of technical knowledge; and increasing the diffusion and transfer of technical knowledge between institutions. The efficiency of each mechanism should be continuously monitored. This task requires the use of clear benchmarks and the identification of verifiable goals. The mechanism must be implemented, then evaluated and any needed adjustments made quickly. The Israeli case highlighted the importance of quality of the human capital supply and the availability of venture capital.

Mr. Chung (Senior Research Fellow, Science and Technology Policy Institute, Korea), explained that *Korea's* achievements in technological development could not be separated from the general policy underlying its rapid export-based, industrial transformation. Korea's model relies on close co-operation among 30 large and diversified industrial groups, the *chaebol*, and on the state's industrial policy. The *chaebol* produce 42% of Korea's industrial output, with 20 of them accounting for 56% of gross expenditures on R&D. The government provided strong financial and tax support and ensured a supply of qualified human resources. In Mr. Chung's view, this approach was unsustainable due to the relatively weak development of basic science. He saw some similarities with developments in Russia, where diversified conglomerates started to emerge as a consequence of post-crisis property reallocation and as a response to weak property and contractual rights.

Estonia's recent experience was described by *Ms. K. Männik (Head of Technology and Innovation Division, Estonian Ministry of Economic Affairs)*. She emphasised the importance of increased co-operation between key institutions in the R&D community and the public and private sectors. The first steps in implementing Estonia's knowledge-based economic policy related to increasing national awareness and stimulating co-operation through media channels, public presentations and lobbying. Institutional reorganisations led to the establishment of the Ministry of Education, the Estonian Science Foundation and the Estonian Technology Agency (Ministry of Economy) as the key governmental agencies overseeing R&D strategy and financing.

The *Hungarian* case also highlighted the importance of setting clear, well-structured and verifiable goals. Hungary sought to adjust its state innovation policy towards the existing structure of the economy. *Mr. F. Kleinheincz (Deputy Director, R&D Division, Ministry of Education, Hungary)* described Hungary's choice of three basic targets: stimulating domestic, in-house R&D by multinational corporations operating in the country; activating small business innovation development; and providing strong tax and accelerated depreciation incentives. The Hungarian Government recently doubled its basic science funding, intensified university-industry co-operative programmes and put in place a regional innovation strategy.

Mr. V. Avtonomov (Ministry of Economic Development and Trade, Russia) discussed Russia's "Long-term Government Strategy for Economic Modernisation". The Strategy seeks to support private business initiatives by strengthening the framework of state and market institutions that in turn ensure favourable and equitable conditions for economic activity. Sustainable growth in the coming decade will be impossible unless innovation activity can be strengthened, private investments in innovation increased, support for science and education raised, efforts to move towards the "New Economy" redoubled and the general competitive climate for domestic production improved. In Mr. Avtonomov's view, government policy should seek to liberalise the activities of SMEs, encourage public/private partnerships in technology development and target such partnerships towards market demand, *i.e.* to the "real needs" of society.

Participants agreed that the experiences of other countries cannot simply be transplanted to Russia or another NIS. Yet, there were some important lessons to be learned from examining how other countries address these issues. For example, discussants from the OECD Member countries emphasised that success relied on creating a broad awareness within their governments of the economic importance of supporting science and innovation. Russian

participants generally agreed that this type of awareness was lacking among many senior Russian legislative and executive branch officials.

In addressing the desire of its Member countries to better understand the economic impact of technology on the economy and the economic tradeoffs of various policy alternatives, the OECD has undertaken a broad range of analytical work. In examining the impact of information technology, innovation and entrepreneurship on national economic growth, a recent OECD study highlighted that "…innovation influences economic growth at both the microeconomic and macroeconomic levels. At the microeconomic level, innovation enables firms to respond to more sophisticated consumer demand and stay ahead of competitors, both domestically and internationally. Innovation surveys for 12 European countries indicate that more than 30% of annual revenues in the manufacturing sector derive from new or improved products, *i.e.* the results of innovation."[1] Moreover, it concluded that "countries that experience the highest levels of growth are likely to be those that can most rapidly develop new products, processes and services based on new technologies and apply them most efficiently to other sectors of the economy."

Mr. D. Malkin (Head of the Science and Technology Policy Division, OECD) noted that the OECD has analysed government support instruments, such as tax incentives, financial support to selected technological areas, or public/private partnerships. The former were found to be technologically neutral and thus enabled governments to avoid having to choose specific technologies for support. Further, Mr. Malkin referred to OECD studies on levels of government support for domestic R&D. These studies have shown that too much government R&D support tended to replace funding that should have been made by companies or venture capital. Thus, it was important for governments to ensure that their support was not a substitute for private R&D investment and that it had important leverage effects on these investments.

BUSINESS ENVIRONMENT AND ENTREPRENEURSHIP

Low involvement of business in innovation characterises one of the imperfections of emerging markets. This problem presents a particular challenge for governments wishing to foster investments, stimulate demand for innovations and partnerships among domestic firms, and create partnerships to exploit public research. Analysing the experience of the OECD countries and comparing it to that of the transition economies can point to ways in which the

latter might adapt their policy frameworks. Transition economies should adopt a more entrepreneurial model of innovation, based on continuous and extensive interaction between industry and science.

The UK Government established the Medical Research Council (MRC) to fund medical research. Most funding is made within its system of government institutes and universities. *Mr. R. Lang (Director for Corporate Relations, Medical Research Council Technology, United Kingdom)* described the functioning of the MRC's technology transfer arm, "MRC Technology". The rationale behind the creation of a special technology transfer operation lies in the belief that to convert an important part of the MRC's research into products that meet the country's health needs, one must draw on the intellectual and financial resources of industry. "MRC Technology" owns and manages a remarkable portfolio of intellectual property. Ownership, however, is limited to the intellectual property from its 40 plus institutes, since the universities own and manage any intellectual property issuing from their MRC grants. The MRC's transfer of medical technology to industry is generally effected through jointly funded research with industrial partners (LINK), licences to existing companies, and spin-out companies. The ability to attract equity capital is considered vital for the growth of spin-out companies. "MRC Technology" also owns a venture fund, a subsidiary which attracts private funds. Mr. Lang explained that the UK Government has established attractive incentive schemes for its scientists. Incentives are on a sliding scale as profits increase: first in line is the inventor, followed by the research unit, then the MRC Commercial Fund. A strict control of personnel is the other side of the coin. The MRC has strict rules governing the outside activities of its researchers. For example, all external income and consultancies must be approved in advance, and the selling of technology elsewhere on one's own initiative is considered a disciplinary offence.

Some Russian entrepreneurs have been able to commercialise domestic technologies. One such success story was presented by *Mr. S. Simaranov (CEO and President, "Technoconsult", Russia)*, who described his company's experience in promoting Russian technologies on the world market. He asserted the importance of ensuring that a new technology company has: clear marketing targets, precise market segmentation, clearly established internal profit centres and general transparency in its property and financial dealings. He notes that there are four basic customers for Russian technology: corporations from developed market economies, foreign venture funds, Russian industrial and venture companies, and industrial companies from developing countries. The crux of the business involves carefully investigating demand and searching for reliable partners. Mr. Simaranov stated that technology brokerage in Russia demands the establishment of high-quality project management, and requires

finding solutions to all legal, financial, and logistical matters prior to signing the contract. Russian economic conditions necessitate the building up of mutual confidence among partners.

Another Russian success story was described by *Mr. N. Rogalev (Director of the Innovative Technology Centre– ITC – and Science Park of the Moscow Power Engineering Institute, Russia)*. He noted that the gap between scientific research and its commercialisation was larger in Russia than in many other countries with significant scientific establishments. He attributed this to a number of factors: the lack of an innovative culture in universities and institutes; the lack of seed capital and business angels, with the Bortnik Fund providing the only bridge; insufficient money spent on preparation and marketing by innovators; restraints on government financing, which is currently only to be spent on wages and salaries and is fraught with red tape; an ageing research community; the need for many university and institute researchers to work in the shadow economy; low levels of government funding; and the difficulty of tapping into international capital sources.

Mr. Rogalev described his efforts to organise an innovation programme at the Moscow Power Engineering Institute. Technology commercialisation projects are centred around the MPEI Science Park, which includes a Technology Transfer Centre, a technology incubator, a nascent financing arrangement (Technology Project Competition), a Training Centre and a Technology Innovation Centre. With the university as a core, these establishments provide opportunities for professors and students to commercialise their research, including taking the results to the pilot production stage. Currently, the Science Park is actively co-operating with 20 MPEI subsidiaries in the production of technology-based products and services.

According to *Ms. J. Walden (Director General, Natural Sciences and Engineering Research Council – NSERC, Canada)*, Canada leads the OECD in the share of university research funded by the private sector (12% in 1997). This reflects the relative greater importance of universities in Canadian R&D, and follows on from NSERC's strategy to link university research to the private sector through collaborative research projects selected on the basis of a peer-review system. Project funds are granted on a competitive basis, with the emphasis placed on the quality of the proposals rather than on institutional reputations. The success of innovation partnerships in Canada arises from the flexible mix of programmes. For example, support for basic research can lead to applied projects and technology transfer. Another important Canadian effort is connected with the development of the Networks of Centres of Excellence (NCE), focused on areas of strategic importance selected by the government. These "virtual networks" can create a critical mass of research capability on a

national scale, while allowing university researchers to function locally. NCEs, too, are based on the excellence of the researchers and on the capacity to train highly qualified professionals. NSERC is also deeply engaged in supporting universities by funding their technology transfer infrastructure, *e.g.* the industry liaison offices.

Transition shocks were severe for large Academy of Science institutes. Such institutes were oriented towards fundamental research and saw their past levels of funding quickly eroded. *Mr. Y. Gleba (CEO Icon Genetics, Germany, and Director of the International Cell Biology Institute, Academy of Sciences, Ukraine)* described his own entrepreneurial efforts to lessen the effects of such shocks. His experience demonstrated how an Academy of Science institute could adjust to new conditions by commercialising some of its output. The adjustment process took place in two clear stages: first, a survival period during which the R&D capacity was reoriented towards low-tech activities; and second, a "renaissance" period, during which channels were established through which to supply the world market with intellectual products. Mr. Gleba's case illustrates how globalisation in science can work. It is not simply a case of "brain drain", but rather of "brain circulation" – as opportunities arose in the home country, scientific talent began to flow back. He described how he overcame the current lack of domestic demand for high-tech skills by seeking customers among multinational agrochemical and pharmaceutical corporations. He accomplished this by co-operating with a small, biotechnology firm based in Germany. This small company operated as a market interface and provider of integrated, customised technological solutions. In conducting his business, Mr. Gleba actively uses his newly acquired commercial skills and his network of contacts throughout the CIS.

The German Association for Economic and Technological Co-operation with Eastern Europe represents another example of successful market networking. It supports German SMEs wishing to reach into the technological pools that exist in emerging markets, especially Russia and the Ukraine. *Mr. B. Groß (CEO German Association for Economic and Technological Co-operation with Eastern Europe, Germany)* described how the association established computer networks, data banks and Internet platforms as multipliers to increase opportunities for successful and mutually beneficial technology co-operation. In his view, Russia possesses valuable elements of competitive advantage in the software industry, but the lack of any strategic approach to this sphere has prevented the country's active participation in the building of the European Information Society.

Financing innovation presents particular problems in economies plagued by weak legal and financial institutions. *Mr. R. Stillman (President, Milbridge Capital Management, United States)* emphasised that investments and technological entrepreneurship needed to be considered in the light of global competition. The lack of institutional investors, such as insurance companies and pension funds, severely limits the supply of domestic venture capital in Russia. Weak and non-transparent shareholder and property rights further exacerbate this problem. Remedying this situation calls for government actions to develop the investment infrastructure, reduce risk and increase the potential returns for scientists, entrepreneurs and investors. Mr. Stillman suggested a multifaceted action plan which would include: a search for potential entrepreneurs in Russia and among Russian emigrants in the United States and Europe; the establishment of an office for continued contact with US investors and venture funds; the encouragement of corporate and individual investors; and the creation of a critical equity mass.

A survey of the experience of the Russian Technology Fund was presented by *Mr. A. Vlasov (Director, Russian Technology Fund)*. He cited three critical elements for the development of Russian entrepreneurship: fostering an entrepreneurial spirit, increasing access to venture capital, and further developing the innovation infrastructure. According to Mr. Vlasov, a troubling trend has recently surfaced. There have been very few high-tech SME start ups in Russia since 1997. He believes that the following reasons might explain this trend: *i)* the top layer of the technological pool (*i.e*. those innovations most suitable for immediate commercialisation), is exhausted; *ii)* the supply of cheap assets for launching new enterprises (which were available at the beginning of the 1990s) no longer exists; and *iii)* Russia is burdened by an unfavourable tax system and over-bureaucratisation. He views the shortage of domestic venture capital as an important negative factor. According to Mr. Vlasov, the major investors in domestic innovation are the EBRD and the US Government. In his view, the infrastructure for technological entrepreneurship is improving but remains insufficient, especially in ensuring capital exit from venture companies. This latter issue relates to the low liquidity of the stock market and the insufficient protection of minority shareholders' rights. One feature of Russian venture capital is that it is oriented towards geographic regions rather than industrial branches. Mr. Vlasov suspects that this orientation reflects the regional clustering of Russian S&T resources. He emphasised that, while Russia currently functions as a technopark for foreigners, there is a need to extend this technological proficiency to domestic companies.

Much of Russia's innovative activity takes place in SMEs. *Mr. S. Poliakov (Deputy Director General, Foundation for Assistance to Small Innovative*

Enterprises, Russia) explained that his organisation is an important provider of financial assistance in the form of soft loans. The Foundation, which has now been in existence for seven years, has supported 1 200 SMEs, posting an average annual output growth of about 15%. In his view, the lack of stable demand for innovations from Russia's large corporations is a major bottleneck to sustainable growth by Russian technology-based SMEs.

Russia's venture capital market is growing, but expanding financial support for innovation and entrepreneurship requires raising the share of domestic funding as well as tax and banking reforms. The development of a strong banking sector and domestic venture capital industry is necessary for the entry and exit of new innovative ventures. Currently, the venture-capital industry remains dependent on foreign funds and is oriented towards loans, with very little finance being directed towards equity positions in new technology-based firms. While a number of private and public funds have emerged to foster small-business creation, greater involvement by Russia's institutional banking sector is required to create a critical mass. Business advisory and information services for scientists and young entrepreneurs are also necessary to build the management skills for new-firm creation. International co-operation in this area, aimed at linking Russian entrepreneurs to foreign partners and markets, has proven successful and could be strengthened.

Networking and the development of stagnating industrial districts are a major activity of the Italian Institute for Industrial Restructuring (IRI). These activities demonstrate that market perspectives that influence the profitability of firms largely condition new start-ups. According to *Mr. U. Dal Canuto (Deputy Central Director, IRI, Italy)*, achieving this goal is possible through the creation of ties with large "virtual corporations", *i.e.* with SMEs inside industrial districts connected to the district's larger enterprises. In his view, policies should favour the creation of SMEs in older environments and these SMEs should be supported in developing new areas. Such policies would include: budget allocations, fiscal deductions, new labour agreements and risk capital.

Mr. B. Grinyov (General Director, the Scientific-Technological Concern MonoCrystals, Ukraine) presented another tale of market adaptation by a traditional Soviet-style research institute. After the collapse of the Soviet Union, his firm undertook major restructuring away from its past dependence on the military-industrial complex. The former single R&D institute has been transformed into seven companies which are financially independent of each other, but maintain co-operation. The institute has managed to overcome the shortage of funds by cleverly marketing its capabilities, albeit not without a change in focus. The institute established a cash flow by selling licences and

finished goods. By reinvesting the funds, it was able to restructure along more profitable lines. For example, pharmaceuticals are now produced at a facility previously dedicated to producing ultra-pure chemicals.

During the discussions, several participants commented that little attention had been given to the role of large high-technology corporations, such as those found in the aerospace industry, in Russia's national innovation system. These entities face major financial and managerial risks in the innovation process, especially in its downstream stage (in the Porter sense). Furthermore, the picture of the Russian national innovation system would not be complete without some debate around the advantages and disadvantages of technological alliances, such as the "Sea Launch", the International Space Lab "Alpha", the supply of rocket engines from "Energia" to "MDD-Boeing" and other international technological alliances involving Russian companies.

Participants generally agreed that the major challenge facing Russian state agencies is how to support demand for industrial innovation in the current unstable macroeconomic environment and incomplete institutional and legal framework. According to Mr. D. Malkin, during Russia's transition to a market-based economy, the S&T system has suffered from a combination of adverse factors that have hindered its evolution to a system more attuned to the requirements of a knowledge-based economy. Major adverse factors include: institutional inertia, dwindling resources devoted to R&D activities, distorted allocation patterns of R&D resources, and difficulties in implementing a basic framework that includes incentive mechanisms that would foster the diffusion of knowledge. A successful transition of the Russian S&T system calls for a broad-based policy reform process aimed at overcoming the weaknesses caused by this combination of factors.

INTELLECTUAL PROPERTY RIGHTS

A well-functioning intellectual property system supports the valorisation of science, since by assigning exclusive rights through patents, copyrights, trademarks or industrial designs, it protects the investments needed to commercialise or exploit new technologies. The importance of defining property rights to intellectual property, especially for state institutions, has recently received high-level attention by the Russian Government. *Mr. P. Leonard (Director, Intellectual Property Institute, United Kingdom)* reviewed the importance of intellectual property law to an effective science policy. He noted that the rise of new technologies presents a continuous

challenge to the legal institutions to adapt in such a way that maintains their positive role in economic growth.

The Russian Federation has largely completed an ambitious legislative programme to create an appropriate legal environment for the protection of intellectual property. *Ms. N. Zolotykh (Deputy General Director and Patent Attorney, "Transtechnology", Russia)* described the most important Russian legislative acts affecting intellectual property protection, including general acts (*e.g.* the Civil and Criminal Codes) and special laws (*e.g.* the laws on patents, trade marks, copyrights, computer programs, integrated circuit topologies and export control). Against this background of substantial progress, she noted that a number of issues surrounding the legal regulation of domain names and secrets remain unresolved.

Equally problematical, according to Ms. Zolotykh, were some key issues in employer-employee relations, specifically those that relate to conflict of interest. The latter concept is critical to establishing ownership over intellectual property, yet it is currently unknown in Russian law. Consequently, many international legal persons establish contracts directly with researchers, while others choose to deal directly with the institutes. In such a situation, it is conceivable that the rights to a particular intellectual property portfolio could be sold twice, thereby infringing the exclusive rights of one or other of the parties. She asserted that the issues surrounding employer-employee relations require legal clarification.

The transfer of know-how, often an important part of commercial negotiations, is another area requiring greater precision in Russian law. Currently, it is not dealt with directly in the Civil Code and requires careful contract drafting.

Finally, Ms. Zolotykh pointed to the considerable legislative uncertainty relating to ownership rights and to the disposal and use of scientific and technological results financed wholly or partially out of federal budget resources. She cited this uncertainty as an important factor limiting the interest of foreign investors in Russian technologies. She specifically cited a recent governmental act[2] that gave the Russian Federation ownership rights to results obtained through state contracts for scientific research or experimental design work. Such contracts form the basis for most state funding of science and, as mentioned above, the state remains the principal source of funds for science in Russia. She noted that considerable uncertainty also existed in the case of the rights to the results of scientific and technological activity carried out during the Soviet period.

Russian Federation policy makers are not alone in their search for a resolution to the property issues related to publicly funded research. A background paper prepared for a recent OECD Workshop on this issue concluded: "In many countries, there is still great diversity among institutions as to ownership and revenue sharing from publicly funded research. In Canada, there is a split between universities that retain title and those that grant title to the inventor. In Germany, title depends on both institution and source of funding. To the extent that this variation represents a barrier to commercialisation of research results, governments should review the impact of different ownership arrangements."[3]

According to *Mr. A. Von Füner (European Patent Attorney, Germany)*, the adaptation of Soviet intellectual property legislation to the needs of a market economy has been accomplished successfully. Soviet laws had their intellectual roots in German law; thus many intellectual property concepts were already well known to Russian jurists. His experience in obtaining patents in the Russian or Eurasian patent offices was positive. As he had no experience in dealing with the Board of Appeals, he could not comment its functioning. However, according to Mr. Von Füner, a number of issues remain concerning the enforcement of intellectual property rights and legal transparency. He noted that legal decisions or clarifications are published haphazardly, generally in newspapers. Moreover, no state bodies publish court decisions; it is thus impossible to know what the enforcement climate is like, especially in the provinces. At best, one reads of occasional decisions in the press. He mentioned that disputes about rights to earlier Soviet inventors' certificates (*avtorskoye svidetel'stvo*) have recently come to the courts. Cases have also arisen over domain names, whereby Russian individuals had registered the names of Western companies and sought to be paid to relinquish their rights to them.

Under the aegis of the Finnish Ministry for Industry and Trade, The VTT Technical Research Centre of Finland has as its mission to "develop technology to improve both the competitiveness of industry and the basic infrastructure of society, and to foster the creation of new businesses". *Mr. V. Lindroos (Head of Legal and Personnel Affairs, VTT, Finland)* described how VTT managed its intellectual property. VTT employees are not given ownership rights and VTT carefully controls the transfer of its technologies. It does not sell its core technologies, but rather provides user rights to them. As a non-profit organisation, VTT seeks primarily to position itself in technology development that promotes the growth of the Finnish economy in accordance with the national industrial strategy. This role places it principally in applied research areas, between the basic research conducted by universities and the

development work generally carried out in industry. The returns from its intellectual property sales are used to fund its strategic research.

Mr. I. Linnako (Managing Director, Sitrans Ltd., Finland) and *Mr. B. Simonov (General Director, Innovation Agency, Russia)* described their experiences with intellectual property rights in the commercialisation of Russian technologies. Mr. Linnako stated that Sitrans, an independent fund with assets of over USD 1 billion, was active on the Russian market between 1990 and 1995. The generally negative view of Russian economic and legal institutions had led many Russian researchers to try to file first for patent protection abroad. In his view, very few advisory services were available to provincial researchers and intellectual property questions needed to be resolved in order to attract venture capital. Mr. Linnako emphasised the importance of having a professional management team to take the lead in product commercialisation, with the researcher having a key, but subordinate, role as team member. Mr. Simonov believed that intellectual property issues are not a serious impediment to the commercialisation of Russian technologies. In his experience, common sense allowed one to surmount any issues that surfaced relating to intellectual property. At the same time, he agreed that it would be important to adopt legislation on some of the issues relating to intellectual property raised in the earlier presentations.

From the ensuing discussions, it became clear that there was a generally positive view of Russia's legislative framework for intellectual property. The transparency of implementing the legislation and the enforcement of rules at the institute level appear to be more problematic. The management of intellectual property at publicly funded research institutions requires active administration. At the same time, as was noted at the above-mentioned OECD Workshop, individual facilities have a key role to play in improving the legal environment. Public research institutions "… must develop safeguards that balance their new commercial orientation with their public missions. This requires establishing protocols on limits to public dissemination of research results, maintaining independence in public research, financial conflicts of interest and their resolution, and managing disparities in funding across disciplines. Many of the conflicts of interest issues may only be resolved as they emerge. But having a basic and flexible framework for managing conflict can help institutions be better prepared to meet future challenges."[4]

Many of the problems surrounding ownership appear to be the result of uneven management at the institute level, with minimal control over the actions of employees and an absence of rules on conflict of interests. There is a general perception that institutional interests are often sacrificed to personal interests. (It's almost as if the Russian Government had designed an excellent system of

highways and traffic rules, while its citizens continued to drive on both sides of the road.) In addition, the lack of financing clearly impedes the ability of institutions to obtain appropriate foreign protection for their intellectual property. As was noted throughout the Seminar, domestic demand for innovation is low, thus the inability to afford foreign protection for innovations directly undermines an institute's ability to commercialise its technology on the international market.

HUMAN RESOURCES FOR INNOVATION

Russia has made considerable progress in developing human resources for innovation. Educating managers and researchers in fields related to innovation is a key element in establishing a successful innovation policy. *Mr. A. Porshnev (Rector, State University of Management, Russia)* explained that, while the Russian economy has recently shown strong overall growth, the technological industries have not generally participated in the upswing. In his view, this points to the importance for Russia of ensuring that its educational institutions meet the challenge of training people for the "New Economy". He noted that innovation management has been incorporated into the curriculum. Furthermore, the MinIST has taken measures to support training by creating a Research and Methodological Council to develop manager training and retraining through courses, university curricula and post-graduate studies. There is now competition among the various programmes, with new training centres being attached to existing universities.

In addition to programmes attached to existing educational facilities, Russia has created a new Higher Educational Institute, the Russian State University for Innovation Technologies and Business.[5] *Mr. A. Kharine (Rector)* described how the university was created and outlined its current structure. The university was established after a careful review of relevant foreign experience. He interpreted the recent appearance of SMEs in science as the result of the decline in budgetary allocations to traditional scientific establishments, while noting that these SMEs generally lacked management staff and expertise. His university, which was created through the efforts of three Ministries, namely MinIST, Education and Economic, seeks to provide education to fill this gap. The founding of the university was largely based on the premise that the human factor is the key to developing an innovation culture.

With the rapid changes taking place in the Russian economy and scientific establishment, policy makers need accurate statistics and indicators to monitor trends. *Ms J. Bond (Office of Senator Joseph Lieberman and the National Science Foundation, United States)* described how the US National Science Foundation built up its ability to identify and measure social changes so that it could address science policy problems. The interest in better understanding S&T human resource issues arose from a realisation among policy makers that scientists and engineers were a vital national resource, especially as the economy becomes increasingly knowledge-based. The issues addressed included: Are we training the right people to meet changing economic demands? What are the trends in the globalisation of science? Should we be talking about brain drain or brain circulation? The NSF developed a set of mobility indicators to help policy makers analyse the development, attraction, training, retraining and re-attraction of scientists. According to Ms. Bond, the mobility indicators show that the earlier view of a brain drain towards the United States now appears overly simplistic. Brain circulation would seem to be a better characterisation – many foreign scientists and engineers employed in the United States are now returning to their home countries as new economic opportunities emerge. Moreover, recent trends show that Asian countries are training their own S&T students by establishing high-quality educational facilities. She suggested that such a brain circulation might also occur in the case of the Russian scientists who have emigrated over the past decade.

OECD Member countries have been actively working with the Russian Government to develop innovation training programmes within Russia's science and engineering community. *Ms. E. Bell (Director, Science Unit, British Council, Moscow Office, United Kingdom)* described the United Kingdom's experience in making available its national expertise for training Russian scientists and managers in key innovation-related skills. The British Council views such training programmes as especially important since they serve to build up a core of specialists who will continue to improve Russia's innovation system in the coming years. The British Council has established a portfolio of training projects in response to Russian requests. Most recently, it conducted a series of seminars on intellectual property rights management and venture capital. In addition, it has sought to build technology transfer partnerships. *Mr. Zinov (Russian Federation)* added that the British Council programme was viewed quite positively for its ability to provide training to Russian experts in a number of Russia's scientifically oriented cities, such as Samara and Chernogolovka.

Mr. Yu Shlenov (Head, Economic Administration, Ministry of Education, Russia) described how the Ministry of Education had established its main goals

in line with the recent national economic strategy, frequently referred to as the "Gref Plan". A major effort had been undertaken to render the national curricula more flexible. He noted that a consortium of new types of universities had been established, geared to training in industrial branches, with information technology especially important for rural areas. The consortium also involved the use of technoparks.

Some participants observed that universities in the OECD area played a more important role in R&D than did their Russian counterparts, whose R&D staff often worked in the shadow of more prestigious Academy of Science institutes. Mr. Malkin noted that the statistics show that, while OECD universities are responsible for a relatively low share of total OECD area R&D, the economic impact of their research is higher than that of government laboratories. He also noted that a relatively important share of university scientific and engineering research was funded by industry. Consequently, he expected that there would be a general shift in Russia towards university-funded R&D. Mr. Sher noted that there was considerable room for foreign universities to complement the efforts of Russian universities in building an innovation-oriented curriculum.

Mr. A. Povolotsky drew attention to the current need to train low- and intermediate-level experts in the area of S&T management. In his view, many mid-level Russian experts have retired without providing training for their successors. Consequently, there is a major need to develop the intermediate level or, as he put it, "covert the human resources into human capital".

CLOSING REMARKS

Ms. I. Osokina (Vice-Minister, MinIST, Russia) and *Mr. R. Vihko (President of the Academy of Finland)*, who co-chaired the Seminar, concluded. Ms. Osokina noted that MinIST viewed the enactment of a special law on innovation as particularly important for facilitating MinIST's task of supporting an innovation-oriented S&T policy. She believed that the Seminar had accomplished a useful exchange of experience. Mr. Vihko noted that one of the Seminar's goals, that of highlighting the current challenges and putting forward policy recommendations, was largely achieved.

The Helsinki Seminar ended with broad agreement on the following policy messages:

- ***Russia's "innovation gap" could widen unless institutional reforms are taken to link the emerging innovation infrastructure to the science system and the development of a domestic market.***

  The transformation of Russia's scientific assets into innovation and growth is dependent on a well-functioning innovation system characterised by intensive and permanent interaction between industry and public research. Russia has made great progress in developing an infrastructure to support innovation (technology parks, incubators, innovation centres) and has set some basic rules to encourage investment and entrepreneurship. However, the Russian innovation system is developing in a piecemeal fashion. The emerging private sector remains insufficiently linked to the main performers of public R&D (*i.e.* academies, branch institutes, universities). Russia continues to suffer from institutional rigidities as well as inefficient and distorted patterns of R&D funding (with low private expenditures) and R&D performance (a high share of which is carried out in public institutions) inherited from the Soviet Union. The traditional manufacturing and resource-based industries, which account for two-thirds of industrial investment in R&D, have few incentives to invest in innovation and generate little domestic demand for the emerging domestic innovative firms, which are forced to rely on export markets. Building the internal market for innovation will require comprehensive institutional reforms, including in areas which fall outside the remit of technology and innovation policy makers.

- ***The experience of OECD governments shows that bridging the "innovation gap" will require policies to reduce the market risks to innovation and incentives for technology commercialisation and the creation of innovative, small firms.***

  A key message was that governments have an active, but limited, role to play in fostering innovation. Framework conditions such as tax, competition, product and labour market policies must be put in place in order to create market pressure for firms to upgrade and invest in R&D and innovation. The lack of incentives for public research institutions to engage in closer knowledge transactions with industry remains an issue in Russia. Industry/science relationships should be actively encouraged through regulatory reforms, measures to facilitate the mobility of researchers and public/private partnerships. The allocation of research funding could be used to foster such partnerships. The experience of several countries (France, Israel, Finland and Korea) showed that a systematic approach to innovation is vital and that support should focus on bottlenecks in the innovation

system. Governments should shy away from building wholesale innovation support structures, and retain a flexible mix of programmes that are evaluated, benchmarked and adjusted. At the institution level, the experience of OECD countries with commercialising public research results showed that "success breeds success" and that it is important to increase awareness of innovation among policy makers, firms, entrepreneurs, public research centres and universities.

- ***Strong and stable intellectual property rights are needed in order to transform Russian knowledge into technology and innovation.***

  Russia has made considerable progress in setting and enforcing intellectual property rights at national level and in line with its international obligations. However, there is a need for clear IPR rules at the institutional level. Transparent IPR policies at the level of public research institutions and universities will reduce the risks involved in financing innovative ventures and commercialising public research, and will help to attract a greater share of foreign direct investment. Russia should also improve the diffusion of legal information on IPR-related court decisions so as to ensure a transparent enforcement environment. The experience gained by the OECD countries in building the institutions (*e.g.* technology licensing offices) and know-how for technology commercialisation can be extremely useful to Russia and the other NIS.

- ***The scope for mobilising Russia's stock of human resources for innovation remains limited due to scarce research opportunities in the domestic business sector and an ageing research population in the public sector.***

  The emergence of a new type of university, linking scientific curricula with business and entrepreneurial skill building is a welcome development for human resources in Russia. Emigration of Russian scientists has abated and enrolment in science and technology among students remains strong, albeit less so than in the past. The emergence of an export-oriented high-technology sector has the potential to generate employment opportunities for Russia's highly skilled scientists and engineers. However, realising the full contribution of Russia's stock of skilled workers to growth will require generating demand in the existing large industrial firms, many of which have little incentive to invest in innovation. Insofar as Russian scientists and entrepreneurs residing abroad constitute a reservoir of brainpower and venture capital, Russia should implement measures to promote the return migration of Russian talent, including business angels.

- ***Russia's venture capital market is growing, but expanding finance for innovation and entrepreneurship requires increasing the share of domestic funds as well as undertaking tax and banking reforms.***

  The development of a strong banking sector and a domestic venture capital industry is necessary for the entry and exit of new innovative ventures. Russia's venture capital industry remains dependent on foreign funds and oriented towards loans, with very little finance directed towards equity positions in new technology-based firms. While a number of private and public funds have emerged to foster small-business creation, greater involvement by Russia's institutional banking sector is required to create a critical mass. Business advisory and information services for scientists and young entrepreneurs are necessary for building the management skills for new-firm creation. International co-operation designed to link Russian entrepreneurs with foreign partners and markets, has proved successful and could usefully be strengthened.

NOTES AND REFERENCES

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5. See http://www.itbu.ru

MINISTRY OF INDUSTRY SCIENCE AND TECHNOLOGIES
OF THE RUSSIAN FEDERATION

Background Document

THE ROLE OF THE STATE IN CREATING A FAVORABLE INNOVATION CLIMATE IN RUSSIA

HELSINKI SEMINAR

1-2 MARCH 2001

INTRODUCTION

This report, presented as background documentation at the Helsinki Seminar, characterises the current status of Russia's innovation activity and the climate for innovation. It analyses the key underlying factors and makes recommendations for the pro-reform efforts to help Russia adapt to the new (market-oriented) environment of the country and the changing global technological context. The authors attempt to analyse the reasons for the weakness of innovative activity in Russia, identify the key sensitive points and bottlenecks, and define the main characteristics of the policy which the Russian Government intends to pursue with a view to creating a favourable innovation climate and increasing the impact of innovation and sophisticated technology on national economic growth. This calls, in the first place, for creating the necessary institutional and legal mechanisms, mobilising human resources, supporting competition, and improving the system of governance.

The statistical data on Russia cited in the report are sourced, unless otherwise indicated, from Russia's State Statistics Committee (*Goskomstat*) and Patent Agency (*Rospatent*). In Part II of the report, those ideas which deserve additional discussion are marked with an asterisk (*).

Before proceeding to the main part of the report, two examples illustrate the paradoxical nature of Russia's situation today:

- In 1998, there were 65 researchers per 10 000 working population in Russia. In the United States, according to 1997 statistics, the relevant proportion was 74 to 10 000. Domestic input in R&D in 1998 amounted to less than 1% (0.93% to be precise) of GDP in Russia and to 2.8% in the United States. Spending on each scientist's research activities is 15 to 20 times lower in Russia than in the United States. However, patents per capita issued in Russia are nearly three-quarters the level of the United States – a very impressive figure considering the scarcity of Russia's funding for scientific research.

How can this be explained? Why do Russian researchers continue to produce patentable ideas in spite of their meagre pay cheques?

Although its level of patenting is high, Russia's share of the world market for high-technology products is less than 0.3% – 130 times lower than the US share.

Why is it that patentable R&D results fail to become competitive high-tech products?

The answer may lie in the fact that the state has not been sufficiently active in creating a favourable innovation climate in the country and has not paid due attention to advances in innovative research. However, a simple enumeration of measures taken by the state in that area would suffice to show that the problem is not so clear-cut. In 1998-99, the President and Government of the Russian Federation, together with a number of ministries and government agencies, adopted a package of normative documents laying a solid conceptual, institutional and legal foundation for the development of the national innovation system.

Key government actions include: "The Concept of Russian Federation Innovation Policy", the Russian Federation Government Directive "On Approving the 1999-2000 Plan of Action to Implement Russian Federation Innovation Policy in 1999-2000", the Government Resolution "On Creating Prerequisites for Attracting Investment in Innovation Sector", the Russian Federation President's Decree "On State Policy Aimed at Involving the Results of Scientific and Technological Research, and Intellectual Property Items in Science and Technology, in Economic Turnover", the 1998-2000 Inter-Agency Programme to Invigorate Innovative Activity in Russia's Science and Technology, and the Federal Law "On Leasing".

Considerable progress has been achieved in laying the groundwork for a national innovation system. Specifically, a system of State Science Centres has been set up; work is underway to create a series of federal Science and Hi-Tech Centres in strategic areas of science and technology; a network of Innovative Technology Centres (ITCs) has been established; and Innovative Production Complexes (IPCs) are under development. In addition, there is a Foundation for Small Business Support in Science and Technology, a Federal Foundation for Small Business Development, and a system of extra-budgetary funds to finance technological development.

Currently, 20 venture funds have been registered in Russia, managing a total of USD 2 billion. Innovation support is also provided by the State Innovation Corporation, the Russian Financial Corporation, federal and regional small business support foundations, foreign-based organisations working on the Russian market, and various venture funds. To accelerate the development of venture businesses, a Venture Innovation Foundation was set up in early 2000 at the initiative of the Science Ministry, with assistance from various other organisations, to improve the procedure of awarding grants to business ventures.

As regards information infrastructure, the Science Ministry has entered a new stage of information system construction – setting up a computerised information network linking the innovative technology centres (ITCs), technology pools, state research centres (SRCs), and innovation-oriented organisations in science, technology and production.

Clearly, the government has been anything but inactive. ***So what is the problem?***

To analyse the reasons underlying the current situation in Russia, one needs to take a closer look at the innovation sector, bearing in mind that many problems have their roots outside that sphere, and that any attempt to improve the innovation climate or adjust the innovation processes without tackling the wider problems of market or investment development would be as meaningless as trying to tune the transmission of a car without an engine.

The report is presented in two parts. Part I analyses the status of innovative activity and its associated factors, and identifies the underlying causes of the current stagnation in Russia's innovation sphere. Analysis of business performance shows that entrepreneurs tend to be rather inert, are not oriented towards the dynamic renewal of technology, and maintain only loose co-operative links with the R&D sector. Russia's innovative enterprises have been slow to adopt modern technology from abroad. Small businesses and ventures have so far failed to become innovation catalysts. The national innovation system remains rudimentary. R&D resulting from the national science system lacks demand and has been prone to stagnation, although many provisional indicators of its efficiency (*e.g.* patent activity) are relatively favourable. In spite of the efforts undertaken by the government, Russia's innovation environment is in need of drastic reform.

Part II sets out guidelines for Russia's shift towards innovative development, identifies its major stages, and suggests a system of measures that the government should take to activate the innovation climate factors. Now that this country has fulfilled one of the key preliminary requirements for the innovation process to start up; namely, it is on the path to economic growth, these measures, aimed at securing Russia's shift towards innovative development, are deemed to be particularly important.

PART I

INNOVATIVE ACTIVITY AND THE INNOVATION CLIMATE IN RUSSIA: CURRENT STATUS

CURRENT STATUS OF INNOVATION IN RUSSIA

The business community

The introduction of innovation processes in Russia's business community has so far been modest. In 1998, among firms surveyed by the Russian Federation State Statistics Committee, the share of enterprises engaged in innovative activities did not exceed 6%. For reference, in a similar survey undertaken in the United States in 1996, the share of innovative companies was one-third of the total.

Among *service companies* surveyed, 64.9% provided innovative services which, however, accounted for only 7.7% of the total volume of services produced in 1998.

The major resources of innovative activity, measured in absolute terms by the number of innovative enterprises and the amount of innovation-related spending, are concentrated in private companies and in firms of mixed ownership (without foreign participation).

The structure of innovation-related expenditures is archaic. In terms of innovation technology expenditures, the share of R&D related to the development of new products, services, production (transfer) technology and new production processes amounted in 1998 to 18.3%, down on the 1997 level of 19.6%. It should be noted that the relevant share in the OECD countries exceeds one-third of all innovation-related spending. Purchases of machines and equipment made up the largest share (48.1%) of innovation-related expenditures by Russian firms. At the same time, purchases of new technology accounted for only 2.4% of total spending on innovation (including 0.5% of expenditures on patent rights and licences for industrial designs and useful models). The smallest share of total innovation-related spending in 1998 related to the training of personnel (0.5%) and market research (0.6%).

As far as the *structure of innovation expenditure sources* is concerned, an overwhelming majority of companies (76.9%) relied on their own capital; the share of foreign investments amounted to 10.2%; federal budget allocations did not exceed 3%; and allocations from regional and local budgets were insignificant at 0.28%. Some 2.6% of total spending on innovation was sourced

from extra-budgetary funds. This testifies to both the low level of co-operation in the innovation sphere and the lack of real opportunities to attract borrowed capital.

Foreign experience has so far failed to have any tangible effect on technological innovation in Russia. Only 28% of technology-buying companies imported technology from other countries, with the bulk of purchased scientific and technological innovations having been produced domestically – Russian businesses seem to be in no hurry to acquire sophisticated foreign technology.

Most innovative entrepreneurs in Russia do not seek entry into foreign markets. They take pains to preserve the status quo or to create new markets for the sale of their products in Russia and the CIS, focusing more on cost reductions than on quality improvements. Small businesses (employing up to 49 workers) constitute a notable exception; they pay considerable attention to quality improvements, as well as to scaling down environmental pollution, raising the degree of production universality, and improving working conditions. Such measures allow small businesses to gain competitive advantage over other producers. It should be noted, however, that their share of innovation-related spending remains very modest, the highest concentration of innovation expenditures (85% of the total) being shown by large enterprises.

A 1998 survey undertaken by the Russian Federation State Statistics Committee to identify the *factors hampering innovation* showed that 74% of the polled companies cited the deficit of equity capital as the key barrier to innovation among the six most important economic, production-related and other negative factors. The second and third most significant impediments were identified as:

- Insufficient financial support by the state.
- The high cost of innovation.

Lack of equity capital on the part of enterprises could be *offset by the existence of external investment sources* which, however, have been reduced to virtually zero following the 1998 crisis. However, the conditions for attracting borrowed capital are gradually becoming more favourable.

The financial aspects stressed by the polled companies should not be over-emphasised. It should be borne in mind that the survey involved innovation-oriented producers for whom lack of equity capital presents the greatest barrier. On the one hand, only innovation-oriented firms will be confronted by this problem. On the other hand, lack of financial resources, particularly of equity

capital, may result from a number of factors, among which the potential investors' own inefficiency and the absence of well-functioning innovation institutions.

The majority of Russian enterprises are inert. They do not analyse or forecast market development trends, and very often have neither the desire nor the opportunity to collect, process or utilise technological or economic information. Their readiness to take risks, even calculated risks, is very low. They are not accustomed to maintaining efficient links with research organisations, consulting firms, consumers or suppliers, to promoting co-operation with other enterprises in search of new economic or investment opportunities, or to upgrading the professional skills of their employees. The structure of their innovation expenditures is archaic, with most enterprises preferring to spend the bulk of funds on purchases of new equipment (largely domestically or CIS-manufactured), rather than on R&D or the acquisition of patents and know-how. Russian firms are in no rush to catch up on sophisticated foreign technology.

Small innovative businesses and ventures

The number of small innovative enterprises *remains insufficient* even allowing for the low level of demand for innovation which characterises the situation in Russia today. Most of these enterprises are in machine-building and metalworking (37.7%), light industry (13.5%), the food industry (12.3%), and woodworking (13.1%). All in all, some 50 000 small technology companies employ 200 000 workers in Russia (of which not more than 10% are really operative). The aggregate value of their sales amounts to RUR 30 billion. Industries with the highest degree of monopolisation (the fuel and energy sectors, and ferrous and non-ferrous metallurgy) provide the least favourable opportunities for small business development.

A number of projects have been initiated and financed by foreign-based charity foundations *supporting small-business development in Russia*. For example, the British Council is working on a series of programmes aimed at bridging the gap between science-intensive projects and venture investments. In 1998-99, the Eurasia Foundation, together with the Federal Foundation for Small Business Support in Science and Technology, conducted a programme to develop consulting support for small innovative enterprises. The Science Ministry, with assistance from the Russian Technological Development Foundation and the Innovation Agency, held an open competition for innovative scientific and technological projects under the slogan "New Technology for a Specific Industrial Enterprise", sponsored by the Russian Technological

Development Foundation. The Russian Federation's Education Ministry has actively supported the development of enterprise within the college and university community. This kind of activity should be further promoted.

Russia's Science Ministry has contributed to the creation of an *investment risk insurance system* by holding a series of seminars for businessmen and scientists in Moscow and St. Petersburg, and concluding agreements with the insurance companies *Ingosstrakh* and *Ost-West Alliance*, the Russian affiliate of Europe's largest insurer, *Alliance A.G.* The choice of insurance partners working on foreign markets was not accidental, and was determined by the fact that in most cases the commercialisation of R&D results involves either exports of new technology or science-intensive products, or imports of equipment.

Sources of venture financing

In today's Russia, only 20 venture funds are actually in operation, controlling a total of USD 2 billion. Nearly 25% of the total amount has already been invested, and some USD 1.5 billion will be invested in the near future (for reference, in the United States, venture capital amounted to USD 37.7 billion in 1995). Almost all of the venture funds operating in Russia are financial institutions involving foreign capital. They include, first and foremost, several Regional Venture Funds (RVFs) and Small Economic Entity Financing Funds (SEEF), in which EBRD is a 100% investor, as well as other direct investment funds (such as the Russian Technological Foundation), in which EBRD is a co-investor.

Russia-wide, *27 mutual funds are in operation*. However, their assets total a mere RUR 2 billion. As regards Russian insurance companies and pension funds, they remain too weak to present a significant source of venture capital. In countries with advanced venture industries, about 50% of venture capital is sourced domestically, and in those Western nations where venture investments began to develop recently, national capital sources are prevalent. However, there is actually no national capital in Russia's venture industry, and this is considered to represent a major barrier to its development. Investments have so far been available only from EBRD and the US Government.

Other factors which have slowed down the development of venture investments include the *low liquidity of venture capital* in Russia resulting from the absence of an IPO (initial public offering) market; the low level of confidence in Russian companies on the world market; and a lack of experience in the acquisition of companies by large Russian enterprises.

Unlike the United States, the group of the major clients of Russia's venture financing system has included exporters, producers of import-substituting products, and even import-dependent companies, rather than businesses oriented towards technological innovation. Only 1% of Russia's venture investments has been channelled into the high-tech sector. Investments in technological companies have not exceeded USD 5 million (this figure refers to the institutional market of venture capital; estimates of the volume of business angels' investments are not available). Indeed, of all the venture funds established in Russia with EBRD participation, the Russian Technological Foundation seems to have been the sole investor in new technology (having completed seven transactions with an average volume of investments of USD 500 000 per transaction).

Asked *which sources of financing they regarded as most significant*, small innovation firms cited, at the top of the list, the Foundation for Small Business Support in Science and Technology, followed by the Science Ministry, the Education Ministry, and other municipal funds and business support programmes. Some companies which have already progressed beyond the start-up stage of development have tried to obtain bank loans.

Although the *regional venture funds* are yet to become a meaningful source of investments in new technology, they already play a positive role in Russia's venture capital market development by:

- Demonstrating to other companies' managers that venture capital can be highly efficient in Russia.
- Attracting private investors to the Russian market (and thereby serving as a market development catalyst).
- Encouraging the development of Russia's venture industry professionals.

Financing the different stages of venture business. As a rule, investment shortages are felt most acutely at the start-up stage. Regional venture funds step in to offer their financial support at later stages. An investment-seeking company is required to have a volume of sales compatible with the average size of RVF investments (USD 300 000-500 000 as a minimum, with an average of USD 1 000 000-2 000 000). At the foundation and start-up stage of a small firm, the required volume of investments amounts to some USD 50 000.

The risk assessments made by RVF managers (these funds actually perform as budget-financed organisations) are not exclusively market-based, which means that the minimisation of risks they require is not the minimisation

needed in considering an investment project (although the RVFs perform that function as well); rather, it is minimisation of risks by a bureaucrat expected to bear full responsibility for a project's failure if financing is denied, but capable of easily explaining his negative financing decision by reference to "Russian specifics". Thus, the RVF senior managers are strongly motivated *not* to provide investments, and are insufficiently motivated to maximise the returns on their funds' capital.

While clearly understanding that such projects often yield the largest investment returns, RVF senior managers are *very reluctant to consider high-tech projects*, often for reasons linked to what can be termed "techno-nationalism", *i.e.* out of fear (often well-grounded) that a high-technology project amply financed by an RVF may present a strong challenge to Western industrial leaders controlling a particular regional market. This kind of fear is all the more relevant since most projects in "traditional" industries (food industry, etc.) are oriented first and foremost to fulfilling domestic market demand, whereas high-tech projects are most efficient when their products are sold on international markets.

Thus, for all the positive trends observed, Russia *has yet to create a genuinely efficient system of small and venture business support.* Such a system is crucial for a number of reasons. On the one hand, large Russian enterprises lack flexibility and are averse to innovation. Russia has had a tradition of creating new enterprises to commercialise new products. On the other hand, patent statistics show that it is individuals, not enterprises, that have the most impressive innovation potential (they own more than two-thirds of the nation's patents). Therefore, an efficient system of innovation support to businesses can, given the newly resumed economic growth, encourage patent-holders to start up their own businesses by "sowing and reaping" their innovative ideas in the production sector.

Co-operation and integration processes

As noted above, there has been considerable progress in the development of the *national innovation system infrastructure.* Specifically, a system of State Science Centres has been set up and work is underway to create a series of federal Science and Hi-Tech Centres in strategic areas of science and technology. There is a Foundation for Small Business Support in Science and Technology, a Federal Foundation for Small Business Development, and a system of extra-budgetary funds of technological development.

There are *technology pools* at 60 colleges and universities across Russia. In regions with considerable scientific and technological potential, a network of regional Innovation Technology Centres (ITCs) is being set up. Today, there are 18 such centres financed from the federal budget, and 17 centres financed from the regional budgets; a total of 266 small businesses have been set up under their supervision, providing 6 000 jobs for qualified specialists. The volume of products sold by these firms has grown by 50% to 100% annually. ITCs have been set up on the vacant premises of institutions and organisations unable to pay maintenance costs. In 1998, firms operating under 18 ITCs produced RUR 390 000 000 worth of goods and paid a total of RUR 46 000 000 of taxes, having received only RUR 75 000 000 from the federal budget. In 1999, the Science Ministry announced a drive towards the creation of a federal ITC network supervising some 500-600 innovation and technological companies.

Since 1999, the Science Ministry, together with other relevant ministries, has been involved in setting up *Innovative Production Complexes (IPC) on the basis of scientific institutions, ITCs and industrial enterprises.* It is hoped that the institutional unification of entities at different stages of the innovation cycle will help to reduce the time involved in the development, commercial production and marketing of competitive products.

The most promising pattern of *innovation investment activity* has been shown by St. Petersburg, where the Regional Foundation for the Scientific and Technological Development of St. Petersburg, the Russian Technology Venture Fund, and a number of technology pools and innovation centres have worked to complement each others' efforts, and where an Innovative Production Centre Construction Programme has been implemented.

Thus, some experience has been acquired in *organising co-operative processes in the area of science and innovation*, although it is difficult to diffuse on a grand scale due to the production sector's insufficient openness to innovation.

The science system

Number of scientists. In 1998, there were 58.2 R&D specialists, including 28.4 researchers, per 10 000 population in Russia. The relevant figures in the structure of employment were 134 and 65.2. These generally high indicators mark, however, a notable drop from the level of a few years ago. Even today, the number of researchers per 10 000 employed citizens in Russia is significantly higher than the OECD average (55 researchers per

10 000 employees in 1995). The large number of scientists is a "traditionally" Russian phenomenon; in the past, the level was even higher.

Distribution of researchers by sectors of science. Of the total number of researchers, 29.8% worked in the state sector; 65.3% in private businesses; 4.8% in higher education, and 0.04% in private non-profit institutions. To ensure the integrity of scientific and innovation processes, this balance needs to be shifted in favour of the higher education sector, starting with a reduction in the share of the state sector. State-owned enterprises, as a rule, are too large and lack flexibility.

The period since 1990 has been marked by *a reduction of the share of researchers* in the total number of R&D workers (Table 2).

Table 2. **Distribution of R&D researchers, by category of personnel**

Thousands

	1990	1998	1998-90 (%)
R&D workers, total	1 943.4	855.2	44.0
Researchers	992.6	417.0	42.0
Ratio of researchers to total R&D workers	51.1	48.7	–

This trend cannot be explained by changes in the nature of research activities or by the need to provide better working conditions for researchers. If it persists, it will undermine the efficiency of scientific organisations.

The age structure of qualified scientific personnel is extremely unfavourable. The share of researchers aged 50 and above exceeds 35% of the total, including nearly one-half of Candidates and 81% of Doctors of Science. Approximately one in ten scientists is over 60 years of age (including 14% of Candidates, and 44% of Doctors of Science), and only 9% are under 29 years of age. The average age of members of the Russian Academy of Sciences is 58, which is very close to retirement. In 1998, the average age of full Academy members was 68.2, and of corresponding members, 63.2.

The *negative trends leading to lower quality parameters of scientific personnel* are related, first and foremost, to the low level of earnings in science (approximately USD 65 to 70 per month in 1999). As a result, specialists capable of earning considerably more in other sectors have been abandoning science. The issue of personnel rotation and preservation of scientific schools

has become Russian science's most important strategic problem. Meanwhile, college and university graduates account for only 8% of newly employed workers.

The *hidden unemployment* occurring in the scientific community manifests itself in the rise in unpaid leave of absence and a reduction in the length of the working week. Whether these tendencies can be curbed will depend on whether R&D funding increases as a result of reforms and restructuring or – which would be far more economically efficient– due to enhanced demand for the outputs of scientific research.

Russia's *expenditures on science as a share of GDP* amounted to a mere 0.93% in 1998 – 2.4 times below the OECD average. For reference, in 1990 the Russian share was 2.03%. The economic crisis dealt a painful blow to science financing. With economic growth appearing more and more likely, funding for scientific research may be expected to grow in both absolute and relative terms.

Demand for scientific research products by both the state and industry plays a crucial role in the development of the national science system. Insufficient demand can be explained, first and foremost, by the absence of investments in the economy, and by the embryonic condition of Russia's innovation system. The state has remained the single largest source of science financing (52.2% in 1998).

The role of the business sector in science financing

The development of science and the use of scientific research results in the innovation process would be unthinkable if the business community did not show a lively interest in the country's scientific advancement. The aggregate share of Russia's business sector in R&D financing increased from 15.5% in 1997 to 17.3% in 1998, while the share of federal budget allocations fell from 59.6% to 52.2% over the same period (direct budget expenditures on R&D, and indirect financing channelled through state-owned industrial enterprises and higher educational institutions). However, these figures should not be interpreted as a sign of the business community's growing interest in R&D. The share of the business sector's expenditures grew only because of the drastic cuts in the share of government spending in the wake of the August 1998 crisis. In other words, given the simultaneous decrease in the volume of both governmental and non-governmental spending on R&D, the former dropped at a somewhat faster rate. This can be explained by the fact that the development of national science continues to be financed from the federal budget on a residual

basis, with the "residue" being the difference between two large amounts, and thus very sensitive to any changes in their values in times of crisis.

If the figures for R&D financing by the business community were recalculated using the official consumer price deflator, the volume of financing would have shrunk by 10.2%. Based on another factor – the GDP deflator adopted by the Economy Ministry in 1998 – the recalculation would show a very modest (2.8%) rise in financing. The consumer price deflator appears to be a better indicator since it more accurately reflects the structure of science-related expenditures, showing that the bulk of these expenses is made up of salaries and wages (including social security deductions). Other expenditures on science (purchases of equipment, cost of repairs, etc.) fell sharply at the end of 1998, when the prices of relevant goods and services soared after August. It should be borne in mind that payments by firms for R&D purchases were made for the most part at the year's end, when the rouble's value in real terms was much lower than that resulting from recalculation based on either deflator.

Thus, *it is too early to highlight any growth in the business sector's interest in R&D.* This conclusion is confirmed by the fact that in 1998 the share of innovative enterprises that had purchased R&D results from other parties during the previous three years, amounted to only 20.8%. This can be partly explained by the lack of free money, and especially legal free money, at the disposal of most enterprises.

The dynamics of the ratio of basic to applied R&D was characterised by the share of applied research dropping by nearly one-half from 33.4% in 1991 to 16.9% in 1998, and the share of basic research sharply increasing (Table 3).

Table 3. **R&D structure**

Percentages

Type of R&D	1991	1995	1996	1997	1998
Basic research	9.3	15.7	15.8	17.7	16.1
Applied research	33.4	18.1	16.2	16.8	16.9
Development	57.3	66.2	68.0	65.5	67.0

These *changes to the structure of R&D* can be explained by the fact that, traditionally, the greater part of basic research was conducted by the institutes of the Russian Academy of Sciences and financed from the federal budget, partly through the Basic Research Fund. Applied research in the USSR was financed by various ministries, government agencies and industrial enterprises, and supported by sizeable allocations from the defence science and technology

budget. This explains the drastic cuts in the share of the state-funded R&D which occurred during the post-Soviet period of reforms. It is expected this share will grow rapidly as demand for innovation increases.

As regards *R&D targets and objectives*, economic development ranks first with 38.7%, followed by general scientific advancement (27.6%), preservation of the defence potential (22.6%), and peaceful exploration of space (0.4%). This structure reflects the dual task faced by the scientific community: to secure the promotion of new technology while preserving the core of national science.

Thus, *despite the protracted period of low demand for scientific products, the Russian science system appears viable.* The vector of its activity has shifted towards basic research, where Russia is one of the world leaders. Although the total number and share of researchers in the structure of R&D specialists has gradually fallen off and problems have arisen in the area of personnel rotation, the rate of these processes has slowed over the past few years, and a reversal of the negative trend can be expected as economic growth resumes and Russia embarks on a path of innovative development.

Patenting

The low level of innovative activity in Russia explains the fact that the number of patent requests filed by Russian applicants in foreign countries in 1996 (14 384) was three times as large as the number of patent requests filed by foreigners in Russia (4 908). In the OECD countries, Russian applicants filed 7 888 requests, while the reciprocal flow amounted to 4 404 requests. In 1996, the number of Russian patent requests filed abroad grew by 62% compared with the 1995 level, and increased three-fold compared with 1992. The distribution factor (the number of Russian patent requests filed abroad to that of requests filed at home) was 0.8 in 1996.

Russia's self-sufficiency factor was very high (0.77) in 1998, showing the share of Russian patent requests filed in the total number of requests filed with the national Patent Agency. The share of patents awarded to non-residents was 17.6%. Of the developed countries, the relevant share was lower only in Japan (13.1%), with the US share amounting to 45%, and Germany's share to 65%.

The number of foreign to domestic patent requests (*dependence factor*) was approximately 0.3 in Russia in 1998. The most prolific foreign applicants for patents in Russia was the United States, with 20.8% of the total patents awarded in 1998, followed by Germany (14.4%), France (7.2%), and the United

Kingdom (4.7%). The share of all the OECD countries in the number of patents awarded to foreign applicants in Russia in 1998 was 79.7%.

The *intellectual property market* in Russia is virtually non-existent, although there is an impressive list of ready-to-use scientific research results in the form of patents, licences, etc. The number of agreements on licence trading and patent right cession totalled 1 616 in 1998 – a rather modest figure, although double the level of 1993. The aggregate number of patents effective in Russia in 1998 was 173 081, up nearly 300% on 1993. There are 1.2 patents per 10 000 population in Russia. However, the low rate of market development has led to the above-mentioned potential lying untapped and quickly becoming out of date.

To sum up, although the indicators of Russia's applied research activity are impressive, the commercialisation of its results is proceeding only slowly, and its impact on innovation has been almost insignificant. An indirect proof thereof is the low level of intellectual property market advancement (the share of the number of domestic agreements on licence trading and patent cession in 1996-98 in the number of patents awarded to domestic applicants was less than 7.2%). The poor innovation climate is reflected in the high self-sufficiency factor, as well as in the fact that the flow of patent requests from Russia to foreign countries is 80% higher than the reciprocal flow.

Foreign trade in intellectual property

Technological balance

Russia's *volume of foreign trade in intellectual property* totalled USD 100 500 000 in 1998 (exports plus imports), nearly 65 times less than that of the United States (excluding intellectual property transactions between US firms and their daughter companies abroad). The value of imports (USD 57 700 000) exceeded export revenues (USD 43 800 000) by 40%. In the United States, in contrast, exports were nearly five times higher than imports.

Despite this striking difference between Russia and the United States in the value of intellectual property trading, its *share in total foreign trade* is almost identical (0.08 in Russia *vs*. 0.09 in the United States), which testifies to the modest size of Russia's foreign trade turnover, but also reflects the country's efforts to become more involved in global intellectual property exchanges.

Technical services accounted for the largest (40.2%) share of Russia's total intellectual property trading in 1998, followed by scientific research (13.3%),

invention patents (11.7%), know-how (5.6%), and patent licences (3.6%). Industrial designs and trademarks were at the bottom of the list, with 0.05% and 0.007%, respectively.

As regards exports, technical services yielded the largest revenues, amounting to USD 19 100 000 (or 44.7% of the total). Invention patents ranked second (19.4%), scientific research, third (14.1%), and know-how, fourth (7.2%). The shares of patent licences, industrial designs and trademarks in total export revenues were insignificant (0.8%, 0.1% and 0.009%, respectively).

The structure of imports is somewhat different, although here, too, technical services ranked first, with a 36.9% share (USD 21 300 000) in total payments for imports. Scientific research products accounted for 12.6% of all imports. The shares of imported invention patents (5.9%), patent licences (5.5%) and know-how (4.4%) were roughly equal. The number of domestic agreements on licence trading and the cession of patent rights in 1996-98 to the number of patents awarded to Russian applicants amounted to a mere 7.2%, with the share of trademarks being negligible (0.005%).

The United States is Russia's most important partner in intellectual property trading. In 1998, exports to the United States yielded 52.3% of all export revenues, and payments for US products amounted to 42.7% of the total. EU Member States ranked second, accounting for 16.9% of all exports and 31.7% of all imports. It should be noted that there were no imports of Japanese technology in 1998, and exports to that country amounted to only 0.5% of the total. The entire volume of CIS technology imports consisted of imports from Ukraine.

Thus, although the volume of Russia's intellectual property trading has been rather modest to date, its share in the country's total foreign trade actually matches that of the United States. Despite the existence of an impressive scientific potential, Russia's intellectual property imports have exceeded exports, which shows that the country still lags far behind the rest of the world.

FOSTERING AN INNOVATION CLIMATE

Russia has an impressive scientific potential, a high-quality education system and a large pool of qualified technical specialists. However, as can be seen from this report and the survey cited above, the Russian entrepreneurial

spirit is totally undeveloped and the investment risks to which both internal and external investors are exposed remain too high. The basic "motivating forces" of the innovation process in Russia have yet to be adequately developed. The role of market forces has risen, but market relations have yet to become a meaningful factor. The market-regulating laws are fragmentary and contradictory. The institutional base is incomplete, and structural reforms are still at the initial stage. Russia has never actually been involved in the modern processes of innovation globalisation, except in those areas of activity supported by international foundations. Where exceptions have occurred, these have often had a bitter flavour, boiling down to cheap sales of intellectual property or the hosting of environment-polluting foreign production plants on Russian soil. To deal with such problems, Russia needs time, experience, political will and an efficient democratic system.

The investment climate. Russia's banking system is seriously underdeveloped. The August 1998 crisis threw into bold relief the fact that the Central Bank's control over banking activities had often been insufficient. Confidence in the banking system, lost in the wake of the 1998 crisis, has been restored with great difficulty and most citizens prefer to keep their savings at home. The stock market is weak and the level of enterprise capitalisation extremely low. Speculative capital is preferred over production capital. The system of investment-protection instruments is rather vague, particularly where foreign investors and shareholders with no blocking parcels of shares are concerned. The latter factor restricts the opportunities for investors to make modest investments in small businesses – a major disadvantage for enterprises and investors alike.

Property issues. The numerous inefficient property holders in Russia often have no strategic interest in production development. The privatisation processes taking place in the country have been far from optimal. The nature of the innovation process and the type of property ownership are beginning to display a degree of interdependence: the further a property item moves from state ownership, the more efficiently it is used. Thus, with the average 12.7% share of truly innovative products in the total output of innovative enterprises, this share does not exceed 10% for state-owned enterprises and 10.2% for those based on mixed ownership (with no foreign participation);. However, the share rises to 12.9% for private companies, 18.4% for foreign-owned enterprises, and 38.1% for firms based on mixed ownership (with foreign participation). The fact that foreign-owned enterprises do not appear in this list can be explained by the complete lack of competition for their "ordinary" (formally non-innovative) products which are quite novel to Russia.

The expansion of the sector of efficient property owners has been seriously hampered by the absence of clear enforceable laws and the lack of a well-functioning bankruptcy system. As a result, Russia is compelled to maintain – largely by selling its resources and plundering those sectors which perform efficiently – the enormous burden of unprofitable enterprises inherited from the Soviet era. In 1998, for example, half of the nation's industrial enterprises were loss-making, with their aggregate losses amounting to 6.2% of Russia's total industrial output. On the other hand, some "bright" managers have taken advantage of legislative loopholes to organise false bankruptcy procedures in order to avoid the payment of accumulated debts or to purchase at below the market price an enterprise with a well-functioning production cycle and a solid market position. Successful attempts to re-distribute property through a reliance on non-market mechanisms have been reported.

Risk insurance is rudimentary. The state insurance system is weak and private insurance is insufficiently supported. The existing system of laws and regulations fails to provide for the legal use of returnable financing by state-owned non-commercial foundations or extra-budgetary R&D funds. Any such attempts lead to the application of the Lending Institutions Law, which hinders the settlement of legal disputes over claims for the return of loans. Start-up funds, which enable enterprises to reduce the level of risks associated with investments in innovation projects, could help to consolidate the national insurance system. So far, no such funds have been established. Neither do the banks have any incentive to participate in venture business financing.

No laws have yet been passed to regulate the performance of venture capitalists in Russia. In fact, until recently, national legislation made no mention of venture investment as such. As a result, the pre-investment period in venture capital investment projects is drawn out over at least 18 months. All the preparatory stages, including the choice of a subject for investment, the evaluation of various investment risks, and negotiations with the project initiators, *i.e.* the owners or managers of an enterprise, can be completed within three to four months. The rest of the time is taken up by the registration of the investment project with the Central Bank (the opening of Category "I" and "T" accounts), prospectus registration with the Federal Securities Commission (FSC), and co-ordination of various matters with the Ministry for Anti-Monopoly Policy and Enterprise Support, tax-collecting agencies, etc. As a result, venture funds or some of their participants, and even recipient enterprises themselves, have sometimes withdrawn from investment projects because the registration procedures had been dragged out by the relevant government agencies. The chain of co-ordination and registration procedures accompanying

a company's closure is no less time-consuming. Clearly, the more intricate the procedure, the greater the opportunities for corruption.

Russian legislation provides no regulation of venture fund activity. Under Russian law, pension funds – which in the United States and Western Europe are the largest suppliers of capital for venture funds – are not allowed to invest in venture funds. Regrettably, the draft laws currently under consideration fail to provide any reason for optimism. Specifically, the draft law "On Investment Activities and State Innovation Policy" defines venture investment funds as "non-commercial organisations established by legal entities and/or individuals based on voluntary property contributions and/or voluntary investments in exchange for stock capital shares, to finance the development and production of new types of products and/or technology involving a high level of risks". On the one hand, the prospect of the term "venture fund" appearing in national legislation is a positive development; on the other, defining such a fund as a non-commercial organisation is completely at odds with the essence of venture investing. The application of the existing law has given rise to considerable problems.

Admitting foreign venture capital to the Russian market (and foreign investments in general) is a very complicated procedure. Since most venture funds currently operating in Russia involve foreign investment capital, this is an issue that needs to be dealt with and solved without delay. The combined assets of existing venture funds exceed the value of Russia's entire development budget for the year 2000.

What distinguishes Russia's *tax benefit system* from its Western analogues is that it does not encourage investments in research and development but merely supports scientific organisations engaged in R&D.

The current rules relating to the calculation of *taxes on profits* provide for the exemption of R&D expenditures from the tax base. Intangible asset amortisation is included in the cost of products, jobs and services. In addition, firms which carry out R&D, experiments, design, or the technical retooling of their production, as well as those introducing innovations, may be entitled to a tax credit for the payment of taxes on profits. These benefits may only come into operation once Russia has solved its general taxation-related problems. The weak system of tax control and tax collection renders these and other "classical" methods of innovation stimulation virtually meaningless.

VAT-related benefits may prove to be more efficient. R&D financed from the budget, as well as from the special extra-budgetary funds of ministries, other government agencies and associations, are exempt from this kind of taxation, as

are the contractual jobs fulfilled by educational and scientific institutions, and patenting and licensing operations (except intermediary) involving industrial property items or copyrights.

The land tax exemption granted to organisations conducting R&D and to higher learning institutions, regardless of the efficiency of their performance, allows them to survive but provides no incentive to function more efficiently. The same is true for other tax exemptions offered to scientific organisations financed from the federal budget.

It is expected that many of the provisions of the current tax laws will be replaced by the norms written into the Russian Federation Tax Code (Part Two) passed by the State Duma at its first reading. Preliminary analysis of the draft shows that it is likely to hinder, rather than encourage, Russia's efforts to create a favourable innovation climate. The sections on "Subjects of Relations" (Article 9), "Institutions, Notions and Terms" (Article 11), and "Special Tax Regimes" (Article 18) do not specifically define innovation cycle participants. As before, the entities (subjects) and processes (objects) of innovation activity remain outside the framework of tax legislation. The question remains open as to which taxation rules will be applicable to budget-financed organisations, small innovative enterprises (SIEs), Federal Hi-Tech Centres (FHTCs), finance and industry groups, science towns and other subjects of innovative activity (such as technopolises, technology pools, personnel training centres, product certification centres, intellectual property protection agencies, etc.). An analysis of Part Two of the Tax Code in terms of the key instruments of tax policy aimed at encouraging innovation, shows that many of the current tax benefits have either been excluded from the Code or have been made subject to significant restrictions. The need for this kind of changes is not clear.

Intellectual property

As far as this issue is concerned, it is clear that, under certain circumstances, intellectual property may become an intangible asset, *i.e.* part of a company's property. However, the financial and economic mechanisms applicable to this new property's turnover and accounting are rather vague, since matters related to intellectual property's inclusion in an organisation's authorised capital, mortgage, transfer to trust management, etc., remain unresolved. The financial success of an enterprise will depend to a considerable extent on how competently the value of intellectual property is assessed, and how professionally the operations with intellectual property are reflected in the company's books.

Protection of intellectual property rights. As regards intellectual property, Russian Federation legislation generally complies with international standards. Russia has ratified many international agreements and conventions dealing with intellectual property, including the Paris Convention on the protection of industrial property, the Madrid Agreement on the international registration of trademarks, the Nice Agreement on the international classification of goods and services for purposes of trademark registration; the Locarno Agreement on the international classification of industrial designs, the Patent Co-operation Treaty, the Strasbourg Agreement on the international classification of patents, and the Budapest Treaty of international recognition of microorganic deposits for patenting purposes. At the same time, the law suffers from a number of ambiguities and discrepancies that are not conducive to an innovation-friendly legal environment in Russia. These primarily relate to the following:

- Restrictions of the rights of intellectual property owners.
- Legislative ambiguity as to the rules of disclosure of commercial and production secrets.
- Weak control over the enforcement of law and observance of the rights of patent holders.
- No control over unfair competition.
- Inefficient application of legislation effectively protecting the title to industrial property.

Since the old Soviet-style innovation infrastructure was largely torn down in the 1990s, it is particularly important that a new infrastructure be created in its stead, which will prove viable under the very specific market conditions of today's Russia. This work is currently underway, but is by no means completed.

REASONS FOR THE STAGNATION OF INNOVATION ACTIVITY: PRELIMINARY CONCLUSIONS

Innovation activity in Russia is characterised by a wide disparity between the country's *sufficiently high innovation potential*, measured in terms of human resources, and its *strikingly low results*. This conclusion has been confirmed by independent observers. A survey of 16 new industrialised economies in transition, among them Russia, was undertaken in 1996, based on four generalising indicators (J.D. Roessner, L. Porter, N. Newman, H. Xu,

1996 Indicators of Technology-Based Competitiveness of Nations, NSF Report, Georgia Institute of Technology, Atlanta, 1997):

- *National orientation*, *i.e.* an indicator of activity aimed at raising the level of a country's technology-based competitiveness (Russia ranked 15th, between South Africa and Argentina).
- *Social and economic infrastructure* supporting the material, human, and organisational/economic resources essential to the performance of a modern, technologically advanced country (Russia ranked 9th, ahead of China, India, Mexico, Indonesia, Thailand, Hungary and Argentina, but after Poland and Venezuela).
- *Technological infrastructure*, *i.e.* the social and economic institutions that provide the potential for the development, production and sales of new technology (Russia ranked first, far ahead of the other countries).
- *Production potential*, *i.e.* the material and human resources underlying production and securing the efficiency of high-technology products (Russia ranked 7th, ahead not only of the "Tigers" – Singapore, Korea, Chinese Taipei and Malaysia – but also India and the Philippines.) In our view, this fourth indicator was overestimated since the experts considered, among other things, the existence of domestic supplies of materials and semi-finished products for high-technology production lines. In Russia, high-level supplies of this kind are primarily characteristic of the defence industry, for which the economic aspect of production has always been a sensitive point.

The reasons for the gap between the potential and the results can be divided into four major groups relating to: *i)* stabilisation*; ii)* creation of a competitive environment*; iii)* institutions*;* and *iv)* management.

Stabilisation (political; economic, including financial; and legal) enhances the degree of predictability and reduces the risks at each stage of the innovation process. The *competitive environment* creates incentives and increases innovation efficiency. The relevant set of *institutions* creates a sound legal base, facilitates the necessary organisational and informational interactions, and lifts their level and quality to a higher level. Clever *management* introduces a rationale, imparts social significance to the innovation process, and improves the degree and quality of innovative co-operation.

Major outstanding problems related to stabilisation

Russia's technological progress is impeded by the heavy burden of its huge, technologically backward and non-competitive industry. The current level of allocations for industrial restructuring is clearly insufficient. The available funds are inefficiently utilised. In addition, the situation in Russia is characterised by:

- Poor law-enforcement.
- A high degree of demonetisation of economic relations.
- Capital flight.
- A wide gap between the purchasing power parity and the market value of hard currency.
- High interest rates.
- A large proportion of idle or unprofitable enterprises that have not implemented bankruptcy procedures.
- A rapidly ageing (and backward) technological base.
- A cumbersome system of state social obligations.
- A high level of corruption, in many aspects resulting from the fact that the state is not separated from the business sector.
- A low level of public confidence in the national banking system.
- A high level of mutual indebtedness (both among enterprises and between enterprises and the state), undermining respect for contractual obligations.

Major outstanding problems related to the creation of a competitive environment

Established during the reform process, Russia's market mechanism proved viable in the aftermath of the August 1998 crisis. However, it is far from perfect. In particular, the conditions for the development of fair competition have yet to be created:

- The "rules of the game" are neither final nor equitable; for example, terms of access to, and presence on, the market vary for different market players.

- The state is not separated from the business sector.
- The law-enforcement system needs to be adjusted.
- A sizeable part of the economy remains “in the shadows”.
- The economy continues to be essentially oligopolistic.
- Preferential access to market, loan and tender preferences, etc., are often granted to businessmen with powerful connections in the top echelons, rather than to those displaying outstanding business talent. This in itself is an element of corruption and a corruption-breeding factor.
- Administrative regulation is excessive.
- The average size of enterprises and scientific organisations is artificially inflated.
- The share of inefficient property holders is large.
- There is little experience of the world economic system.
- Bankruptcy procedures are inefficient and need to be adjusted.
- Market relations are highly criminalised.

Major outstanding problems related to market institutions and the innovation process

- Economic relations between the federal centre and the regions, as well as among the regions, need to be systematised.
- The stock market is underdeveloped.
- Citizens have little confidence in the banking system.
- The system of investment protection and the relevant legal practices are weak.
- The tax system is inappropriate; the share of shadow dealings and semi-legal economic practices is too large.
- The system of investment risk insurance is under-developed.
- The legislative base for innovation activity regulation is weak.
- The level of information and consulting services for innovation is low.
- The mechanisms of intellectual property turnover need to be adjusted.

Major outstanding problems related to management

One of the most serious deficiencies of the national system of economic management (including during the pre-reform period) has traditionally consisted in the *underestimation of the importance of the human factor*. The Russian Government tended to "treat the symptoms" of economic illnesses instead of suggesting a coherent and constructive development strategy. Other problems include:

- Lack of a strong entrepreneurial spirit and market-based outlook.
- Inadequacy of management targets.
- A low level of innovation culture.
- No clear-cut policy priorities in the area of industrial innovation.
- Organisational weaknesses pertaining to the processes of co-operation.

Let us now proceed to answer the questions raised at the beginning of this report. Despite the low level of earnings in science, Russia has managed to retain an impressive scientific potential. Driven by inertia, the continuation of many research projects has been motivated by purely scientific interest. However, this situation cannot last. The researchers showing this kind of motivation are growing older and will soon be compelled to retire. There is no one to replace them: the younger generation will not accept the salary levels that can be earned in science today.

The gap between the large number of patents awarded to Russian citizens and the low level of technology employed in production can be explained by the *unfavourable innovation climate and the absence of a comprehensive, nation-wide innovation system* capable of connecting the national scientific potential and the direct results of its activity to the market.

Analysis of the innovation process in Russia shows that if the country is to pursue an efficient policy aimed at improving the innovation climate and creating a favourable innovation environment, the Russian Government should not confine its efforts to an elementary set of pro-reform measures but should embark on a long-term programme of national economic advancement and should press for a shift towards innovative development.

PART II

DEVELOPMENT OF RUSSIA'S INNOVATION CAPACITY: GUIDELINES AND TARGETS

GUIDELINES FOR ENHANCING INNOVATION IN RUSSIA

The key problem facing Russia today is how to overcome the gap between its strategic goals and its actual capabilities. On the one hand, the Russian economy has a *large but inefficient manufacturing sector* which continues to consume the greater part of the nation's material and financial resources. Its enterprises, equipped with machinery that was already outdated in the early 1990s, are a heavy burden on the nation. Only its human resources and defence facilities have the potential for restructuring. On the other hand, Russia enjoys a number of competitive advantages, including:

- A favourable geographical position.
- An impressive ecological potential.
- Considerable opportunities in terms of natural resources, energy agents and technological materials.
- Well-developed primary processing industries.
- A significant potential in the defence and adjacent industries (including the space, aviation, shipbuilding, and chemical industries).
- A large pool of patents, know-how and other industrial property items.
- A highly educated population and a vast network of educational institutions.
- A good system of higher education.
- Highly qualified scientific personnel and world-renowned scientific schools, particularly in the area of basic research.
- A potent power-producing base and energy infrastructure.
- A well-developed transport infrastructure (mainly, the pipeline and railroad networks).

The nation's well-being and the efficiency of its economy must be based on the intensive use of knowledge which needs to be permanently upgraded and materialised in the form of high-technology products and services. Economic growth must be financed through investments in both tangible and intangible assets (human resources, organisational change, R&D, dissemination of

innovations, training and retraining of workers and managers, market research, promotion of contacts between producers and consumers, etc.).

Using other countries' experiences in the area of innovative technology as a major factor of economic growth is particularly important for a country with very modest technological achievements in civilian industry and with little, if any, practical experience in organising the innovation process within the framework of a market-oriented system. However, as noted above, Russian enterprises tend to rely primarily on domestic R&D achievements and domestic technology. Therefore, a key task of government policy in this area is to create a system (beginning with an appropriate institutional framework) that can keep abreast of the latest foreign innovations, including organisational change, improve upon them and diffuse the results. This would enable us to assimilate modern innovation culture, raise the competitiveness of Russian products (initially on the domestic market, due to their relative cheapness), and bring the level of workers' and managers' qualifications in line with modern requirements.

This path of development would be a natural choice, given the lack of competitiveness of Russia's civilian industry, its technological backwardness, the reluctance of potential investors' to invest in domestic innovations, and the meagre financing of R&D. However, it would only represent a partial solution, since *a country that confines its innovation policy to the adoption of mainly foreign technology will never be able to join the world economic leaders.* It would be doomed to permanently lag behind.

Relying on its pool of highly educated professionals and its impressive scientific and technological potential (particularly in the area of basic research), Russia should embark upon the above-described path *only to steer onto a highway of innovative development* based on the ample supply of innovative ideas of its own.

While *stepping up its technological advancement*, Russia will need to pass through several consecutive stages of development (not necessarily marked by clear-cut time dividers) that would differ in terms of the types and sources of economic growth:

- The resource stage.
- The investment stage.
- The innovation-based stage.

The *resource stage* (at which Russia finds itself today) is characterised by orientation towards exports or the primary processing of raw materials. This stage corresponds to the "colonial" type of growth described in the literature, the only difference being that Russia should be able to proceed quickly to the investment stage of development by redistributing the resources accumulated in the course of its "colonial" activities.

The shift to the investment stage should be prepared by:

- Putting the national economy in order.
- Creating a set of mechanisms to promote competition.
- Expanding the zone of efficient property ownership.
- Creating and maintaining a favourable innovation climate in the country.
- Improving tax legislation and the instruments of its enforcement.
- Adopting international standards of product quality and environmental protection.

During and after Russia's shift to the investment stage, the government should provide leadership in creating and perfecting the instruments of:

- Mobilising human resources.
- Pursuing a policy of "limited isolationism".
- Attraction of large-scale private investments.
- Protection and utilisation of intellectual property.
- Creating and maintaining an appropriate innovation development infrastructure.
- Supporting science and orienting it towards the fulfilment of national priorities.
- Promoting interaction between scientists and producers.

In the early stages, the range of *state activities should be sufficiently wide*, despite certain restrictions on its ability to interfere in business matters. Gradually, the state should shift from "quantitative" to qualitative support with, where possible, a leap to the uppermost levels of technological advancement. The country should move away from predominantly-raw material-based performance and investments in innovation-simulating projects towards more

advanced sources of competitiveness. The government should do its best to activate all of the innovation environment factors, including public support for scientific research and innovation, the provision of high-quality education, the promotion of competition and co-operation, and the passing of new laws to protect intellectual property.

The state should play an increasingly active role in improving the country's business and innovation climate at the investment stage. Its function would be to promote fair competition, provide stronger financial incentives to innovation, and develop the relevant institutions.

A key task would be to create an infrastructure capable of encouraging the development of the business community's readiness to take risks in order to gain profits. Businessmen need to learn to organise internal co-operation in their enterprises, establish efficient ties with research centres, consulting firms, consumers and suppliers, promote co-operation with other firms in search of new business and investment opportunities, and upgrade the educational levels of their personnel. It would be necessary to develop the mechanisms of insurance, guarantees, and partial innovation risk compensation.

The innovation stage should prepare Russia for a shift to a higher level of advancement – to national development on the basis of predominantly domestic innovations. That implies switching innovation demand to domestically produced innovations. A well-adjusted process of accumulation and dissemination of knowledge should lead to significant growth in the number of highly educated people, a high level of patenting activity and a sizeable share of science-intensive technology in national exports. However, success in this direction will depend on the existence of a strong scientific base in Russia.

By the beginning of the period of innovation-based development, the environment-forming and information-disseminating functions of the state should have laid the foundation for innovation-based development regulation. The state should provide full-scale information support for industrial production, ensure the development of higher educational institutions and research centres, and promote their contacts with industry. At this point, the private sector, too, should be in a position to create and maintain efficiently performing specialised enterprises in science and technology, and shoulder the responsibility for personnel training and the development of domestic technology. Particular attention should be paid to raising the image of new directions of scientific research in the eyes of the general public.

IMPROVING RUSSIA'S INNOVATION CLIMATE: TASKS AND MEASURES

In modern Russia, government policy should provide for the full-scale development of emerging market structures and correction of failures, on the one hand, by the state itself, and on the other, by the market. Key tasks should include:

Co-ordination of government and public efforts to lay a solid foundation for a modern market economy that would encourage efficient innovation, including:

- Fostering a market outlook and entrepreneurial spirit in Russia's citizens; organising the training of specialists able to manage the market economy with due efficiency.
- Providing a comprehensive and consistent legislative base for market development.
- Building a basic infrastructure for the market economy (stock and financial markets, a banking system, and adequate information, consulting, legal and law-enforcement systems).
- Promoting inter-regional co-operation.
- Creating favourable conditions for the integration of economic entities in the world economic system, with reliance on both the existing and potential competitive advantages of the Russian economy.

Compensation for and correction of:

- Government policy failures, primarily excessive state interference in the innovation processes that serves to undermine the efficiency of market interactions.
- Imbalances between co-operation and competition.
- The private sector's tendency to underestimate the prospects of technological development owing to its inability to foresee or assess the likely advantages of innovation.
- Distortions in the development of the innovation system which lead to a reduction in the efficiency of the innovation potential.

- Systemic violations which hamper the promotion of innovation-enhancing interactions.

Putting the economy in order

The first and most important task would be to bring order to the country and to Russian society. This will require that the following measures be taken:

- Uproot corruption by separating the state from business and by gradually moving away from the practice of business "authorisation"; reduce restrictions to access to the market.*
- Enhance the transparency and reliability of the banking system and render the economic performance of companies as open as possible in real terms in order to create favourable conditions for the accumulation of citizens' savings in bank accounts or securities; prior to that, ensure that the accounting system complies with international standards, that the auditing system is improving, that balance sheets are published regularly, etc.
- Create the conditions for enterprises to fully legalise their economic performance (this would pull a sizeable part of the economy out of the shadows), restrict the outflow of capital, and prepare its repatriation.
- Create prerequisites for reducing the share of barter deals in Russia's trade exchanges – for example, by introducing a fixed share of non-monetary exchanges to be considered in the system of benefits and in fiscal relations with the state.
- See through a debt restructuring (including companies' debts to the state, and vice versa); impose stricter sanctions for mutual non-payments (which must be regarded as a serious offence against property).
- Activate the stock market and use its mechanisms to modernise production in the real sector of the economy. This calls for measures to level out trade and real-sector incomes.
- Expand the *efficient property ownership zone** by improving the legislative base and bankruptcy practices.
- Impose sanctions for false bankruptcy or deliberate actions leading to bankruptcy, including the thriftless use of assets.

- Radically improve the efficiency of state property uses by promoting competitive practices in the appointment of senior managers and approval of their programmes of action.
- Review existing legislation (and law-enforcement practices) so as to effectively protect investments. This would be particularly important for foreign investors as well as for shareholders with no blocking parcels of shares. Insufficient legal protection prevents these bodies from making modest investments in small businesses.
- Organise an investment risk insurance system with emphasis on the development of private insurance. Create start-up funds capable of acting as mobilising elements of the insurance system.
- Lift the legislative and regulatory restrictions which prevent the use of state-owned non-commercial and extra-budgetary funds to finance R&D on a returnable basis. Currently, attempts to do so lead to the application of the Lending Institutions Law, hindering the settlement of legal disputes over the lawfulness of claims for the return of loans.

To increase the efficiency and innovation-enhancing orientation of benefits, it will be necessary to specify the procedures and requirements for the granting of tax benefits, review those provisions of the tax law provisions which give rise to ambiguous interpretation, and provide a more detailed definition of the tax base.

Fiscal-based support

The government should encourage technological advancement by pursuing an appropriate tax policy* providing for:

- Preservation of existing tax benefits related to scientific organisations' principal activity.
- Accelerated amortisation due to reduced turnover time and the use of non-linear methods of its calculation for capitalised R&D expenditures.
- Tax credits allowing a reduction of the tax base by a specified percentage of R&D costs.
- Where the fulfilment of national priorities is involved, the full amount of R&D expenditures for the current period shall be deducted from the tax base (and sometimes, additional tax subsidies may be offered).

- Tax base calculation in accordance with internationally recognised economic norms and accounting standards.
- More detailed differentiation of the objects of taxation.
- Extension of VAT benefits for R&D to the regional level (currently, these benefits are only available for R&D financed from the federal budget, the special extra-budgetary funds of ministries, etc.). These benefits would be more efficient if they were available not only for state-ordered R&D but also for other R&D work related to the fulfilment of federal-level priorities.

Before passing Part Two of the Tax Code, an amendment to the existing legislation should be passed, providing for the following costs to be reflected as "other production costs":

- Rewards to inventors, authors of rationalisation proposals, and those facilitating the commercialisation of innovations.
- Amounts spent on patenting, enforcing protection documents, payment of rewards to those who facilitate the development and/or use of patented inventions and industrial designs, or acquisition of licences to produce goods (jobs, services) using patented inventions and industrial designs.
- Amounts spent on remuneration for product certification. Such a benefit would make sense in view of the economic content of the above-mentioned payments and the fact that it would encourage increased spending on the commercialisation of technology and R&D results.

Newly-founded enterprises should be entitled to profit tax benefits for the production of certain types of innovative products (on a sliding scale).

The final version of Part Two of the Tax Code should provide for a broader R&D cost capitalisation procedure whereby these costs would be reflected as the costs of production of the relevant goods (jobs, services).

In addition to direct tax benefits, the *mechanisms of investment tax credits (ITC)* securing the return and repayment of the benefits offered make economic sense. In considering the prospects for introducing ITCs, it would be advisable to discuss the possibility of guarantee provision and the potential for securing compensation for the reduced flow of revenue into the budget. The standard mechanisms of mortgage and guarantee could be complemented with *additional*

measures to compensate the federal budget for the revenue reduction resulting from the introduction of benefits related to the rescheduling of tax payments, and a system of guarantees could be devised to protect the state against a borrower's failure to fulfil his contractual obligations. These measures, which would be applicable pursuant to an ITC agreement to be concluded by an authorised government body, the ITC-seeking organisation, and the other direct participants in the process, could include:

- Reduced financing of investment programmes (or special-purpose scientific programmes) on a returnable basis.
- Full or partial termination of financial support for benefit-enjoying organisations and/or government programmes involving organisations financed from the federal budget.
- Reduced budgetary financing of a higher-level organisation (ministry, other government agency, etc.) or an enterprise holding the controlling block of shares.
- Slashing subsidies or other budgetary financial support for a subject of the Russian Federation who provides security for a guilty organisation, or revision of the terms of such Russian Federation subject's obligations to the federal authorities or federal budget.

Customs benefits may provide an equally efficient incentive to innovation as do tax benefits. Customs import duties should be charged on an escalating scale, rising from a low level for raw materials to a higher level for semi-finished products or component parts, and to a still higher level for finished goods.

Promoting competition

The development of a *competitive environment* requires clear and stable "rules of the game" (laws and regulations, appropriate institutions, and a system of preferences) to be established for market participants. These rules must be comprehensive, consistent and equitable. Decisions concerning a person's access to the market or preferential treatment during the distribution of loans or organisation of tenders must depend on that person's business talent, rather than his corruption-breeding connections in the top echelons.

Key elements of government policy in this area should include measures to:

- Activate anti-monopoly policy.
- De-centralise the country's economic capacities and, relying on the technological potential of large enterprises, set up small, economically independent and flexible production companies*, including through bankruptcy procedures.
- Encourage the development of legal business (this should help to draw many illegal and semi-legal enterprises out of the shadow economy).
- Adjust the law-enforcement machinery.
- Create efficient mechanisms of state loan distribution and tender organisation on a competitive basis.

Preparing the emergence and rapid development of small high-tech businesses

Business incubators are expected to play an important role in breeding small high-tech businesses. The state should act as the main organiser of these kinds of institutions. As a matter of priority, the status of an incubator and the rules of its interaction with the state need to be specified with due regard for the relevant international experience. The federal High-tech Centres can and must provide scientific and technological support for business incubator development, which would enable incubated companies to use the Centre's equipment and R&D results.

A system of *tax benefits and incentives for "business angels"* would be very helpful.

The development of *co-operative distribution and supply networks for small business** needs to be encouraged.

Leveraging venture capital

*The venture fund system**. The Russian Federation's Ministry of Science and Technology designed a programme of venture investment development that was later reflected in the science and innovation policy decisions taken by the Government Commission for Science and Innovation Policy. The government intends to participate in the creation of the system by contributing property worth RUR 100 million from the assets of its Russian Technological Development Fund. At later stages of its development, the fund is expected to invest capital borrowed from extra-budgetary sources. Both domestic and

foreign investors would provide money to replenish the authorised capital of this and other similar funds. The relevant agreements have been reached with the European Bank for Reconstruction and Development (EBRD), the administration of SITRA Management, Ltd., the International Finance Corporation, and the European Commission. Many regional governors have expressed support for the setting up of regional venture funds.

Seeking to develop the *venture investment system*, Russia' Science Ministry has concluded a number of agreements with the Taxes and Duties Ministry, the Ministry for Anti-Monopoly Policy and Enterprise Support, and the Economy Ministry. The following set of measures was scheduled for 2000:

- The registration and launching of the Venture Innovation Fund in St. Petersburg.
- Creation of an organisational/methodological base for the regional and intra-industry venture funds.
- Measures to organise trading in venture business securities, to be held at Moscow's Central Stock Exchange.
- Compilation of a list of innovation projects to be financed with venture capital, etc.

Access to finance and credit

Commercial banks should be a key source of funds for the promotion of innovation (until now, most enterprises have relied largely on their own financial resources). Bringing the refinancing interest rate closer to the rate of real inflation is a "must" as such a measure would lead to a reduction of the interest rate.

It would be desirable to review the benefits *granted to the commercial banks** which finance or provide loans for innovation projects. Specifically, a system of benefits should be worked out to link the share of innovation loans in the bank's total loans with the Central Bank's rate and rules of mandatory reserve formation, and with other parameters of bank activity that are subject to reflection in its relations with the Central Bank. Yet another benefit option would be partial return to a commercial bank of taxes paid, depending on the average term of loans it has extended over the previous year.

*The secondary market of securities** should be used as an important instrument of innovation financing. The creation of a specialised stock market would help accomplish the following two tasks:

- The stock market would enable small innovative businesses to accumulate capital through the sale of their shares.
- Venture funds would be offered an efficient strategy of "exit" from the companies in which they invest capital; this strategy would encourage venture financing.

As a first step to such a stock market, the project *Growth Market Saint-Petersburg, GMS*, should be implemented. Its objective is to create, in accordance with international standards, a new trading segment at the St. Petersburg Stock Exchange for the shares of innovation-based and growing companies in St. Petersburg, the Leningrad Oblast and the entire North-Western Region. The new market should provide opportunities for long-term capital investments for both Russian and international investors.

To keep the market working, urgent measures should be taken to comply with international requirements concerning information transparency and to organise stock trading in addition to the circulation of information and the marketing of shares. This would require a pool of specialists. In addition, floors should be opened for trading in the part of stock which has been distributed among a wide range of investors.

One example of trading floor creation is the "Russian Funds" project. The *Russkiye Fondy* (Russian Funds) Company, which purchased the controlling blocks of the Rambler Search System and the information site Lenta.RU jointly with the Orion Capital Advisors Corporation, has begun talks with the Moscow Inter-bank Currency Exchange and the St. Petersburg Stock Exchange on opening a trading floor in Russia where the shares of exclusively domestic Internet companies would be quoted. According to the management of Russian Funds, a specialised trading floor modelled after the US stock exchange NASDAQ should accelerate the development of Russian Internet sites into fully fledged business projects. The new trading floor would be used as a stepping stone for domestic Internet projects wishing to break through to Western capital markets.

Developing human resources

Mobilising human resources is central to creating a favourable innovation climate. The following measures need to be taken as a matter of priority:

- Work out and implement a national programme of innovation-knowledge dissemination and innovation-culture development.
- Draw up an inventory of existing scientific schools and pools of teachers, and determine the level of financial support required.
- Create a system of consulting services for innovative enterprises.
- Set up (within the next two to three years) a network of centres for the training and retraining of personnel, including managers and specialists in science and technology; upgrade the skills of regional administrators to enable them to deal with innovation activity issues in the regions; develop long-distance education programmes and provide the necessary equipment.
- Create the conditions for engineers and technicians to be able to move within the state and private R&D sectors, and shuttle between the two sectors and production.

To increase the impact of science on the innovation processes, *young scientists (post-graduate students) can be "planted" in companies* to implement specific applied research projects under the supervision of their dons in research institutes and universities, and subsequently obtain their diplomas and scientific degrees. This kind of "scientific intervention" can proceed within the framework of special programmes. Enterprises benefit from the consulting, scientific and technological assistance they need from the universities and research institutes, while building up a pool of highly qualified young businessmen.

It would be necessary to ensure that *well-educated and highly qualified specialists can move freely* back and forth between state-owned scientific institutions and high-tech enterprises. Staff of such state-owned scientific institutions should be granted special rights and benefits, including in relation to the use of intellectual property created with the financial support or participation of the state. Direct foreign investments can play a useful role in upgrading the skills of highly specialised industry personnel; specifically, in acquiring the ability to disseminate technological knowledge. The state could foster joint projects and encourage its employees to work part-time at such enterprises on beneficial terms.

Protection of intellectual property rights*

A well-substantiated long-term *programme to consolidate the system of legal protection and realisation of intellectual property rights,* including a system of evaluation of such property, needs to be adopted rapidly. This will require:

- Significant amendments to the Russian Federation Patent Law provisions having to do with in-house inventions; imposition of sanctions for violations of patent rights; secret inventions and foreign patenting; appeals against Patent Agency decisions, etc.
- Create a system of special patent courts, including courts of arbitration.
- Pass a law that would protect a person's title to intellectual property in science and technology.
- Pass a law on the basic rules of management of intellectual property in science and technology belonging to the Russian Federation.
- Codify the laws on intellectual property.

Mechanisms of innovation-based co-operation

State policy aimed at *promoting co-operation* among the core actors of the innovation processes should mainly target those types of economic activity that require stronger co-operative links to produce better innovation results. In the case of industry, these activities can be divided into four major groups:

- R&D-intensive production.
- Mass production.
- Production heavily dependent on suppliers in terms of technology.
- Production with a high level of specialisation.

To successfully promote innovation, *Group 1 enterprises* (which include pharmaceutical, aerospace and other industries), in addition to their own R&D work, need to have direct access to the basic research projects conducted by state research centres and institutions of higher learning. To some extent, this access is already provided by the technological centres, including those in the regions, but the need for co-operative links at the R&D level gives rise to problems requiring additional analysis.

Group 2 enterprises (which include, for example, light industry companies, transportation vehicle assemblers, etc.) need access to the technical projects conducted by small businesses within the science sector and at technical universities. This requirement has been partially met by the technology pools of colleges and universities, but wider access is needed. New forms of co-operation should be explored, for example within finance and industry groups.

Group 3 enterprises (the woodworking industry and the service sector) prefer to adopt new technology by purchasing plug-and-play equipment. Their innovation activity is heavily dependent on co-operation with suppliers. Increasingly strong competition among the latter, invigorated by the Federal Foundation for Small Business Support and the system of extra-budgetary funds supporting Russia's technological advancement and venture investments, is deemed to be crucial to improving the innovation aspect of co-operation.

Group 4 enterprises (for example, companies producing computers and PC software) conduct active R&D of their own, working in close contact with each other and with their customers. This kind of co-operation could be invigorated by the development of regional innovation centres and provision of support for the venture business.

The following measures would help to promote co-operation:

- A system of legal consulting services for innovation process participants should be launched with state assistance or participation.
- The scientific sector's infrastructure needs to be improved and diversified (modernisation of information services and scientific library networks; making them accessible to all organisations and individuals – probably, on a commercial basis).
- The system of scientific consulting services for innovative enterprises needs to be further developed.

Adopting world-class standards

It is vitally important for Russia to adopt international standards of product quality and environmental protection. Relevant measures should include:

- A single national centre for technological standards, technological development, and testing, development and demonstration of

production systems should be established based on the potential of the Russian Federation Committee for Standards *(Gosstandart).*

- Measures taken in the area of standardisation and certification (compatible with the GATT/WTO principles) should be regarded as instruments of internal market regulation and protection. This idea may be specified in the course amending the Federal Law "On Measures to Protect the Russian Federation's Economic Interests in Foreign Trade".

Enhancing the science system

To deal with the science sector's outstanding problems, the following measures should be taken as a matter of priority:

- Design and implement measures to raise the prestige of scientific activity, and create the conditions for scientists' incomes to exceed the average per capita earnings in industrial production. Specifically, a system of measures needs to be devised to preserve the national scientific schools and attract young people into the science sector; a special draft law should be passed to determine the status of the scientific worker and provide the latter with certain social guarantees.
- Develop the system of state support for R&D in the priority directions in science and technology, and in the area of critical technology.
- Improve the system of forecasting Russia's technological progress to provide analytical support for decision making to determine priority directions for scientific research.
- Based on the chosen set of priorities, reorganise the system of federal target programme (FTP) development for the various industries, including Federal Target Programmes in Science and Technology (FTPST) expected to provide a scientific potential and scientific base for the implementation of other FTPs within each particular industry.
- Draw up an "inventory" of highly qualified scientific personnel and monitor the key directions of activity and the potential of various organisations with a view to optimising the choice of scientific workers for the fulfilment of state orders, including in the course of contests among potential contractors.
- Co-ordinate scientific research conducted with state participation. For that purpose, compile the necessary databases on the various directions of research, and on scientific organisations and schools in

the areas of science related to national priorities. Co-ordinating interference should be recommended, rather than mandatory; therefore, it may be addressed to organisations involving any forms of property ownership and any forms of subordination, including the institutes of the Russian Academy of Sciences. Information pertaining to research co-ordination may also be used in decision making concerning national priorities.

Facilitating the diffusion of knowledge

Services related to the dissemination of knowledge are deemed to constitute one of the country's key priorities. An information network needs to be established for this purpose; modern computer equipment and means of communication should be installed in at least 50 basic infrastructure facilities (ITCs, technology-promotion centres, etc.); special software, including packages facilitating work on the Internet, need to be developed; and program-oriented databases on the key directions of innovation activity need to be compiled.

The lease of unique science-intensive equipment should be regarded as a very important element of support for innovation activities. At a time when the means of production appear to be hopelessly out of date, and financing is scarce, investments in the form of lease practices are particularly helpful: on the one hand, they invigorate the production retooling processes in each area of activity, on the other hand, they increase demand, diversify the order portfolio, and boost the development of investments.

There are plans to *develop the infrastructure* which should make it possible to comply with the Lease Law, which spells out the rights and responsibilities of the parties, establishing a sound legislative base for lease relations, and providing the mechanisms of state support for leasing activities. Of particular significance in terms of innovation support and innovation policy implementation is the fact that the lessors seeking to renew their pools of machinery and equipment are granted, in addition to accelerated amortisation, the right to write off as amortisation deductions during the first year of asset utilisation up to 35% of the initial value of the fixed assets with a wear-out period longer than three years.

Reaping the benefits of globalisation

The processes of globalisation have had a mixed effect on the Russian economy. To secure the country's gradual inclusion in the world economy, the government should provide support for domestic business activity by:

- Ensuring that managers duly learn the registration and certification rules effective in foreign countries, are able to organise distribution networks, are familiar with the specific features of national markets, etc.
- Setting up information and consulting centres to support the international co-operation processes involving Russian scientists and businessmen.
- Providing assistance related to the legal protection of Russian intellectual property abroad, including by shouldering the payment of litigation costs.

It would make sense to draw up a list of areas in which Russia's participation in international projects could be sponsored by the state.

Teaching school students to work with the Internet can be an important means of preparing Russia's accession to the globalisation process.

In conclusion, the authors of the report would like to express the hope that through the concerted efforts of the state and society, and in co-operation with the international community, Russia will be able to overcome the difficulties and become a fully fledged participant in the global innovation process.

ANNEX

PROGRAMME OF THE HELSINKI SEMINAR ON INNOVATION POLICY AND THE VALORISATION OF SCIENCE AND TECHNOLOGY IN RUSSIA

1-2 March 2001

THE EVENT: Co-Sponsored by the OECD, the Ministry of Trade and Industry of Finland, the United States Civilian R&D Foundation and INTAS (International Association for the Promotion of Co-operation with Scientists from the New Independent States of the former Soviet Union) and in Co-operation with Ministry of Industry, Science and Technologies of the Russian Federation (MinIST).

OBJECTIVES: This seminar, through discussion and exchange of experience between senior decision makers in government, public research institutions and business from OECD countries, Russia, and the Newly Independent States (NIS), aims to inform policy making in Russia and the NIS with regard to the institutional settings, policies and measures for enhancing innovation and the application and commercialisation of science and technology. The seminar will also identify good practices and policies that could facilitate the S&T policy reform process in Russia and other NIS countries in the areas of intellectual property rights; human resources in science and technology, financing of science-based ventures; and public/private partnerships.

PARTICIPANTS: In order to ensure frank discussions and exchange of views, participation in the seminar will be limited to approximately 50 experts from the Russian Federation, INTAS and OECD and Observer countries, and other international organisations. Participants will include government officials as well as representatives of research institutions and the business sector.

LANGUAGE: English and Russian, with simultaneous interpretation.

THURSDAY, 1 MARCH

Welcome by the Chairs:

Reijo Vihko, President of the Academy of Finland

Irina Osokina, Vice-Minister of Industry, Science and Technologies, Russia

Session 1: Current Challenges in S&T Policy and Innovation – The View from Russia. This session will present the views of key members of the Russian science and technology community on the current issues and problems facing Russia's innovation system.

Session Moderator: Reijo Vihko, President of the Academy of Finland

Alexander Bocharov, Deputy Head, Department of Innovation and Commercialisation of Technologies, MinIST, Russia

Vladimir Bespalov, General Director, Alliance of the Innovative and Technological Centres of Russia

Respondents:

Gerson Sher, President and Executive Director, CRDF, United States

Richard Burger, Relations with NIS partner countries, INTAS member states, and international organisations, INTAS

Discussion and interventions from the floor

Session 2: Institutional and policy frameworks for S&T innovation. This session will examine the experience of OECD countries in adapting policy frameworks at national and regional levels to a more entrepreneurial model of innovation based on a permanent and extensive interaction between industry and science.

Session Moderator: Irina Osokina, Vice-Minister of Industry, Science and Technologies, Russia

Timo Kekkonen, Director General of the Technology Department, Ministry of Trade and Industry, Finland

Didier Coulomb, Deputy Director of Technology Development, Ministry of Research, France

Walt Plosila, Vice-President, Public Technology Management, Battelle Memorial Institute, United States

Respondent:

Alexandre Povolotsky, Institute for Research on National and Economic Security, Russia

Discussion and interventions from the floor

Session 3: Panel discussion on good practices in innovation. Panellists will discuss the experience of governments, public research institutions and industry with implementing policies and programmes for fostering innovation in their countries. Panellists will highlight good practices and discuss how and whether such practices can be adapted to the innovation systems of other countries.

Panel Moderator: Sung-Chul Chung, Senior Research Fellow, Science and Technology Policy Institute, Korea

Rob Lang, Director Corporate Relations, Medical Research Council Technology, United Kingdom

Sergey Simaranov, Director, International Business and Technology Incubator, Moscow, Russia

Katrin Männik, Head of Division, Division of Technology and Innovation, Ministry of Economic Affairs, Estonia

Baruch Raz, Science Counsellor, Israeli Embassy, United Kingdom

Nikolay Rogalev, Director, Innovative Technological Centre, Science Park of the Moscow Power Engineering Institute, Russia

Ferenc Kleinheincz, Deputy Director, Ministry of Education, R&D Division, Hungary

Discussion and interventions from the floor

Session 4: Intellectual Property Rights. This session will examine the growing importance of intellectual property rights (IPRs) in innovation and the commercialisation of public research results. Experts will discuss the role of IPR rules at the economy-wide and industry level as well as good policies and practices for managing and exploiting IPR at the level of public research institutions.

Session Moderator: Vladimir Zinov, Director, Centre for Technology Commercialisation of the Academy of the National Economy, Russia

Paul Leonard, Director of the Intellectual Property Institute, United Kingdom

Alexander von Füner, European Patent Attorney, Germany

Natalia Zolotykh, Deputy Director General, Legal Office, Transtechnology, Russia

Varpu Lindroos, Head of Legal and Personnel Affairs, VTT (Technical Research Centre), Finland

Respondents: Ilkka Linnako, Managing Director, Sitrans Ltd., Finland

Boris Simonov, General Director, Innovation Agency, Russia

Discussion and interventions from the floor

FRIDAY, 2 MARCH

Session 5: Encouraging Innovation Partnerships. This session will highlight examples of successful public/private partnerships for fostering research and innovation from the point of view of industry, government and public research institutions.

Session Moderator: Irina Osokina, Vice-Minister of Industry, Science and Technologies, Russia

Valeri Avtonomov, Section of Department of Industry and Programmes, Russia

Janet Walden, Director, Research Partnerships Directorate, Natural Sciences and Engineering Research Council, Canada

Yuri Gleba, CEO, Icon Genetics, Munich Germany and Director of the International Cell Biology Institute, Academy of Sciences, Ukraine

Bernd Groß, CEO, German Association for Economic & Technological Co-operation with Eastern Europe, Germany

Respondent:

Sergey Simaranov, Director, International Business and Technology Incubator, Russia

Discussion and interventions from the floor

Session 6: Human Resources for Innovation. This session will examine the growing demand for human resources in science and technology and the adequacy of supply systems and policy responses in OECD countries and Russia against a background of global competition for talent and international migration of science graduates and researchers. The role of mobility between public research and industry as well as changing requirements for the training researchers will also be addressed.

Session Moderator: Reijo Vihko, President of the Academy of Finland

Jennifer Bond, Office of Senator Joseph Lieberman and National Science Foundation, United States

Analoty Porshnev, Rector, State University of Management, Russia

Elizabeth Bell, Director, Science Unit, British Council, Moscow Office, Russia

Alexandre Kharine, Rector, State University for Innovation, Technologies and Business, Russia

Respondent:

Yury Shlenov, Head, Economic Administration, Ministry of Education, Russia

Discussion and interventions from the floor

Session 7: Investment and Entrepreneurship. The experience of OECD and transition economies in financing innovation and promoting entrepreneurship will be assessed with a view to identifying policies and good practices in particular as regards the effectiveness of government policies and support measures.

Session Moderator: Nikolay Rogalev, Director, Innovative Technological Centre, Science Park of the Moscow Engineering Institute, Russia

Robert Stillman, President, Milbridge Capital Management, LLC, United States

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Umberto Dal Canuto, Deputy Central Director, Institute for Industrial Restructuring (IRI), Italy

Boris Viktorovich Grinyov, General-Director of the Scientific-Technological Concern, MonoCrystals, Ukraine

Respondent:

Alfred Watkins, Principal Guarantee Specialist, World Bank

Discussion and interventions from the floor

Presentation by the Rapporteurs. The Rapporteurs will present the main issues and messages emerging from the presentations by experts and the discussions in the individual sessions. They will identify a set of issues and questions for discussion by the Panellists in the Concluding Panel.

Jack Martens, Consultant, United States

Alexander Dynkin, Deputy Director of the Institute of World Economy and International Relations (IMEMO), Russia

Session 8: Concluding Panel drawing on the presentations by Rapporteurs and discussions in the preceding sessions. The Panellists will discuss their views on the lessons from OECD countries, Russia and NIS countries in enhancing the economic valorisation of scientific and technological assets and the scope for further policy action.

Panel Moderators: Reijo Vihko, President of the Academy of Finland, and **Irina Osokina**, Vice-Minister of Industry, Science and Technologies, Russia

Alpo Kuparinen, Deputy Director, Ministry of Trade and Industry, Finland

Alexander Bocharov, Deputy Head, Department of Innovation and Commercialisation of Technologies, MinIST, Russia

Matthias Parske, European Patent Attorney and Legal Advisor, INTAS

Gerson Sher, President and Executive Director, CRDF, United States

Daniel Malkin, Head of the Science and Technology Policy Division, Directorate for Science, Technology and Industry, OECD

Closing Remarks by the Chairs

Reijo Vihko, President of the Academy of Finland

Irina Osokina, Vice-Minister of Industry, Science and Technologies, Russia

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