

## R&D SECTOR

The R&D market began to develop later in Russia than most other domestic markets. Before the early 1990s, instead of an R&D market, there were state-owned research institutes that gave research results to manufacturers for free. Manufacturers were not accustomed to independently ordering and paying for such research, and institutes chose the areas of their research with little care towards their practical use, following an internal logic of development of a particular technological discipline. A consequence of that is, on the one hand, a persistent misunderstanding by many Russian researchers of the wide gap between an original idea (or a prototype model) and a commercially relevant technology. And on the other hand, many manufacturers do not consider it necessary to include research expenses in product cost, nor are they prepared to spend money on purchasing original technologies or patenting on a scale that fits with their businesses. This is the reason why the Russian R&D market was slow to develop.

The development of the R&D market was adversely affected by poorly planned privatisation, where a vast majority of research and development organizations remained owned by the state. The ones that were privatised, as a rule, were sold separately from the industrial enterprises that were technologically linked to them. The result of such a policy is that only now, ten years after the launch of the privatisation, the links between science and industry are beginning to be restored: industrial groups now create their own R&D units, acquire previously privatised scientific research institutes, or establish long-term relations with state-owned research institutes.

Simultaneous with the destruction of the link between science and manufacturing in Russia, doors were opened to imports of equipment and technology. With favourable financial terms available to foreign suppliers and in the absence of reasonable technological or customs barriers, the country was virtually flooded with imported equipment, which forced out similar equipment designed by local researchers.

Against this background, a great number of small science-intensive companies were created after reform began in Russia. They were mostly established as a means of survival for former and

current researchers from the scientific research institutes and design bureaus, who continued in some cases to use the capacities and resources of their "mother" institutions. In the absence of a consistent state policy to support that segment of the innovations market, only a few of them were able to achieve considerable successes on the market and expand into the global innovations market. By the end of 1990s, at best they had managed to become niche manufacturers on local markets and develop their know-how, waiting for investors to come in the future.

Only in the past five years have changes in the R&D market begun to happen. During that period, Russia saw an emergence of large industrial groups, which faced increasing competition on the global market, and dynamic medium-size businesses that were successful in the domestic market. Aware of the need for R&D to survive in a competitive environment, they started to demand development of new original technologies and products. Meanwhile, the "old" scientific research institutes and the new science-intensive small firms, which had been able to retain the core of their research teams and find certain market niches, developed into sorts of engineering firms capable of flexible responses to emerging demands and running R&D projects.

To some extent, these tendencies can be seen in the Russian Innovations Contest, which has been annually organized by the Expert Magazine since 2001. Over that period, 1,400 innovation projects have been submitted by companies and individual inventors taking part in the contest. The geographic distribution and the fields of technology covered by these projects give a clear picture of R&D activity in Russia. The most active among the contest participants were companies from Moscow and the Moscow Region (35%), St. Petersburg (15%), Novosibirsk (10%), and Tomsk (5%). The technological clusters represented included the power industry and alternative energy sources (12%), new materials and nanotechnologies (11%), biotechnology (14%), instrument-making (10%), and IT and telecommunications (11%). On average, over the past three years, the earnings of a company participating in the contest have grown by 60%. This suggests that Russia has definite centers of growth of R&D activities, and that they have had positive development over the past three years.

Further development of the innovations market depends on the policies of three key groups: the state that makes the rules for this new market and continues to control a major part of its resources; the industrial sector that shapes the demand for innovations and acts as a strategic investor; and the R&D sector that offers the innovative products.

Let us consider these players in more detail.

## State

A peculiarity in Russia is that until now the state has been the owner of, or held a majority interest, in most R&D organisations. The fact that the state owns principal world-class R&D institutions, especially the ones comprising the Russian Academy of Sciences (RAS), is of prime importance. Over 72% of the scientific institutes are fully state-owned, and the state holds a definite, often considerable interest in 13.5% of them.

Another peculiarity is that under the current laws, the state possesses all of the rights to R&D results and inventions created with government funds. Given the role of the state before the 1990s and since even now state budget funds make up 57.3% of total R&D expenses (see the table below), it is clear that practically any technology transfer requires the approval of state authorities. According to Boris Simonov, Head of the Russian Agency for Patents, a mere one percent of the intellectual property created in the country is lawfully used by enterprises.

Despite such an important role played by the state, the government had not been able to formulate a clear plan of action to create a national R&D system until 2002. Only in March 2002 did the President approve "The Policy Framework of the Russian Federation in the Sphere of Development of Science and Technology for the Period until 2010". This document declared the development of science and technology among the country's top priorities, with the focus on transitioning to development on the basis of R&D and on ensuring the competitiveness of Russia's R&D sector.

Since the approval of this framework, several important decisions have been made which are expected to have a favourable impact on the development of R&D in Russia:

▲ The government has approved a proposal to transfer the results of state-financed research to

researchers free of charge. This makes it possible for the researchers who developed intellectual property in scientific institutes and design bureaus with government money to take ownership of this property and use it for commercial purposes. A law to this effect is to be adopted before the year-end.

▲ The government of the Russian Federation has approved the concept of a draft law to create special economic areas (SEAs), including so-called technology implementation areas (TEAs). These TEAs will have an area not more than one square kilometre and serve for the implementation of breakthrough scientific ideas and technologies. The concept of the draft law seeks to create a very simple administrative procedure for investors registering in such areas. Residents of the SEAs will be exempt from customs duties on equipment and materials necessary to implement investment projects, and the regional authorities will be able to reduce their taxes on income, property, and land, or exempt them from such taxes. A law to that effect may be passed before the end of 2004. The first TEAs may be created in Russia in 2005.

▲ The Ministry of Education and Science was created from the reorganization of the Russian government. The Ministry is headed by Andrey Fursenko, well known for his commitment to R&D development in Russia.

▲ A contest has been organized to select twelve R&D projects of national importance. Within the next three years, the government will allocate about USD 200 million in funds to support these projects. The peculiarity of this contest was that

Table 1

### The structure of internal R&D expenses by source of funds, 2003

Sources of finance	%
1. Budget funds	57.3
2. Funds provided by businesses	20.7
3. Own funds of R&D institutions	9.6
4. Foreign funds	8.0
5. Off-budget funds	4.1
6. Funds provided by higher education institutions	0.1
7. Funds provided by non-profit organizations	0.09

Source: "Russian Science in Figures: 2003". Statistical report. – Moscow: CISN, 2004

the awards committee was comprised of government officials, businessmen, and researchers.

▲ In 2003, a tender was held to create technology transfer centres (TTC) to work on the commercialisation of technologies developed by the Russian Academy of Sciences and state-owned R&D centers and institutions. Six such centers are to be formed in Russia, one in each Federal District. The government will allocate USD 100.000 for the creation of each centre. In 2004, another ten technology transfer centers are to be formed.

▲ The State Foundation to support development of small business R&D has launched a new programme, START, to provide "seed money" to small firms engaged in the R&D business. Under this programme, a research group may receive up to USD 25.000 from the Foundation within three years, with the funds made available on a grant basis. The Foundation has plans to finance up to 400 projects in 2004.

▲ The Federal Commission for the Securities Market has adopted a resolution which mentions, for the first time in the history venture firms' underground activities, "venture" funds among other investment institutions.

▲ The State Venture Innovation Fund (VIF) has begun activities. The VIF and a group of private investment companies have jointly set up the first two dedicated venture funds. Ten percent of these funds' capital was contributed by the Venture Innovation Fund.

Under the Federal Law "On Federal State Unitary Enterprises", most scientific research institutes currently owned by the state will be reorganized into joint-stock companies in the next two years. Subsequently, they may be privatised. Undoubtedly, large and medium-sized Russian companies will use this opportunity to create "research-production-market" chains in their structure.

## Manufacturing sector

It is generally believed that Russian businesses, which evolved on the basis of extraction and primary processing of raw materials, trading, and intermediary services, are not predisposed toward innovation. According to the Institute of National Economic Forecasting of the Russian Academy of Sciences, 65% of Russian companies spend less than

1% of turnover on research and development, and a mere 15% of the companies spend over 4%. Nevertheless, it should be noted that as companies develop, they start exhibiting demand for various innovations.

It might be useful to look at information gathered in a survey of 725 Russian companies conducted by the Institute of the Transitional Economy. According to the survey, 87% of companies surveyed reported that they were carrying out some kind of R&D activity. The most common was the purchase of new equipment, with 64% of the respondents engaged in this activity. In addition, 61% had been engaged in new product launches in the previous three years, 33% conducted their own research and development, and 16% outsourced their R&D. On the average, R&D expenses of companies engaged in such activities equalled 2% of their turnover. New technologies and licenses were bought by 36% and 7%, respectively and 31% engaged in further personnel training and market research.

For the sake of simplicity, five stages can be delineated for the R&D evolutions of large Russian companies:

In the first stage, various internal changes occur in the organization and management system, such as relationship structurings among units, introductions of planning and budgeting, employments of new personnel, wider uses of computers in administrative data processing, and implementations of ERP systems.

"Market" innovations are made in the second stage: companies create sales and distribution networks and logistics chains, formulate their marketing policies, occasionally merge into vertically-integrated groups, and change their product packagings and designs.

The third stage involves "modernization" innovations: equipment upgrades, creations of new product lines (without serious technology changes), implementations of quality and knowledge management systems, and the establishments of product development departments.

The fourth stage is connected with serious technological modernizations involving purchases of assembled production lines (mostly made by well-known foreign manufacturers, with at times used equipment) and technologies, the creation of R&D units engaged in development of original products based

on these technologies, the search for new market niches, and the implementation of CAD systems.

Only in the fifth stage, when the companies begin to realize that certain solutions cannot help gain major competitive advantages, do they start implementing proper technological innovations. They then develop original technologies, create corporate R&D units and venture funds, ally with relevant research teams, buy small innovations firms, diversify their operations by quickly entering developing hi-tech market segments, and implement pro-active patent and licensing policies.

Today, most Russian manufacturers are in the second, or at best the third, stage of innovation development; and only a few are entering the fourth stage. There are occasional reports of some companies attempting development of an element included in the fifth "technological" stage:

- ▲ Norilsk Nickel provided USD40 million in funds to the Russian Academy of Sciences to finance the development of hydrogen energy technologies.

- ▲ AFK Sistema announced development plans for the Research Centre KNT that works in microelectronics. It has plans to increase the capitalization of KNT to USD 1.5 billion over the year, with sales amounting to USD 800-900 million annually compared to USD 100 million in 2003.

- ▲ YUKOS invested USD18 million for the creation of its own R&D institute, with an area of 10.000 square metres. The institute will serve the corporate interests of the company – USD10 million in funds are expected to support its research operations;

- ▲ The Promyshlennye Investory ("Industrial Investors") Fund engaged in industrial asset management has invested USD1 million in Russian Biotechnologies Co., which is working on the development of original methods for cancer treatment, and has announced plans to invest a further USD 5.2 million.

- ▲ Surgutneftegaz acquired a 100% stake in the St. Petersburg-based OAO Institute for the Design of Enterprises in the Chemical and Petrochemical Industry for USD 6.5 million at a privatisation auction.

The venture investment sector is also developing. According to Expert Magazine, transaction values with venture companies on the market grew from USD 17 million in 1999 to USD 40 million in 2003.

Alfa Group announced creation of the Russian Technologies Venture Fund, with an initial capital of USD 20 million. Techsnabexport, the major supplier of enriched uranium to the world market, and Aerospace Equipment Corporation jointly with the state-owned Venture Innovation Fund have set up venture funds with capital of USD 10 million each. One of the leading US venture capital firms, Draper Fisher Jurvetson (DFJ), is establishing a subsidiary venture fund with a Russian partner in Russia with capital projected at USD 50 million. Despite the lack of reliable statistics, one can safely say that there are several Russian businesses independently investing in technology companies. For instance, in early 2004, the CEO of Wimm-Bill-Dann [Foods], David Yakobashvili, announced joint investment of USD 30 million by the company and its partners for the development and production of self-rescue protective hoods called Phoenix. They will raise another USD 50 million for the project this year, including USD 20 million of its own funds and USD 30 million from loans.

## Research and development sector

A peculiarity of this sector in Russia is that, unlike that of many other developing countries, it is developing on the basis of huge—even by world standards—scientific clusters created in the former USSR. (In the late 1980s, the USSR ranked first in the world in the number of R&D personnel). Although the R&D sector shrank in size and the number of employees fell by half, the sector retained its development potential along with an important role in the nation's economic life. Most of the backbone organizations that characterized the sector managed to survive. Historically, such backbone organizations in Russia were large scientific research institutes (NII), design bureaus (KB), institutes of the Russian Academy of Sciences, and universities and institutes. According to statistics, these organizations comprise over 80% of the total number of R&D institutions in Russia.

Clearly, most of these organizations will have to undergo serious internal changes, primarily in their management systems. In the next few years, the key question for the development of Russia's R&D system will be how to create dynamic R&D centres on the basis of these post-Soviet institutes. The most likely answer will be the combination of the

capacities and expertise of these institutes along with the energy and market experience of smaller science-intensive companies. As was noted in the beginning of this review, these small firms emerged in the early 1990s with the start of reforms. Today, there are 22.00 small firms in the R&D sector, though not more than 15.000 of them are really effective. The value of their products is USD 872 million.

These firms have different origins – some of them are laboratories split off from their institutes and research units that became independent after the breakdown of the Soviet-era institutes. Others are spin-offs set up by large research institutions. Still others are implementation firms created by technology developers for marketing their products. Also, firms are beginning to be set up by businessmen with experience in technology commercialisation with hopes of attracting foreign venture investments.

It should be noted that these companies are developing in a very adverse environment due to insufficient interest shown by large Russian corporations for technological innovation, the absence of a system for receiving loans and venture capital, and an underdeveloped infrastructure for R&D activities. Of all the forms of state support for such companies, one may mention the Foundation for developing small businesses in the R&D sector, which provided direct financial support of about USD 70 million to over 2.500 firms over the ten years of its existence. It was only in the past few years that R&D and technology centres began to be created throughout the various regions in Russia. These centres provide assistance for establishing and "raising" small R&D firms during their beginning years.

As a result of the aforementioned adverse conditions, over the past five years the number of small R&D firms has declined rather than increased. The upside is that the companies that did survive gained market experience and expertise in marketing science-intensive products. The following are just a few examples of such companies:

▲ Biocad, Moscow, is a biotechnology company established in the mid-1990s. The company's founder Mr. Morozov invested USD 250.000 of own funds and was able to convince his old business partners of the sector's growth prospects.

Biocad began with the production of bifidumbacterin. A factory was then built and a distribution company created to sell biological preparations made by other manufacturers. The company's turnover totalled USD 4 million last year. All work on the creation of preparations is carried out in Biocad's research centre based in the former Scientific Research Institute of Engineering Immunology near Moscow, which the company bought out of bankruptcy. About a year ago, Biocad was joined by a research team from the famous NPO Vektor, based in Novosibirsk. Today, most of the company's 110 employees are engaged in scientific research. Morozov introduced a planning system that used integrated operational schedules, traditionally applied in industries that engage in long-term projects. Recently, the company started developing new pharmaceutical products that do not have counterparts on the world market.

▲ Tidex, St. Petersburg, was established in 1994. The company manufactures optical components and devices, from 2mm lenses to 1.5m mirrors for astronomic telescopes. Almost all products are exported to Germany, the USA, France, and Great Britain. The company is currently working on a project to design tera-hertz devices intended for detecting chemicals, explosives, or bacteriological substances in sealed packages. The Company's turnover totals USD 970.000.

▲ Paragon Software was established in 1994, and specializes in software development. Since 1998, Paragon has been engaged in the creation of dictionary software. It has a 40% world market share of dictionary software for palm-based handheld devices. Paragon began to grow rapidly in early 2001, when the first models of more advanced mobile telephones appeared and Paragon started to cooperate with Nokia and SonyEricsson. Paragon was able to capture 60% of the world market for dictionary software for mobile devices. The company's turnover in 2002 was USD 2.7 million.

▲ The Moscow-based Unichimtek was established in 1990 by a group of scientists from Moscow State University. The company specializes in the development and manufacture of modified graphite products. Today, the company has 700 employees including about 300 researchers, manufacturing engineers, and developers. In 2003, sales

totalled USD 22 million, and are expected to grow to USD 60 million by 2006. In 2003, Unichimtek and Moscow State University formed a scientific research institute called the Institute of New Carbon Materials and Technologies. The company's project won a "Twelve R&D Projects of National Importance" award organized by the Ministry of Industry and Science.

▲ SPIRIT Group was created in the early 1990s. The company specializes in developing software for digital telephony, voice and data integration, echo suppression, noise-reduction, multimedia, and satellite communications. Among SPIRIT's customers are the global leaders in telecom equipment manufacturing such as Amtel, Japan Radio Company (JRC), Hyundai, Leica, NEC, Nortel Networks, Panasonic, Philips, Samsung, Siemens, Texas Instruments, Toshiba, etc. SPIRIT has offices or representatives in twelve countries. From 1994-1997, SPIRIT did all of its business in Japan. Then the company entered the US market, and in 2002 it began to actively market its products in Europe and in Russia in 2003. SeeStorm Inc., a subsidiary of SPIRIT, has been picked for 2003 pulver100 list by Pulver.com – the list includes the most innovative and fastest-growing private companies in the telecom industry. At the Wireless Japan-2003 expo this summer, SeeStorm's application for 3-D talking characters on cell phones got a prestigious award, the Overall Best Exhibitor Award.

▲ The Krasnodar-based Firn Co., established in late 1980s, specialised in the manufacture of laser crystals. Before the mid-1990s, the company sold crystals in Russia and Europe. After Firn received USD600,000 in grants from several international foundations, the company focused on developing industrial technology for producing lanthanum-scandium borate of high-grade optical quality for micro lasers. A project is currently underway to build a production line.

▲ A4Vision was established in 1998. The company develops systems and solutions for face-recognition scanning and creates security systems on that basis. In 1998, the company received USD 1.5 million in investments from MyQube Venture Fund. In 2001, MyQube was joined by the Swiss peripherals manufacturer Logitech, and as a result the first tranche of investments totalled about USD 10

million. In 2003, the company raised another USD 14 million. The scanners made by A4Vision have been installed in the Milan airport and the Royal Bank of Scotland. Currently, the company's turnover totals USD 1 million. In 2004, the company's turnover is planned to increase to USD 3-5 million through mass commercial productions and the maintenance of security systems;

▲ The Chelyabinsk-based industrial group Metran was established in the early 1990s. The company is engaged in the manufacture of process control automation and regulation equipment along with the provision of engineering services. The turnover of the company is over USD 30 million annually. Metran is a private company with foreign capital from a venture fund set up by the EBRD in 2000. The company has been cooperating with the US corporation Emerson Process Management since 1996. During their last visit in February of this year, Emerson's representatives discussed the possibility of creating a joint scientific research centre in the interests of both companies. The principal consumers of Metran's products are Gazprom, LUKoil, electricity companies, chemical and petrochemical manufacturers, and housing and public utilities.

As can be seen, some of these companies can hardly be considered small. The very development logic for these and many other "new" science-intensive companies results in nascent interests for joining forces with post-Soviet institutes. One of the leading experts on innovations processes in Russia, Minister of Science and Education Andrey Fursenko, has noted the following tendency – "Today, the standard formula accepted worldwide—the acquisition of small firms by larger corporations—does not work, or at least performs poorly in Russia. We do not have large corporations capable of effectively absorbing innovation through the acquisition of small firms. Today, small firms with the most active managements are gradually beginning to take over units of larger enterprises – large [research] institutes that are falling apart to various extents. Over the next decade, Russia may already see the emergence of large, independent hi-tech companies carrying our science-intensive research at the most advanced levels that offer solutions of commercial interest and competitive products for the global market."