Could Scientists Save Russian Economy?

Irina PEAUCELLE (CEPREMAP/CNRS, France)

Abstract

This paper describes the relationship between demand and offer of S&T in order to appreciate the capability of Russia to integrate the knowledge-based society, favourable for growth take off.

In historical perspective the demand for S&T is determined by the evolution of productive forces' distribution. When any form of the distribution of economic activities stabilises, each sector seeks to introduce new machines and replace the labour. Doing this effort the society calls for S&T. Which forces incarnate the societal demand at the short run? It is the state, who finances massively the research. Hence, the state has all means to incite, to arbitrate, but also to curb the research arguing the principle of precaution. Citizens represented by their political parties and media reflect and seek to move the social demand into societal one. For example, they may support the proposal to increase research personnel at the periods of sharp unemployment. Finally, the role of scientist in a society is to add new ingredients to the collective process of scientific policy making. In an industrial economy, knowledge is the departure for IPR contracts for transformation of machinery useful for manufacturing of new goods. In a knowledge-based economy the knowledge producers and different consumers interact directly, meanwhile the IPR protection becomes less important. The scientists are sensitive to abstract knowledge (science-oriented research) demand as well as to purely commercial knowledge demand.

The paper explains the reasons of insufficiency of demand for S&T and weakness of actors in contemporary Russia.

Offer description takes a selective look at the framework of innovation system, examining institutional arrangements and efficiency in performing innovation activity, linking science and industry. Scientific specialisation is characterised by measuring the relative weight that selected scientific disciplines occupy in the Russian science system. Technological specialisation is evaluated as usually on the basis of patenting activity and of S&T intensity.

I verify that S&T output by Russian inside researchers is decreasing in nineties, and try to spell out it by economic behaviour of scientists. These characteristics rise questions: would researchers modify at short run their behaviour? And may scientists outside of Russia participate in science renaissance.

May scientists save Russian economy?

1. Introduction

To answer satisfactory the question "May scientists save Russian economy?" one has to elucidate some theoretical and philosophical moot points in relation to the progress in the science in general and in social sciences in particular. In rupture with post-modernism I will assume that the progress subsists that stands for perceptible improvement of societal communication and well being. If invention is public or private good, the inventor may appropriate it and use for a purpose of development. In such case the science as a main body for invention became factor of growth, of enrichment of human experience, of health status increase of nation. But it seems that it isn't an onward movement. One has to establish a fact that academic economics discipline in XX century did not demonstrate a sufficient intellectual development to predict novel facts, for example, it was incapable to stave the Russian economy off crisis after the collapse of centrally planning mechanism of governance. The remarkable progress of basic sciences during the century is not transforming into innovations in Russian society. The scientists had sufficient strength to explain the soviet system insufficiency, but they became exhausted in restructuring.

The economic slow-down of Russia in ninetieth is determined by the loss of world markets and by substitution of Russian goods and services on national market area. To master this unfavourable economic trend the development of inventions of USSR period and the utilisation of new and high technologies seems to be vital for assuring the production of goods and services corresponding to Russian and world demand. But how do to proceeds? How to order the priorities among social, economic and S&T needs? And who, what forces might assure the respect of the ordering? The social and politic groups, on which the government policy may to lean, are not sufficiently structured or constituted. The states' own economic foundation is fragile, as the informal sector is too large.

Our challenge is to identify the existing analogies and differences in patterns of knowledge accumulation and use, with a view to help policy makers to learn from this comparison the scope and priorities for action in the field of science, technology and innovation policy.

2. Demand for S&T and S&T output

In historical perspective the demand for S&T is determined by the evolution of productive forces' distribution. When any form of the distribution of economic activities stabilises, each sector using human activity seeks to introduce new machines and replace the labour. Doing this effort the society calls for S&T.

How to orient the demand for S&T at the short run. The demand shall not be reduced to requirements expressed by the population. But societal needs at some historical period reveal the demand for politics and obviously influence one aspect of them - the scientific priorities. For example, after WW II the shortage of nourishment directs the scientists' work. All disciplines followed a specific purpose - to increase the productivity of agriculture. Governments' support of agricultural research led to huge productivity increases in the relatively short, for the research and development, term. The biology and chemistry are faced now with different tasks – to repair the ecological inconveniences of this rapid growth and to improve the quality of goods and of human health. In the developed countries the biotechnology and medicine became leading domain of science in 1990s. The citizens not only express a demand for sciences, but also as patients, producers, or through their representatives they now make many decisions in scientific domains. For example, the group of French patients created an association for the treatment of muscular dystrophy that raised 80 million of dollars in charity. As the disease has a genetic origin the association has invested massively in molecular biology. Actually the total funding of basic research in this field by association is larger then one of French government.

Which forces incarnate the societal demand? It is the state, who finances massively the research. Hence, the state has all means to incite, to arbitrate, but also to curb the research arguing the principle of precaution. Citizens represented by their political parties and media reflect and seek to move the social demand into societal one. For example, they may support the proposal to increase research personnel at the periods of sharp unemployment. Finally, the role of scientist in a society is not only to simplify and to put an end to controversies, writes the French philosopher Bruno Latour (1998), but also to add new ingredients to the collective process of scientific policy making.

The demand for science has both characters: social and individual. The social demand is of long-term type and needs probably the development of complex systems of knowledge. The new problems that must be resolved at this level are: sustainable ecology, creation of a post-nuclear energy civilisation, elaboration of a principally new element base for the computer, development of post neo-classical logic of information technology, but also terrorism, epidemics, or mass violence. The theories of such synthetic type could not provide profitability soon and that is why their elaboration should not be financed privately. The individuals' demand for R&D, for example the demand for new goods, may be satisfied in the short term. These aspects of the S&T mainly serve the productive side of economy and for this reason its social significance is badly perceived by politic power. The inspiring for health, education or mode of life needs permanent efforts for conciliating partially the population with political offers. "Theory sees itself and other things as in a mirror and this may provide an occasion to rise its self-estimation", writes German sociologist N.Luhmann (1995, p.482). Due to this auto referencing the scientists initiate the long-term demand for R&D and reveal the spheres that are not claimed by today society. Besides, the scientific society could bring about more than to contrive the prevailing claim, forming new areas of demand for knowledge.

Knowledge creating: education, world-outlook and science, determines the civil society as well as the technological sphere. The two concepts of Russian science reforming (Guerasimov (1998)) developed in 1997, one by Science and Technology Ministry commission and other by Guild of Science Managers, differ on the weight they assign to the social aspect or to technology. The first text points out that new technologies really influence the Earth evolution, that the science became a powerful productive force and will determine in the next millennium the competitive capacities of countries on the world market. For those reasons the Russian science has to be managed in order to become the national resource for renewal and development. In the second conception the human aspects prevail over economic. The authors pay attention to the occurrence that the degree of civilisation in each country is determined by development of science, culture, education and health. As currently, culture, education and the health are imbued with the scientific ideas, the societal priority must be the science promotion.

The survey realised on 9-10 January 1999 in Russia records: 70% of population are agreeing with the statement that “in future the technology will play more a important role in human life, than actually”, against 17% having the opposite point of view (13% didn’t express their opinion). There are equivalent shares of people supposing that “in future the people will learn (43%) to eliminate the detriment, that inflict the technology and civilisation to nature", and those convinced that "in future the destruction of the nature by technology and civilisation will strengthen" (42%). It is interesting to report also the view on the future values of the feeling and of the intellect. Only 21% of interviewed think that the intuition and feeling will be developing first of all, against 54% thinking that the people will be more rational and intellectual. The conviction is gained (65% against 19%)) that the labour will occupy more place and leisure less place then now in human life. It appears that culturally the Russians are attached more than other Europeans to knowledge producing activity and seek to preserve it. This is just an impression, since methodologically strict survey on willingness to pay for science was never realised. For example, the French population seems to be very reticent to scientific progress. In 1999 only 39%of interviewed persons estimated that the science dos more good than harm (Seznec (2000)).

The permanent lack of industry and agriculture demands, due to serious developmental problems, highly complicates the innovation processes and ceases involvement of the RTD potential in solving the national economic and social problems. Fortunately, the technology development programs were traditionally elaborated from centre for whom the public objectives had primary role, not opinion in S&T. Positive results of such policy are undeniable, for example, in space and aeronautic.

In total, nearly 70-80 thousands of scientists are deeply involved in scientific research in Russia. Their number certainly couldn't measure the scientific performance, at least at short term.

One is forced to accept that under conditions of indefiniteness of the notion of the quality of scientists and the information on the structure of the scientific society, as well as their spread over the scientific fields, the only objective index specific for the state of the scientific research is the final product of this research - the scientific publications.

It is recognised that the quality of researchers in USSR and the level of fundamental (basic) sciences were highs. In 1990 Russia was in a head in the field of chemistry representing 15.3% of word scientific publications, but only 6.9% in 1995. Then came physic with respectively more then 13% in 1990 and 7.3% in 1995 of world publications. Sciences of universe represented 7.5% and sciences for engineers 6% of publications in 1990. (Source: OST, Indicators 1998).

In 1993 the scientific product of Russian researchers published in foreign and international issues, as well as in Russian journals with high impact-factor was approximately

23 thousand publications, while the number of authors per each of them was, in the average, 3.0-3.5. Efremov (2000) relates that in 1993 to be granted by Soros Foundation the researchers had to be authors of at least of three articles published in internationally recognised scientific journals. Only 20 763 Russian researchers corresponded to this criteria and were granted.

The reduction of Russian scientific position since the state freed itself from S&T management is dramatic and too rapid in all domains. In mathematics it is relatively less perceivable (21 percent of decrease), but drastic in medical sciences (76 percent of decrease).

Technological specialisation of a nation is evaluated usually on the basis of patenting activity.

Indicators of patent applications in Russian Federation

	1992	1993	1994	1995	1996
Dependency ratio (non resident/resident)	0.50	0.53	0.94	1.35	1.56
Autosufficiency ratio (resident/national)	0.67	0.65	0.51	0.43	0.39
Inventiveness coefficient (resident/10000 population)	2.70	1.90	1.40	1.20	1.20
Rate of diffusion (external patenting/resident)	-	0.16	0.31	0.42	0.82

Source: OECD (1999)

Some indicators of patenting in Russian Federation show that inventiveness of the population and representation of resident patentees among the patentees granted in this country decrease persistently between 1992 and 1996. Both indicators autosufficiency ratio and inventiveness coefficient also testify to the slowdown of interests for national patenting, since the external patenting became a binding form of IPR protection only in some sectors of Russian economy. The greater percentage of the world total corresponds to the group of Chemistry - Metallurgy. It was equal in 1996 to 0.42 % of European patents and to 0.27% of US patents.

The place of Russian Federation in the world patenting is too small, especially in comparison with other industrialised countries.

Number of international applications received by International Bureau by country of origin and the corresponding percentage of the total

Country of origin	Number of applications		Percentage	
	1995	1996	1995	1996
Russian Federation	288	366	0.7	0.8
United States	16 588	20 828	42.6	44.0
Japan	2 700	3 861	6.9	8.2
France	1 808	2 307	4.6	4.9
Total	38 906	47 291	100	100

Source: WIPO 1998

The technology balance of payments registers the commercial transactions related to international technology and know-how transfers. This indicator may be used as an element of S&T output. It consists of the money paid or received for the use of patents, licences, know-how, trademarks, technical services and for industrial S&T carried out abroad.

Russian technology balance of payments

	1993	1994	1995	1996	1997
Receipts (millions rouble)	764	7 917	18 544	816 100	1 018 847
Payments (millions rouble)	3 6964	5 2498	20 113	225 818	64 480
Coverage ration	0.02	0.15	0.92	3.61	15.80

Source: OECD (1999)

After a relative equilibrium in 1995 of technology transfers in value the coverage rate, which shows to what extent Russia covers its own requirements of technological imports by its corresponding exports, increases significantly in 1996 and in 1997. To appreciate this breaking for Russian reconstruction process it would be important to know if it is or not the result of technology import reduction, which could take place as a consequence of the general industrial crisis in Russia.

Using only the data summarising the patenting one might jump to a hasty conclusion as for scientific or innovation backwardness. The weakness of Russia in terms of granted patents might have several causes that have nothing in common with scientific development and capability. For example, patents incite inventors to disclose their inventions when otherwise they would stay in secrecy. If we think over the share the defense industry occupies in Russian S&T, we couldn't be astonished at patenting deficiency. Certainly secrecy is not a sole reason of intellectual property rights (IPR) underdevelopment.

3. IPR in industrial and in knowledge based society

By thirties the Soviet Union had given birth to about one thousands research institutes, employing tens of thousands of scientists in a co-ordinated programme designed to meet the needs of the entire society. The Soviet Union presented its strategy for the development of R&D, based on centralised planning in 1931 at the international congress of the history of science and technology in London. This form of management was very audacious. The subject matter for scientific work in institutes was given beforehand. The state organised the complete cycle: funded the researches and was the consumer, educated the specialists and guaranteed their employment.

In other countries the knowledge production was often the state prerogative, but innovation was always a sphere of private sector. IPR was essential for innovations in those conditions. Contractual research is a main form of R&D in the majority of Western countries. It is important to distinguish among industrial stakes, societal ones and stakes of knowledge. Precariousness of contractual research as well as the reappraisal of economic repercussions by authorities led the scientists in Western countries to refuse to make an attempt in risky domains.

As against, the research sector in USSR suffered mainly because of secrecy and isolation, which caused the general inferiority of scientific level. The ideology was powerful even in natural sciences, and public character of S&T could not protect against its negative effect. The national economy had the hard task to maintain the military industry and the role of the research sector here was important. So, the neglect of IPR was not the main obstacle for innovation in USSR.

The situation changed after liberalisation of Russian economy. The need for foreign investment and advanced technology explains the introduction of new patent regime, since the Western investors waited for an adequate protection of IPR. Certainly, the infringements in patent protection change foreign firms' location and direct investment decisions. The membership of international property organisations incites also the modernisation of national legislation.

When the state abandons the financial support of development in R&D activity, the venture capital became the main force in innovation process. Venture capital is, strictly speaking, a subset of private equity and refers to equity investments made for the launch, early development, or expansion of a business.

The role of venture capitalists in integration of scientific and industrial efforts in restructuring is well documented in recent literature. Usually venture capitalists look for products that offer a clear advantage over the competition and favour by that the high technology diffusion, as it was the case in the last decade for software and biotechnology. The venture firm is committed to producing superior financial returns by investing in high-potential, early-stage companies where the highly risky projects are predominant. If a usual lender tries to secure lending against various pledged assets: inventories, real estate or equipment; he accepts guarantees from the state or banks as collateral; the venture capital has for collateral the patents and ideas. Many science-based firms do not find the consumers and do not generate profits for long time, leading them to bankruptcy. Proprietary barriers to competition are inquired into, whether they are technology or product-oriented (patent) or market-oriented (brand franchise). The patent may serve as a guarantee of scientific validity for investor.

New Russian law recognised patents as the only form of protection of inventions, protected product-by-process claims, created the Patent Office, and established a Patent Court. The law rectified the protection of an inventor's rights; at the same time it also contained several provision to protect the State's interest in ensuring adequate access to beneficial inventions. Additionally the “State Fund of Inventions” was created to which patent holders could unilaterally and voluntarily transfer their rights to an invention.

Finally, the rights of inventors in the Russian Federation have strengthened considerably, but measures relating to the enforcement of patent rights continue to be imperfect and the licensing is relatively compulsory. The incentive to secure patent rights seems not sufficient (Peaucelle (1998)).

Besides IPR legislation, the government may use some other mechanisms of incentive, such as: rationalising the R&D attributions, or a change in firm’s cash flow through a fiscal policy. The supporting of private initiatives in high technology industries and in services may become a direction of state policy in the domain of innovation. Fiscal policy tends usually to privilege the rent capital instead to risk capital. The government funds are concentrated therefore into some sectors and some programmes with guaranteed outcomes. In order to change such trend new fiscal mechanisms have to be introduced for supporting the investments with large potentiality for growth and high risk. Industrial, commercial and agricultural enterprises taxed on the revenue might benefit of research tax credit if they perform basic and applied research or the development activity.

But, Russian scientists are often against of any form the science privatisation and against the idea that the science might be developing by selling its "product". In his article “Market science is the lack of science” the biologist Maliguin (1998) returns on the government policy of protecting the IPR using law and justice system. According to him the situation with the science is too complicated as the production of scientific information is a long process and positive outlay is difficult to foresee. The length of production cycle and high risk explain that cost-effectiveness of expenditures for scientific could not be anticipated under market mechanism even if the state enforces efficiently the intellectual property rights. The state may organise the accumulation of funds taxing the users of scientific information. The successful ones may cover the losses for aborted projects, and in a sense the state budget funding might play the role of insurance.

Today’s prevailing wisdom in academic economics is that strong patent rights are conducive to economic progress. But Mazzoleni and Nelson (1998) argue that the present movement towards stronger IPR protection may hinder rather than stimulate technological and economic progress. To rise patent protection levels in weakly protecting countries, it is salient to foster a significant research base in those countries. Since R&D activity influences patent protection after a country’s research sector reaches a critical size.

Patents on inventions induce the needed investments to develop and commercialise them. We will see whether such investments may follow the invention faculty of Russian scientists.

Patent infringement cases are scientifically and legally difficult, they are expensive and time-consuming. Before choosing to pursue any form of alternative dispute resolution mechanism, the costs and delays inherent in court litigation must be weighed. Because of the huge sums which may be earned in a successful infringement suit, attempting an attack becomes attractive enough to raise venture capital to pay legal fees of the attacking party, even if the chances of success are objectively slim. And in the US at least, lawyers working on a purely speculative basis on potentially lucrative lawsuits are far from uncommon. It is known also that the lawsuits expenditure often exceeds the R&D funds of the firm.

One of the important patent agencies of Russia (since 1963) “Sojuzpatent” informs us that patent infringement cases are rarely litigated in Russia and most of such cases are settled amicably prior to any judgement rendered by the court. The “Sojuspapent” experience permits recall only one case in 1997 and which prosecution was suspended due to reaching a settlement between the parties involved.

The reasons for patent litigation may have different social effects. Lanjouw and Schankerman (1997) compare two types of successful litigation: patent challenges and patent infringements. They argue that if the plaintiff in a challenge suit is active in R&D, he may appropriate the gains of court decision of patent invalidation, and all other firms innovating in the opened technology space, using innovation freely may benefit also. By contrast the gains from a successful patent infringement suit go mainly to patentee and their likely social positive effect is indirect.

In an industrial economy, knowledge is the departure for IPR contracts for transformation of machinery useful for manufacturing of new goods. In a knowledge-based economy the knowledge producers and different consumers interact directly, meanwhile the IPR protection becomes less important.

Finally, there are many argument pros and cons the improvement of IPR in Russia. If the legislation have been traditionally established in Russia it would be useful at current economic situation. But the globalisation and desindustrialisation as the world trends cast doubt on necessity of excessive effort in this domain, especially in Russian context. .

4. Science, Industry, and Institutions: a vicious circle

Firms usually play a central role in translating advancement in knowledge into economic and social welfare. The indicators of introduction of innovations into industrial sphere may reveal the S&T development, but it must take into account the role of entrepreneurs in liberal economy or of the state in centrally planned one. In both systems the failure of innovation process should not be attributed only to scientific inadequacy.

What is wrong in Russia? How to break of an infernal links.

Prime obstacle is the non-market sector that remains sizeable, taking the shape of *informal economy*. On the one hand, informal economy allows the enlargement of competitiveness of firms involved in shadow activity, the rise of certain strata of population revenue and the decrease of real unemployment. Conceptually these factors may favourably change the S&T asset in Russia (Dolgopiatova (1998)). In practice the small share of firms in formal and informal sectors at the end of ninetieth seeks to develop (less than 25%) comparatively to the share of firms that try to stabilise their market position (nearly 40%) or survive (almost 35%). That is why the technological development appears at the only fifth place among their priorities, after the maximisation of sells, the maximisation of profits, the sustaining of the level of employees revenues and the increase of market share. The investment utilisation of hidden resources by firms is complicated in comparison with their consumption use or personal appropriation. Indeed, the purchase of new equipment depends on the liquidity of assets and this fact constrains the scale of investment and limits the firms' expansion. The shadow funds prevent the possibility of external investments into the firm and bank credit acquisition, as in both cases the interlocutors possess a false underestimated information in regard to the firm performance. Besides, new businessmen didn't work up a good habit of sciences' patronage. They are convinced that the ideas of Russian researchers are unusable and that the technological realisations of developed countries are cheaper and effortlessly adaptable. Part of informal activity, hidden from legal and statistical observation, is a criminal one. It is developing in the forbidden zones. It is difficult to conceive that in these zones some S&T promotion might exist.

On the other hand, the state budget has dropped because of firms' tax shirking and consequently the state monetary support of S&T is reduced as well as other public expenditures.

Second inconvenience lays in the necessity to transform *defense R&D* and industry. During and after World War II, new high-technology industries in USSR were driven by the states' push to strengthen national security. Defense programs dominated the S&T portfolio. The payoffs were substantial, with industry benefiting from defense-driven investments.

The after the Second World War the history of some regions is inextricably intertwined with the needs of the military sector. These regions were transformed into a hinterland of the military-industrial complex with a high concentration of defense-related production becoming at the same time knowledge based industrial cities. Presently sixty towns may be considered as knowledge based cities. About twenty of them are situated around Moscow and ten in Siberia. One million of persons is involved in S&T activity in these sities.

The Siberian branch of Academy of Science was founded in 1957, and has consistently ranked among the Russian top recipients of S&T funding (Boussyguine (1998)). Akademgorodok, an academic suburban town with more than 30 000 persons employed in institutes of the Academy of Science represented an elite part of the Russian scientific system. By comparison, 70 000 persons were employed in research sector of Moscow region and only 15 000 — in Leningrad. The scientific centre in the East of the country composed of specialised institutes has provided the industry with high level of scientific research and a possibility of multi-disciplinarity. It has been championed by Russian scientists as the "Prototypical City" of the future. The military industrial portion of the economy was centred on large state institutions and industries. This element of the regional economy has been a major source of technological innovation. The state seeks to “minimise the distance between the industry and science, to provide a transfer of scientific ideas and inventions toward industrial sphere” (Lavrentiev, first director of Siberian Branch of RAS, 1982). In the opinion of the majority of directors of Akademgorodok institutes, the “rapprochement of science and production sphere” represents “requirement to the science of XXI century”.

The decree of the President of the Russian Federation “About the measures for development of science-cities as cities of science and high technologies” enforces the new industrial district option; encouraging the co-operative, innovative and governance conditions experimented in Akademgorodoks.

Currently the structural changes seem to indicate that Russian administration has put technology policy on the political agenda. Among the technology policy options one may note a shift from a 54 : 46 to 37.5 : 62.5 mix between state weapons and civilian R&D. The commentators are aware also of downsizing of the national weapons laboratory complex. Since 1991 to 1996 the payment for state ordered military sector production dropped more than 33 times (Source: OST Indicators 1998). Still the conversion is not produced, as the civil production in military sector also decreased. The objective is in developing dual use technologies.

Third main problem is the drastic reduction of state funding of R&D that should be compensated by private and principally foreign investments in the knowledge-based sectors of economy if any would be recognised as such. Average foreign investments per capita for five years (1994-1999) is equal to about 60$ and FDI to 20$. FDI represent only 1%of Rusian PIB. In Russia the *foreign direct capital* favours Electric power industry, Trade and Business, that are not known as high-tech sectors of economy. The education level is meaningful for FDI only in St.Petersburg and Moscow, suggesting that FDI into Russian’s region is not drowning by labour qualification (see Brock (1998)). Indeed, region allocation of FDI shows that its level depends on crime climate, on market size and on risk. Unlike other CEE countries, the infrastructure development or privatisation into the regions did not explain the FDI briefing. Three-year average per capita FDI in Russian’ regions shows, for example, that Moscow is at the 4^{h} place with the figure of 87 $ per resident (Moscow region 11$ per resident), St.Petersburg at 14th place with 19 $ per resident (Leningrad region 4$), and Novosibirsk region 24th place with only 9 $ per resident.

What can do the state to enforce the innovation in Russia?

a) *Rationalisation of expenditure*

In Russia as in most countries the objective is to balance budget. The constraints likely to grow are by contrast different then in the majority of European countries - low rate of tax collection and dramatic demography. Indeed, the life expectation decreases badly. To assume constant wealth level the nation must increase the expenditure for healthcare, environment and security. Consequently, will result in increasing demand for accountability and for effectiveness of expenditure. The demand for economic science will be expressed in term of elaboration of new tools for better evaluation of social consequences of restructuring. The demand for political science pushes to developing technologies to deliver healthcare and training more effectively. So, better justification for government funding of S&T is recommended.

Demikhov (1998) calls our attention to the necessity to accelerate the process of synergy between the existing but growing old highly qualified population of engineers and researchers, capable to develop any technology, and new generation of businessmen. For a moment the intersection of these populations is very small in Russia. How to involve researchers into the management of new technology sector? Different steps should be taken in favour the firm's creation in priority sectors as energetic, telecommunication, ecology, and health. In Russia the management need to learn how to be efficient respecting the law and discharging the taxes, how organise the labour and more generally human relations into the firm, how to operate with minimum of funds and time, how to serve the client without loosing a self-respect.

b) Russian researchers insist on the some realist S&T policy orientations

Since the S&T development determines different aspects of society activity, of state maintain and of international relations, the usage of science achievements should be regulated by the state. To sustain the autonomy of research evolution and to introduce the new management rules necessitate the elaboration of scientific and technology policy (Yakovets

(1997)). The rules may be different for fundamental and applied sciences. More precisely the scientists wait from the state:

- to estimate and to create the S&T policy in order to appreciate the supply by scientists and entrepreneurs;
- to elaborate the federal target programs which exclude the doubling of projects;
- integration of high education with fundamental research, in order to incite the best researchers to teach and teachers and students to work on modern problems in academic laboratories;
- diffusion of dual technology on world markets of knowledge based goods;
- to reconstruct the scientific links and co-operation into NIS economic space;
- to favour the transformation of purely human aspects of international supporting of Russian science into the mutually suitable projects using existing unsurpassed Russian equipment.

The state may create special institution for registration of new ideas – "bank of ideas", and at least solve the problem of scientific information and libraries replenishment (Shardiko (1998)). It has to restore the specialised secondary schools in natural sciences, in languages and in economics; to organise at national level the concourses for young scientists (called Olympiads). A special care must be devoted to young specialists who likely may leave Russia for military obligation and economic reasons.

5. Russian scientists and migration processes

Labour market transformation since 1992 concerned also the employment in R&D sector, which was reduced and structurally modified. A first movement was characterised by massive migration of researchers out of science toward the non-R&D business. The 1996 outflow contained the voluntary departures in 60% of cases against a relatively small dismisses - 14% (Dynkin and al. (1999)). The volunteers were in majority the scientists of less than forty years old. The internal migration was ten time more important than external (abroad) one. A second movement was distinguished by inflow in the public sector, and in its R&D division in particular, of relatively less qualified persons. Hence, currently about 40% of employed in Russian science are the persons who did not achieved the high education level. The share of new graduated personnel integrating the scientific activity represents only 5%.

The so-called "brain drain"—an exodus of scientists, technicians, and engineers out of former Soviet scientific communities—began in the late 1980s, when the Soviet economy, which could no longer sustain the gruelling pace of the arms race, touched military as well as civilian enterprises. But the attentive look on demographic characteristics of out flows in ninetieth gives an impression that Russia reproduces the old tradition of migration for mainly ethnical reasons. The coefficient of migration and the structure of flows resemble to those of the beginning of the century. Always 60% leave to Germany, 22% move to Israel and 12% to Greece. The ethnical factor of migrants was easier to take into account, as in USSR and in Russia Federation the nationality (ethical group) of persons was ever registered in identification papers. The populations (German, Judaic and Greek) have more pronounced inclination to mobility than all others of the country. Moreover the expatriated persons provoke the departure of their relatives.

With the collapse of the USSR came a loss of central political control, and the relaxation of emigration - immigration restrictions. International borders are becoming easier to cross. It is important to mention that the flows were in reality moderate because of Western country legislation reducing the entry into their territory.

The difficulty of obtaining qualitatively reliable data makes questions such as "Where are all the displaced personnel going?" and "Are they finding meaningful satisfaction?" difficult to answer. In the paper by Nekipelova, Gokhberg and Mindeli (1994) we may find some elements for answer concerning the traits at the moment of departure. Only 8.9 % of persons authorised to leave the Russia in 1993 were occupied in the sector of science and education. The largest proportion of migrants from this sector of activity was among the persons moving to Australia, (14.6% of migrants to this country). Their share was of 10% among the migrant to Greece and 9.6% to USA. The majority of migrants to Germany are peasants from traditionally German regions of Russia Omsk region and Altay.

The economic crisis raised international concerns that inactive and unsatisfied personnel from Russia and especially from nuclear, biological, and chemical weapons of mass destruction complexes might sell their know-how or emigrate.

Proliferation risks remain pronounced throughout the region, and include continued recruitment efforts by foreign representatives. Moody (1996) give some examples: by 1994, the Russian Scientific Centre for Virology and Biotechnology (Vector), which specialises in biological warfare agent R&D, had lost about 3500 personnel since the 1980s. Between 1992 and 1993, Impuls NPO (Moscow), which produces guidance systems, Electro-optics, and civilian electronic equipment, lost about 1800 personnel. Between 1991 and 1996, the All-Russian Scientific Research Institute of Experimental Physics (Arzamas-16), which specialises in nuclear warhead R&D, lost about 5000 of the staff.

China, Taiwan, North Korea, Libya, Iran, and other countries have initiated recruitment of Russian researchers and engineers.

In addition to an apparent general preoccupation in Russia with subordinating law and order to profit making, lack of customs control, insecure borders, and a scarcity of export control specialists increase the odds that enrichment technology diversions would go undetected.

The scientists leaving Russia expect to find the higher prestige, to limit the cut off from world knowledge and to find the decent conditions for work.

In 1991-92, 508 scientists of RAS left the country, that represented about 0.8% of the staff. Among the migrants there were 13.2% of physicians and researcher in astronomy, 11.6% of researchers in biochemistry, biophysics, chemistry of physiologically active compounds. The letter group represented 2% of these domains' personnel. The main destination was Israel with 42% of migrants. As this destination is ethnical the repartition of migrants by scientific branches is relatively homogenous. By contrast the USA (38.6% of persons) was chosen particularly by researchers in biochemistry, biophysics, chemistry of physiologically active compounds and of geography. The departures to the West for long period in the cadre of collaboration contracts had different sector structure and destination. The countries which account much were USA with 38%, Germany with 16% and France with 8.9%; and there were 12% of mathematicians, 9% of researchers in biochemistry, biophysics, chemistry of physiologically active compounds, and 9% of nuclear physics.

The discussions around the Russian science reforming in 1997 returned on the questions related to "brain drain".

Dejina (1998) describes the present state of the "brain drain" phenomenon in Russia background of global and regional intellectual migration, using survey of scientists in Moscow and St.Petersburg. The impact of foreign grants on motives and conditions of the "brain drain" process is described also. It appears that in 1997 the emigration and mobility depend on scientific domain of researchers. This factor especially important in the abroad migration is more powerful than that related to regional and institutional characteristics. For example, in biology the academic laboratories are funded approximately equivalently, but if the "brain drain" from the classical biological domains' is insignificant, the migration from the institutes of molecular biology, biochemistry, cytology and genetic presents as a massive out-flow. The demand for specialists of these scientific areas, particularly in USA, may explain this difference. The young researcher PhD graduates from institutes of biochemical profile leave Russia, since their diplomas are usually recognised. The average age of migrants is 30 years. The likely possibility to migrate modifies the job search strategy in actual Russia. The students seeking for job and integrating an academic laboratory get information about the number of previous departures from it. For them the large number is the indication on possibilities of future external employment. The laboratories with high foreign migration escape from internal one. Job opportunity is the most common factor, regardless of educational specialisation.

The Russian government needs to concentrate on more funds in some fields and improve the infrastructure, as the high wages are not the unique mobile for migration in scientific world. Letter remark is valid for many scientific domains such as physics and mathematics, where research activity is independent on territory object of investigation. By contrast, the institutes owing exceptional collections used for studies (as collection of Botanical Institute of RAS in St.Petersburg or Palaeontology Institute in Moscow) keep easier their personnel, since the conditions for research activity are judged as sufficient.

The geographic situation of laboratory is an important factor for internal migration. For example, scientists from knowledge based industrial cities of Siberia prefer to move to Moscow where they can find effortlessly the parallel job in banks or SMEs. Almost 40 percent of the researchers of Moscow institutes have double employment. The habitants of Moscow and of St.Petersburg estimate (97% of them) that there are too much persons moving to their cities from other regions of Russia or abroad, for economic reasons.

The panel of 20-21 February 1999 shows that 48 percent of Russian population consider that the state must propose to highly qualified specialists that left the country some favourable terms inciting them to return (35 per cent are unfavourable to such measures). The young persons between 18 and 35 year old (54 %), “optimist”(55%) and habitants of big cities (53%) welcome especially the return of specialists.

To work out the level of financial support that Russian scientists should receive from West, one should estimate how much it has cost Russia to educate those young scientists who have left the country and work in research sectors of the West. Russia is spending a fortune educating people who are taking these skills elsewhere for the benefit of other countries.

Lack of jobs for the number of graduates produced explain the abroad migration. It's impossible in a country the size of Russia and especially in crisis to employ all of the people that are trained. In some sense, a net loss of high education graduate people may indicate of a healthy high education system.

The response of the international community to intellectual emigration from Russia, as well as respective Western policies and practices on both national and international levels are decisive for Russian reconstructing. Possible mechanisms (legal, social, economic) for the regulation of the process of the "brain drain" from Russia on the basis of national sources and international co-operation may be suggested.

May be the exodus of Russian scientists is not a dramatic phenomenon as it is often supposed. These moving persons can return in the country or participate actively in renaissance of Russian science from abroud. Nekipelova and ali reference two historical anecdotes. First tells us that Yvan the Terrible (1530-1584) authorised 17 young men to move to West to study. No one returned. By contrast, the experience by Peter the First was completely successful. At the beginning of 18 century he assigned 50 courtiers to study in England, Holland and Venice. All of them return in Russia and became admirals, creators of Russian Marine and initiators of Russian academy of science.

Some Russian scientists consider that the immigrated to West researchers must be considered as part of Russian nation and the special relation in the fields of science must be developed in priority.

Conclusion

The Russian science and economy turn up in a sorry plight in ninetieth. The introduction of liberal ideas and of marketing legislation in R&D spheres didn't change the deal. In spite of this unfortunate report the development of knowledge based economy in Russia is possible, as many elements are already present in social tissue. Both supply and demand make much of R&D, and the striving for knowledge persists. The science being in high degree autonomous vis-à-vis society may raise forces to reform the society. The objectives and the approaches of restructuring must come from scientists and more largely from intellectuals educated following Russian cultural traditions independently on the place where they exercise actually.

Reference

Boussyguine, V. (1998) “Economic activity of Siberian Branch of Russian Academy of Science”, *INCO COPERNICUS*

Dejina, I. (1998) “’Brain drain’: Myths and Reality”, “Moskovskaia pravda”, n°9, 2 Mars.

Demikhov, E. (1998) “Look from outside”, At the Council of Federation, http://194.85.223.6/frbr/pub/reform/3/vzgl.htm (in Russian)

Dolgopiatova, T. (ed) (1998) *Informal Sector in Russian Economy,* Institute of strategy analysis and of entrepreneurship development, Moscow, (in Russian).

Dynkin, A., Gokhberg, L., Ivanova N., Kozlova, O., Mindeli, L., Onischenko, I., Saguieva, G., Shmeliov, I. (1999) "Adaptation of scientific and innovation sphere of Russia to market conditions and the ways to increase its efficiency", Foundation "Bureau of Economic Analysis", Moscow (in Russian), pp.80

Efremov, Yu., (2000) "What for in needy the science for world and for Russia" http://193.233.79.157/pub/reform/17/1.htm (in Russian).

Guerasimov, B. M, “How to reform the national science” http://194.85.223.6/frbr/pub/reform/6/4.htm (in Russian).

Lanjouw, J. and Lerner, J. (1998) “The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature”, *Annales d’Economie et de Statistique*, n°49/50.

Latour, B. (1998) “From the World of Science to the World of Research?”, *Science*, vol.280, 10 April.

Luhmann, N. (1995) *Social systems*, Stanford University Press.

Maliguin, A. (1998) “Market science is the lack of science”, *Nezavisimaia gazeta*, N) 9 (13), 7 October (in Russian).

Mazzoleni, R. and Nelson, R. (1998) “The benefits and costs of strong patent protection: a contribution to the current debate”, *Research Policy* (27)3, pp. 275-286

Moody, A. (1996) “Proliferation Implications of the Brain Drain”, *Post Soviet Prospects*, n° 12.

Nokipelova, E., Gokhberg, L. and Mindeli, L. (1994) *Emigration of scientists: problems, real estimations,* Centre of research and science statistic, Moscow (in Russian).

OECD (1998) *Science and Technology Main Indicators and Basic Statistics in the Russian Federation*, CCNM/DSTI/EAS(98)62.

OST (1996) *"Science & technologie: indicateurs"*

OST (1998) *"Science & technologie: indicateurs"*

Peaucelle, I. (1998) "Intellectual Property Law and Technological Innovations".W.P. *INCO COPERNICUS project*

Peaucelle, I. (1998) "Patenting and Firm Restructuring: Russian case in mind" Couverture orange n° 9809, *CEPREMAP*

Seznec, K. (2000) "Autant de bien que de mal", *Le journal du CNRS*, avril

Shardiko, S.K. (1998) "Academy – relict of heroic epoch", http://194.85.223.6/frbr/pub/reform/5/5.htm (in Russian).

Yakovets, Yu. (1997) "Financing of innovation projects and its legislative enforcement", *Innovatsii*, n°2-3 (in Russian).