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Firms innovation activity and patenting: Russian case in mind

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RTD and restructuring in the CCE and Russia

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Abstract

The Russian Federation, which was created in 1992, recognises patents granted by the USSR. The development of a new IPR law contributed to channel potential private funding towards research activities. The experience of various European countries may be compared with current Russian practices. In this perspective, the following issues may be addressed: the legal framework for intellectual property in the new market situation; the management of patents developed by research centres and firms, and particularly the marketing of new technologies. Finally, patent pricing and its influence on the value of research contracts should also be studied, as they are at the core of negotiations.

La propriété industrielle et l'innovation dans les firmes: avec référence au cas de Russie

Résumé

La Fédération de Russie créée en 1992 a reconnu les brevets déposés par l'URSS. Le nouvelles lois sur la propriété intellectuelle ont contribué à orienter des fonds privés vers le secteur de la recherche. L'expérience de différents pays européens peut être comparée avec celle de la Russie contemporaine. Ce texte propose une analyse de l'essor de la législation sur la propriété industrielle comme résultat d'évolution du système soviétique et des conflits des intérêts sur les nouveaux marchés. On peut constater que l'ampleur de transformation complique de surcroît la gestion des brevets par les centres de recherche et par les firmes.

L'activité d'innovation est encore très timide en Russie. Elle souffre des contraints budgétaires et de l'existence de très grands risques politiques et économiques pour les investissements.

JEL: K1, O3, P31
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Introduction

Firms carry out research for a variety of reasons. The purpose of this paper is to stress the importance of firms' innovation activity in a country such as Russia. We present some theoretical investigations in the field of Intellectual Property Rights and in innovative firm performance; we distinguish between specifically Russian aspects of firms R&D and research organisation features, and other aspects which should develop as the market economy becomes better implanted. We illustrate our argument with some empirical evidence.

In the first part of the paper we study the patenting process as a consequence of national and international legislation and of firms' innovative activity.

The second part analyses how symbioses between science and firms have developed lately in Russia, by focusing on technological capacities and on industrial policies.

I. Laws and promotion of innovation

1. Industrial Property Right

A patent is a document, issued by a government office, which describes the invention and creates a legal situation in which the patented invention can normally only exploited by, or with the authorisation of the patentee.

In our days it is estimated that the number of patents granted worldwide a year is about 710 000. At the end of 1995 about 3.7 million patents were in force in the world. Intellectual property comprises two main branches: industrial property, mainly in inventions, trademarks and industrial designs, and copyright, mainly in literary, musical, artistic and audio-visual works. We will focus on the first branch, which provides the exclusive rights of industrial exploitation.

According to World Intellectual Property Organisation, an invention is a novel idea, which permits the solution of a specific problem in the field of technology. Usually the idea, in order to be protected by low, must be new in the sense that it has not been published or publicly used; it must be non-obvious in the sense that it would not have occurred to any specialist in the field; and it must be capable of industrial application in the sense that it can be industrially produced or used.

What gives rights to appropriability of intellectual property?

Firms are usually motivated to favours the generic knowledge, believing that a particular new product or process will result from that knowledge. The scientists differentiate regularly between their priority rights on discovery and their proprietary rights recorded by patenting. The priority requires to publish quickly the results, whereas the proprietary rights, having for purpose to provide economic rents, discourages the rapid diffusion of information.

This may explain the distinction between two types of property rights differentiating science from technology (Stephan (1996), Dasgupta and David (1987)).

Intellectual Property Rights are for origin the intellectual capital. Intellectual capital is the value of non-public information possessed by an individual in excess of the costs of learning the information. In priority that kind of information corresponds to knowledge consecrated in discovery. It is possible to give larger interpretation to intellectual capital if one accepts to attribute it to persons to whom the discovered information is transmitted before its large diffusion. So, intellectual capital is embodied in human capital. The value of intellectual capital may be increased through collaboration, when the discovery involves techniques that may come into being by personal introduction of knowledge by discoverer and his active participation in transmitting. Such first-hand utilisation of discovery creates the long-lasting supernormal returns, called “natural excludability" (Zucker and al. (1994), Darby, Zucker (1996)). There is the origin of knowledge-based institutions or even societies. Usually universities and academies are the producers of intellectual capital. It is possible to enrich its value by laying some different frameworks: venture capital firms are one of them.

Some biblio-metric studies might help to appreciate the economic impact of "natural excludability" of firms and regions, where certain intellectual community exists, whether spontaneously installed (California) or created by authority (Siberian Academy of science).

Which are the limits of industrial property protection?

The laws of a State relating to industrial property are generally concerned only with acts accomplished in the State itself. Therefore, a patent is effective only in the State where the government offices the grant or the registration. It is not effective in other States. If the owner of patent desires protection in several States, such protection must be obtained in each of them, or in European Patent Office (Munich) for protection in 18 European countries, or in Eurasian Patent Office (Moscow), which have effect in nine countries (Armenia, Azerbaijan, Belarus, Kazakhsten, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turrmenistan), and in some other regional patent offices.

INTELLECTUAL PROPERTY RIGHT (IPR) IN RUSSIA

The present state of legislation of IPR in Russia is the consequence of successive transformations. In USSR the primary source of protection of inventions was a non-proprietary reward, known as the “ Inventor's Certificate ”. It entitled the inventor to payment for use of the invention, and the State received exclusive rights to use and authorise third persons to use the invention for 15 years. But patenting existed also, giving an exclusive right to inventor.

Tab 1. Patents and Inventor’s certificates in USSR and Russia

	1990	1992
Grants of patents	1 119	7 698
Inventor’s certificates	73 009	74 593

Source: “ Patenti Rossii ”

The USSR was a member of Word International Patent Organisation (WIPO)[1] since April 1970 as well as it was a member of the Paris Union and of Bern Union. The Russian Federation took over as from December 1991.

In 1991 the Supreme Soviet of USSR approved legislation to strengthen the laws governing the recognition, acquisition, and enforcement of patent rights in the USSR: Law on Invention. 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. (For more details see Romary and Kwon (1996), Sapsai (1998)). The membership of international property organisations incites also the modernisation of national legislation.

This law recognised patents as the only form of protection of inventions, extended the patent term to 20 years, protected product-by-process claims, created the Patent Office, and established a Patent Court. This 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 law created the "State Fund of Inventions" to which patent holders could unilaterally and voluntarily transfer their rights to an invention.

The Russian Federation recognises patents granted by the USSR, the new law followed a trend of increasing protection of inventions, but retained some features of state intervention and control. The new patent law provides protection for inventions, utility models, and industrial designs as in the EU countries. The patent owner has exclusive rights to use the invention for a period of 20 years from the date of the filling of the patent application with the patent office (the Rospatent).

Table 2. Patents delivered in USSR and Russia by main groups 1990-1994

	USSR			Russia		
Groups	1990		1991	1992	1993	1994
	patents	certificates				
Consumption, necessities of life	121	8033	188	1355	1991	3066
Technological processes and Transport	254	20712	277	1961	3300	4850
Chemistry-Metallurgy	456	12475	294	1429	2414	2906
Textile	43	1071	29	163	273	333
Construction -Mining	46	6503	57	738	1235	1874
Mechanical and Arms	106	8399	119	899	1346	2545
Physics	50	6025	53	707	1297	2916
Electronics	43	9791	65	446	1004	2091

Sources: " Statisticheskie dannie po vidache okhrannikh dokumentov ", M.1997

[1] The origins of Intellectual property organisation go back to the adoption of Paris Convention for protection of industrial property in 1883 and of Berne Convention for the protection of literary and artistic works in 1886.

Table 2. shows a radical modification of patenting activity after the new Patent law was adopted in Russia on September 23, 1992. The number of grants increases in all the groups.

Employee-inventor and employer

Under Russian law, the patent holder can be either the inventor, natural persons and/or legal entities indicated by the inventor in the patent application, or the employer of the inventor, if the invention was created in connection with the inventor's employment or in carrying out a specific assignment given by the employer, unless a contract between the employer and inventor stipulates otherwise. The issue concerning identification of the patent holder in an employment situation prompted considerable debate in the Russian legislature. In the original draft of the patent law, the inventor-employee was entitled to a patent for an invention made in the course of employment unless a contract provided to the contrary. The enacted law reversed the presumption of ownership in favour of the employer. The employee-inventor does retain certain rights to the invention, however. First, the employee-inventor is entitled to be compensated " in an amount that is commensurate with the profit that was derived by the employer or could have been derived by him ", but not entitled for the transfer of the invention to another party, the decision to keep the invention secret, or the failure to obtain a patent. Moreover, if after four months from the date that the employee notified the employer of the invention, the employer has neither filed a patent application, nor transferred the rights to the inventor, nor decided to keep the invention secret, the employee-inventor can file the application and obtain the patent. The employer can still use the employee-inventor's patent, but only for the employer's own production and only upon compensating the employee for the use of the invention.

Protection of State interests

Elaborating the law, the Russian legislature rejected a provision in the draft statement that would have allowed patent holders to exercise their exclusive rights so long as they did not "damage the interests of society and the state". The patent law expressly sets out specific examples of acts of patent infringement, such as: "an unauthorised manufacture, use, importation, offer to sell, sale, other marketing or storage for this purpose of the product containing a patented invention". The law also identifies a number of activities that are not acts of infringement, including the use of devices incorporating inventions protected by patents " for the purposes of scientific research or experimentation, ...for private and non-commercial purposes ", or "where such devices have been legally marketed". Patent rights are inheritable under the new laws. However, all assignments or licenses of a patent must be registered with Rospatent to be valid. The enforcement of patent rights represents problems even if a single Patent Court is established. The law created a two-tier administrative tribunal system composed of the Board of Patent Appeals and the Supreme Patent Board.

Purpose of privatisation of innovation activity

In the middle of the 90-ies more than 90 per cent of Russian research and development was still supported by the State, but it is growing agreement that market-based IPR principles must be developed whereas financial and structural problems persist.

The Federal Fund of Inventions was created to promote the use of inventions in the interest of the Russian Federation. It is authorised to select inventions and by contract acquire the rights to them from patent holders. The Fund is intended to be financially self-sufficient,

obtaining funding through revenues from the sale of licenses of patents owned by the Fund, voluntary contributions, and appropriations from the federal government. The Fund is also designed to encourage international technological exchanges by providing potential foreign licensees with the licensing records of Fund patents.

To encourage the voluntary use of patents, the law provides a 50% reduction in maintenance fees for a patent holder who has granted an " open license " to a patent, i.e., a license granting the right to use the patented invention to any person. Under the open-license scheme, a party may use the invention under terms negotiated with the patent holder.

Incentive to encourage Russian creative activity and to diffuse the ideas

The law seeks to impose the patent holder to use or let others use an invention; so it authorises the compulsory licensing of " non-worked " or " under-worked " patents. For example, if a patent holder has not used or has insufficiently used a patented invention within four years of the patent grant and refuses to license the invention, the law permits any person wishing and ready to use the invention to request a " forced non-exclusive license " from the Supreme Patent Board.

The law stipulates that an invention created in the Russian Federation may be patented in another country only after three months have expired since a patent application for the invention was filed in the Rospatent. However, the Rospatent may permit the applicant to seek a patent in a foreign country before the three-month waiting period in " necessary cases ". The prerequisite for obtaining a patent in a foreign country for an invention created in the Russian Federation is the filling of a patent application in Russia. In any case, foreign patenting incurs high financial costs, and it is complicated by difficulties in getting the necessary information and advice.

Priorities for high technology

The legislature of the Russian Federation has pending in 1996 a " Model Law on Protection of High Technologies of Member States of the Commonwealth of Independent States ". The Model Law defines " high technology " as a " set of information, knowledge, experience, material means of development, creation and production of new products and processes in any branch of the economy, possessing characteristics of maximum world level ". The Model Law proceeds also to address the obligation of the State in regard to high technology, special means of protecting high technologies, special protections of trade secrets, rights of owners of high technology, rights of the State, right of exclusive use by the owners of high technology. Thus a distinction was drawn between the state secrets and the commercial secrets.

Government has always been the principal consumer of high technology especially for defence, aerospace, and nuclear power. Truly questions may be risen: to what extent can government finance high-tech now? Can high-tech industry cover its cost? Does Russia have a market for locally produced high-tech products?

In this sense the Economic Ministry modified its policy by differentiating the investments according to the following considerations: for projects aimed at launching the production of completely new goods, state investment may cover up to 50 % of costs; for projects aimed at substituting imports, - up to 30 % of costs (Industrial Policy p. 8). Furthermore, the government must create conditions for development of internal and external demand for higher-technology production: by helping to promote these products on foreign markets, through instruments of diplomacy, by offering state guarantees; by encouraging the

start-up of joint ventures with foreign participation, which will promote the sale of Russian high-tech products on foreign markets. In the last case, the Expert Institute recommends to be vigilant because a joint venture may be harmful to Russian national security. The government must support the creation of vertically integrated holdings carrying out research, designing, and manufacturing of high-tech products.

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

RUSSIAN PATENTING AND SOME COMPARISONS

Table 3. Patents granted by Russian Federation (Total: Residents plus Non-residents)

1992	7 698
1993	10 869
1994	20 580
1995	25 563
1996	17 884
1997	22 747

Sources: “ Patenti Rossii ”, 1998

The number of grants delivered by Russian Federation decreased significantly in 1996, but not the number of international applications between 1995 and 1996 (see table 4.).

Table 4. 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
Hungary	68	77	0.2	0.2
Czech Republic	28	31	<0.1	<0.1
Poland	22	19	<0.1	<0.1
Ukraine	10	14	<0.1	<0.1
Belarus	11	11	<0.1	<0.1
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 table above shows that in 1996 there was a notable increase in the number of applications and especially from Japan (43 % increase), France (28 % increase) and the United States of America (26% increase), but also from Russia (27% increase) even if its share in the world total stays very small.

Table 5. Patent applications filed and patents granted during 1995 (WIPO statistic)

Country	Applications for patents filed by			Grants of patents to		
	Residents	Non-residents	Total	Residents	Non-residents	Total
Russian Federation	17 611	23 746	41 357	20 861	4 772	25 633
Hungary	1 117	19 770	20 887	534	1 376	1 910
Czech Republic	628	19 382	20 010	577	722	1 299
Poland	2 598	19 491	22 089	1 619	989	2 608
Ukraine	4 806	17 548	22 354	1 139	211	1 350
Belarus	626	16 625	17 251	427	206	633
United States of America	127 476	107 964	235 440	55 739	45 680	101 419
Japan	335 061	53 896	388 957	94 804	14 296	109 100
France	16 140	73 626	89 766	15 299	40 382	55 681

Sources: IP/STAT/1995/A, WIPO

Non-residents are more numerous among the applicants in countries of Europe, than in Japan or in USA.

Russia maintains the better position in the Chemistry-Metallurgy group in both European and US granted patents. The index of specialisation is increasing in groups Electronics and of Chemical-pharmaceutical industry.

Table 6. Russia: Grants of European patents by main groups in 1996 and in % of 1990

Groups	Percentages of the world total		Index of specialisation	
	1996	1996 in % to 1990	1996	1996 in % to 1990
Electronic	0.16	107	0.62	125

Engineering	0.30	81	1.14	95
Chemical-pharmaceutical	0.19	101	0.71	118
Chemistry-Metallurgy	0.42	94	1.59	110
Mechanical-transports	0.30	73	1.12	86
Consumption, Construction	0.24	80	0.90	94
Total	0.27	85	1.00	100

Source: OST, Indicateurs 1998

Table 7. Russia: Grants of US patents by main groups in 1996 and in % of 1990

Groups	Percentages of the world total		Index of specialisation	
	1996	1996 in % to 1990	1996	1996 in % to 1990
Electronic	0.08	103	0.54	133
Engineering	0.17	80	1.17	103
Chemical-pharmaceutical	0.13	107	0.93	139
Chemistry-Metallurgy	0.27	98	1.87	127
Mechanical-transports	0.12	54	0.85	71
Consumption, Construction	0.15	63	1.03	81
Total	0.15	77	1.00	100

Source: OST, Indicateurs 1998

2. Antimonopoly laws and firms acquisition of intellectual property

Normally the intellectual property laws and the antimonopoly laws share the common purpose of promoting innovation. In the absence of IPR, imitators could more rapidly exploit the efforts of innovators and investors without compensation, reducing the value of innovation and eroding the incentives to invest in R&D. The antimonopoly laws succour innovation by prohibiting certain actions by firms that deter those firms and others from competing. But patents confer rights to exclude others from making, using, or selling the invention claimed by the patent for a period of many (twenty) years from the date of issue. Thus intellectual property might create market power in the antimonopoly sense. Although there are clear and important differences in the purpose, extent and duration of protection provided by patent regimes. That is why antimonopoly laws must take differences among these forms into account in evaluating the specific market circumstances in which intellectual property bargaining occur.

The owner of IP often considers that it is most efficient to sell rights or to enter into joint venture arrangement for innovation development. Licensing may provide more efficient exploitation of IP through the reduction of costs and the introduction of new products.

Consequently, licensing serves procompetitive aims. By increasing the expected returns from innovation, licensing may increase the incentive for its elaboration and promotes greater investment in R&D. But licensing arrangements may also raise antimonopoly problems. For example, an agreement that transfers no useful IP, but imposes restraints on persons or firms that otherwise would operate using alternative technologies, may have adverse effects in different markets.

Antimonopoly lows influence the goods markets development as well as technology markets and innovation markets. Technology markets consist of the intellectual property that is licensed or acquired and the technologies that are substitutes for it. The main problems on this market are the measurement of prices and appreciation of market share of firms using new technology. Innovation markets are the sphere of competing of firms with some special characteristics related to their capacity for R&D. For that the capacities to be able to produce innovation must be identifiable with some special properties.

Antimonopoly analysis of IP licensing arrangements examines whether the relationship of the agents to the agreement is principally horizontal or vertical in nature. For that the antimonopoly committees verify if licensing arrangement with respect to a technology market involves the acquisition of IPR that are economic substitutes for technologies that the licensee owns or controls, or if it affects activities that are in a complementary relationship. In both horizontal and vertical licensing restraints it is necessary to evaluate the degree of anticompetitive effect.

ANTIMONOPOLY COMMITTEES IN RUSSIA

The research by Academy of Science of antimonopoly policy started in USSR in 1988, long before the privatisation was engaged. It was a sign of concern that there were potential problems with market economies such as market failures or abuses. The USSR antimonopoly law was approved in 1990 and new Russian law in 1995. The antimonopoly committees were created in 1992 for regulating and registering monopolistic firms. The analysed cases concern a desire of producers to get control of retailers, and that of separated firms to reunite. Other typical cases involve foreign investors, where the objections to the coalitions are connected mainly with foreign investment concerns rather than the impact on Russian competition. The law includes sections defining and limiting the activities of dominant firms, restricting agreements of almost all firms, describing the right to punish anticompetitive actions of firms and government agencies. The antimonopoly committees have to approve structural changes in firms and have discretionary powers to break them up. New legislation could facilitate market entry by new innovators and investors. However, the Russian antimonopoly committees are “ young ” institutions, and they have a relatively weak position compared with industrial ministries and state property committees that are more powerful in controlling the firms’ behaviour. For a moment it is hard to say what may be the real extent of the their impact on the technology or innovations markets structure and if they may impose more appropriate industrial structure or increase innovation.

II. Economic analysis of innovations and firms performances

In this section we will present some theoretical and empirical developments concerning the role of R&D for firms surviving, expansion and transformation in market economy context.

DIFFUSION OF INNOVATIONS AND PATENTING

In market economy the entry and the exit of the firms is a decentralised process. In such environment the diffusion of innovations may be associated with the net entry on the market of firms engaged in manufacturing a new product (Gort and Klepper (1982), Cohen and Klepper (1996)). By contrast, in USSR planned economy the introduction of new products into the manufacturing process as well as the firms creations were decided from the Centre, often independently from one another and separated in time or space from the invention. That is why the following development may be interesting for forecasting purposes in Russian case, when markets will be more complete.

The historical studies revealed the existence of some stages of market of innovations representing the products life cycles through the waves of firms' numbers manufacturing them. Change in output, annual average number of innovations, a change in real price or annual rate of patenting may reference each stage. It was observed that the rate of patenting increases steadily during the initial stages, but grows also in the last stage, which is a period of negative spread of products and of exits of firms from correspondent market. This last wave of patenting led to the conclusion that patents are not a good measure of technological change. The rate of patenting may be linked to a previous increase in innovative effort of firms. This latter one appears to be rising over time even when the productivity of the effort is declining. Thus, the number of patents would measure the input devoted to innovative activity rather than the output of profitable innovations. At the same time, patent counts are often used as an indicator of a firm's success in innovative activity, considering the R&D spending as an input measure of such activity.

As we pointed previously the firms compete on different markets: goods markets, technology markets and innovation markets. The empirical analysis by Geroski and al. (1996) endeavours to describe the causal relations between the types of firm's governance on these markets. The authors argue that patents, but not the reverse stimulate the production of major innovations. Moreover, the production of innovations is more sensitive to demand pressures whereas patents seem to be more sensitive to supply factors such as R&D spending.

Waldman (1996) poses an interesting puzzle on relative inefficiency of innovation activity for firm-innovator. He analyses "planned" moral obsolescence of firm production in terms of the R&D decision and new product introduction. Indeed, the manager could not internalise easily the influence of his decision in the field of research on the value of units produced previously and inventoried or those in production process. In other words the investment in new products can improve the quality of future production and consequently decrease the future value of current production. The incentive to invest in R&D makes the past production obsolete, and may decrease producer's profitability. That is why it is necessary to distinguish between the estimation of R&D effect on current and long run profitabilities of the firm. However, such apparent time inconsistency for firm is (or may be) beneficial from a social point of view.

Thus, the patent protection has opposing effects on firm efficiency at short and long run. On the one hand, a firm covered by patent protection benefits through the use of existing technology and attempts to preserve its market share. It facilitates funding the complementary effort in R&D with aim to consolidate the technological advantage. On the other hand, it takes an interest in innovating for market enhancement and for smoothing the risk of imitation. Intertemporal problem of dating the innovations is in relation with patent duration and with strength of IPR (Park (1997), Brousseau and Foray (1997)).

PATENT LIFE DURATION

It is possible to realise the patent measures in a variety of ways. The IPR jurisprudence determines the legal patent life duration that is why it may be different in various countries and at different periods. For example, there are many discrepancies among the EU sates regarding the duration an industrial design can receive. The Netherlands, Belgium and Luxembourg have a common system, with a 15-year protection period. Germany guarantees protection for 20 years, France for 50 years, and Spain for 10. The governments seek to choose the optimal patent duration, since it is one of forms of their intervention in innovation process. For example, the government may want to consider the effect of a change in the patent length on R&D spending of a firm (Goel (1996) theoretical model). It was observed that an increase in the patent length might increase the number of risky research projects, which is favourable for the development of basic sciences. By contrast, firms with less risky projects might decline the R&D expenses in this case. Therefore, the national patent policy is likely to produce opposite results in different industries.

In current life firms rarely use the whole length of patent. For firms the patent life duration is in relation with the cyclical nature of innovation processes. The patent application generate a revenue, whose amount changes with the years of protection, the obsolescence of knowledge embedded in the patent and some other factors. The firm pays annuities in order to keep their patent rights; it spends also to detect the potential counterfeiters and to condemn them in case of infraction. Certainly, the difference between benefits and costs affects the patent life. Firms stop paying the annuities when costs became equal to or larger than benefits. The patent protection is limited also in space. The substitutes of patented goods or of technological processes may be introduced on the markets of other countries and regions, lowering the intention to continue the patent protection by inventor.

Using cohorts of European patents in French manufacturing at industry and firm level Duguet and Iung (1996) study the impact of some factors of patent duration. The authors find that the bigger are the R&D ratio in sales, the industry concentration and the imitation rate the longer is the patent life. By contrast product diversification reduces the patent length. Joint patenting and the number of countries covered by the patent, as well as the firm size do not appear to influence patent duration in France.

Many difficult and interesting problems may be risen in connection with dating and time duration of patents and innovation activity. First of all a firm has to encounter the dilemma of R&D and investment, the date of patenting of inventions and their length. It can try to compose an optimal portfolio of its patents and licences. And a firm may seek to resolve one more complex problem that consists in estimating of the value of its innovation sphere.

FIRM SIZE, RESTRUCTURING AND INNOVATION

The large firms spend proportionally more on R&D than small firms, but they get less out of their spending. This interesting puzzle rises from observations on the link between R&D expenditure and the number of patents per dollar expended for R&D. What are the reasons?

Several different explanations of this paradox were proposed. For example Rosen (1991) suggests a less risking of R&D in big firms and consequently a less return. From

Cohen and Klepper (1996) point of view, the large firms possess an important advantage in technology competition often related to process innovation activity especially in mature industries (Acs and Audretsh (1990)). The advantage reaches from two circumstances: first, the big firms prefer to use their innovations through their own output instead of selling through patents; and second, since the short run expertise prevails in firms, the output over which firms expect to apply the innovations is related to their current output. Consequently, the bigger is the firm's output at time of R&D decisions, the bigger is its incentive to implement R&D. Small firms are more efficient in innovations for sale in disembodied form. They innovate "by buying knowledge" and using high qualification and creating new products.

In some countries (Audretch and Vivarelli (1994) for Italy; Matusiak (1997) for Poland; Zucker, Darby, and Brewer (1994) for United States) the empirical studies were performed using firm level data in order to compare the relative advantage of firms according to their size in the context of their capability to co-operate with research centres. All of them conclude that spillovers from universities are more important for small firm innovation than for lager ones because the high endowment of researchers and skilled engineers exist especially in small firms. These results corroborate with those of a typology distinguishing upon the organisational ability to innovate (Rizzoni (1994)). The last ones showing those small firms may create flexible systems for learning, by adapting and using external sources of scientific and technological research.

A positive spillover effect of small firm's R&D may be reinforced by weak patent protection and low cost of utilisation of public knowledge in a country, by complementarities in R&D effort of firms in an industry or to government policy (Raut (1995)). There is the question of firm R&D effort and the possibility to be a free rider (to have an advantageous position) due to other private and public R&D investors.

The US experience of financial restructuring and downsizing in the manufacturing sector in 80-ies can be very instructive. The financial restructuring of corporations in US context consists in: private acquisitions of publicly traded firms (merger activity), going private transactions (leveraged buyouts), or significant shifts in the balance sheet toward debt, where no acquisition is involved. The opinion was expressed following which the restructuring was unfavourable to investment in R&D in manufacturing. It is argued also that the search by firms to be a "qualified borrower" had a negative impact on their long-term investment, which contribute to the decline of manufacturing in global competitiveness. All these problems were analysed in details by Hall (1990) (1993). The author proves that the shifts in the firm's balance sheet toward debt were clearly associated with decreases in R&D spending. She specifies also that the increases in leverage and declines in investment and in R&D expending (in US case) are joint consequences. The causes of these opposite developments are: an increase in the value of ordinary capital (because firms exited from publicly traded manufacturing sector), the changes in the relative price of debt to equity, and a steep decline in the absolute value of R&D assets. The decline of R&D assets was especially pronounced in some manufacturing sectors: electrical, instruments, computing, and electronic.

EXTERNAL INCENTIVES

Besides IPR legislation, the government may use some other mechanisms of incentive, such as: increasing of R&D subsidies, the increasing of aggregate GDP and a change in firm's cash flow through a reduction of taxes.

Economic literature judges various policies and their consequences in some countries.

We may look at US experience. Indeed, since 1981 the US tax policy has provided credits to firms to induce them to increase their R&D spending. Hall (1992) estimated that a permanent increase of 5 percent in the R&D tax credit increased long run private spending on R&D by about 5 to 10 %. She testifies that most of the increase would occur during the first three or four years of the credit. Each firm's annual subsidy depends on the corporate tax rate, the size of the R&D credit, the recent growth in the level of the firm's R&D spending, and on whether the firm has taxable income. Hall indicates also that R&D spending adjusts slowly to changes in tax rules, since many R&D projects can not be stopped and started on short interval of time. Thus, she finds that the response to a temporary change in the R&D tax credit is about half the response to a permanent change. This suggests that frequent changes in the tax code may reduce the effectiveness of tax credits in stimulating R&D spending.

Using a dynamic model of UK representative firm engaged in innovation activity and patenting, Geroski, Van Reenen and Walters (1996) simulate the effect of three government policies on firm innovativeness. There are R&D subsidising, a demand promotion, and tax reduction. The authors show that all three types of policy are inefficient, since the injection of 5000m £ of support in each case generates less than 5m-£ value of additional innovative activity. Therefore the governments have to consider other types of incentive, such as for example, a procurement policy which improves the access to long run investments in basic science and the transmission of information between Universities and industries.

Academic research needs a large amount of money. The paper by Connolly (1997) draws our attention to the fact, empirically verified on US data, that external sponsors prefer to fund the research centres that are well internally funded. Her explanation is that sponsors (banks, firms, international institutions) wish to allocate the funds to high quality researches, and judge the quality through the amounts of money already allocated by State, or internally accumulated.

The Hall, Jaffe and Trajtenberg (1998) work incites to pay more attention to the innovative output measure, since the different number of patents across the fields may signify that in some of them it is more easier to take patents. They propose to take into account not the amount of R&D internal spending for attractiveness of new funds, as it is suggested in previous case, but the quantity and the quality of patent's citations. The idea is that citations that spread over a large number of technological fields increase the value of patent holder. Moreover the firm's IP helps to develop inter-firm co-operation by delimiting the competencies of each, to signalise the potential expansion, to assure the technological progress, to reinforce the firm protection.

Zucker and al. study 4946 US firms geographically concentrated around big universities and where star professors take part actively. They are interested to elucidate by this way the links between basic science and industries or firm's development. The scientist may be employed by the firm, have shares, have consulting contracts, be member of scientific advisory boards. It appears that the universities and other research institutions may play a role in creation of "natural excludability" by constraining (geographically or otherwise) their professors' and researchers' ability of freely contracts or ownership positions. Local links

were very important in the development of biotechnology, but were week in the field of high-temperature superconductors. The biotechnological knowledge spillovers on the relatively narrow regional aria have for cause the special market exchange, based on equity sharing. The authors try to evaluate the gap between the economic effect (supranormal labour income, commercial profit,...) of scientific discoveries producing "natural excludability" and those protected by usual IPR mechanism (patents).

The outcome for scientific centres was appreciated (in biotechnology, in California) through the performance of discoverers affiliated with newly created firms. The lasts have different attitudes to patenting in comparisons with they colleagues: they patent in 50% of cases against 15% for non-affiliated researchers. Between them the patentees are cited more frequently; affiliated researchers are cited more frequently than linked ones, and linked are cited more frequently than untied. To estimate this hierarchy the authors of the study calculated publications written with firm science co-authors.

For firm providing "natural excludability" the outcome is estimated in number of products in development; in number of products on the market; and in the net growth of employment. From California firms' observations it can be inferred that intellectual capital, linked to firm through market exchange, including firm's property sharing speeds up significantly the firm's productivity and growth.

VENTURE CAPITAL

Venture capitalists play the role of integration of scientific and industrial efforts in restructuring. 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, which could lead them to bankruptcy. Proprietary barriers to competition are inquired into, whether they are technology or product-oriented (patent) or market-oriented (brand franchise).

Usually, venture capitalists take concentrated equity positions in the firm that they finance (15 - 19%) as well as seats on the board of directors. They buy expertise, and monitor the start-up firms offering advice on corporate and strategic direction issues, financial and capital structure decisions. Venture capitalists fail to recoup their investments in many on the firms, but make very large benefits in few ones. The exit for the venture capitalist is interrelated with the expectation that at some moment the firm will sell shares in the market to other investors and that he sell all of his shares. (Our reference is the discussion on venture capital in France in the meeting organised by CNRS and OST in 1996, see also Adam and Farber (1994)).

III. R&D and innovation in 1990-th Russia

1. Sources of data to analyse the innovation activity of Russian firms

In 1971 The World Intellectual Property Organisation adopted the agreement concerning the international patent classification (Strasbourg agreement). The USSR became party to this agreement in 1976, and it is continued by the Russian Federation as from December 1991. Therefore, the qualified international comparisons on patenting may be realised (see tables 4-7).

The statistical work on innovation activity is more puzzling, because of recent transformations of statistical office and lack of money to fund its quick development. Since 1994 Goskomstat of Russia creates two special forms of survey called " Report on realisation of scientific researches and development " and " Report of industrial enterprises on innovation activity " respectively. The novelty is in redefining the research activity of scientific institutes and in distinguishing the research activity as the object of statistical survey from other possible activities of these institutions. For example, according to the new definition the education and the training, the collection and the treatment of non-specific information, the standardisation and testing, the pre-project studies, the utilisation and the adaptation of existing computers software, the productive activities including introduction of innovations - are not recognised as scientific activities.

By transforming the statistical system Russian Federation tries to meet world standards (rules of Frascaki), but to conserve at the same time the Russian specificity of classification of activities and of scientist's qualification. Now an institution (a company or enterprise) performing research is analysed independently of its activity sector (they are no more exclusively the institutions of High Education or of Academy of sciences), of its form of ownership, and of its management rules. Goskomstat accounts joint research between Russian firms and joint research with foreign firms. Entrepreneurial sector carries out about 75% of research in Russia.

The new forms of scientific statistics are:

a) OECD indicators such as the expenditures for innovation and research and the labour costs;
b) Allocation of expenditures for research by field of science and technology (S&T) and by type of activity;
c) specific Russian indicators such as the value of basic funds in research.

For example, the research activity in 1991 in Russia may be presented according to two forms of statistical approaches.

Table 8. Two forms of statistical approaches

Traditional Russian approach	%	New classification	%
Academic sector	11.8	State sector	17.9
Industrial sectors' research	78.5	Entrepreneurial sector	74.9
High-education Institutes	5.5	Sector of high-education	7.1
Plants' sector	4.2	Private non -lucrative sector	0.1

Source: Gokhberg (1995)

Budget effort to develop the S&T by type of activity and by socio-economic objectives may be appreciated using OECD survey data. In this case, the state funding for applied research might be interpreted as the degree of incentive in favour of industrial innovation. The government strategy to stimulate the innovations in some priority sectors may be revealed through the relative spending for different scientific disciplines (OECD, 1998).

Actually the main sources of information about firms innovation activities are the surveys or case studies. For example, referring to the Gochberg, Kuznetsova (1996) data on innovating activity in 17 000 Russian firms on the period between 1992 and 1994 we may detect some origins of innovations. At that period only 20 % of innovations were due to firms own activity, the others being introduced through transfers. Among the technological transfers informal acquisitions were most frequent. The firms preferred free licensing, using the results of granted projects (32 % of industrial firms), of know-how (17.7 %) and services of engineering and consulting firms (22.7 %).

Table 9. Number of industrial firms realising acquisition of technologies and inventions on 1992-1994
(among 17 000 interviewed)

Patent rights	221
Licenses of patents - including licenses of inventions	392 125
Free licenses - including : - the results of R&D - know-how	1788 1237 672

Source: Gochberg, Kuznetsova (1996)

2. Innovation and investment

In the first section we testify the increase of patenting in Russian Federation even if the share of this country decreases in world total between 1990 and 1996 (tables 1-7). The situation is even worse in term of innovations. The following data show the significant decrease of product innovation in Russia in earlier 90-ies.

Table 10. Share of novelty products in the total production

	1990	1991	1992	1993	1994
Over year	6.5	6.4	7.2	3.4	2.6
-completely new	3.0	3.0	3.0	1.6	0.9
Over last three years	23.6	21.4	19.3	11.3	5.2

Source: “ Rossia v tsifrakh ”, Goskomstat (1995), p.215

Modifications in investment priorities during this period may partly explain this decline.

In 1990 the consumer goods and high-technology sectors determined the industrial strategy. At that period the more active in patenting were the sectors of consumption and of necessities of life, of technological processes and transport, and of chemistry-metallurgy (see table 2.). It is natural that in such conditions and in these sectors the new products were

introduced. In 1992 we find among the ten more attractive sectors oil processing, oil and chemistry, non-ferrous metallurgy, which are the export-oriented sectors with low product innovations.

Table 11. Ranking of industrial sectors by investment attractiveness (the ten best sectors according to the 35 sector classification)

Rank	1990	1992	1995	1996
1	Sewing	Oil-processing	Oil-processing	Oil-processing
2	Leather and footwear	Sewing	Food	Oil refinement
3	Textile	Leather and footwear	Printing and publishing	Food
4	Furniture	Textile	Pulp and paper	Electrical power
5	Food	Rubber and asbestos	Oil and chemistry	Non-ferrous metallurgy
6	Rubber and asbestos	Non-ferrous metallurgy	Rubber and asbestos	Building materials
7	Railway mechanical engineering	Cars	Ferrous metallurgy	Domestic refrigerators and deep freezers
8	Woodworking	Furniture	Non-ferrous metallurgy	Ferrous metallurgy
9	Electronic engineering, instrument making industry	Oil and chemistry	Glass, porcelain and faience	Gas
10	Electrical engineering	Electrical engineering	Electrical engineering	Chemistry, oil and chemistry

Sources: Kurenkov (1997) p.39

REGULATIONS OF THE FEES FOR PATENTING INVENTIONS

The official duration of patent protection is actually of twenty years. The annual fee for the maintenance in force of the patent for an invention are determined in minimum amounts of wage and in US dollars according to the year since the date of receipt of the application. Approved by the decision of the government of August 12, 1996 they were:

Year	Minimum amounts of wage	US dollars	US dollars of the Eurasian patent
Third and fourth	1	100	125
Fifth and sixth	1.5	150	188
Seventh and eighth	2	200	250
Ninth and tenth	3	300	375
Eleventh and twelfth	4.5	450	563
Thirteenth and fourteenth	6	600	750
Fifteenth - eighteenth	7.5	750	938

Nineteenth and twentieth	10	1000	1250

FIRM SIZE, RESTRUCTURING AND INNOVATION

Russian economy continues to be represented by large and giant firms. According to the Anti-Monopoly Committee, nearly 90 % of the country's industrial potential is concentrated in the enterprises with the number of employees over 10 000 (Industrial Policy (1996)).

On the one hand, the firms are independent and the State can no more guide them by administrative methods. On the other hand, nearly all-major companies remain in federal ownership. In strategically important sectors the State holds either absolute controlling interest of 51 %, or at least 25.5 % of the stock, but opportunity to manage and decide is not used because of lack of experience to manage public founds in decentralised economy. Privatisation has created formal conditions for investments, which should improve the technology.

Allocation of investments among firms is extremely unequal. More then 30% of firms do not carry out any investments for years. Since in the Russian economy in general fixed capital investments remain high, exceeding the respective indicators in Europe and USA. The share of fixed capital investment in GDP is more than 21% each year of 1990-th (Aukutsionok, Batyaeva, (1997)).

Using the base of surveys of 200 Russian industrial enterprises Aukutsionek and Kapeliushnikov (1996) characterise the innovation activity of state-owned (principally large), and non-state (relatively small) enterprises. Product innovations prevail in non State (small) enterprises and process innovation in the State-owned (large) ones. All enterprises and especially private ones search now to innovate in order to satisfy the demand.

Table 12. Percentage of firms introducing innovations

	State-owned		Non State	
	1994	1995	1994	1995
- with prevailing product-innovations	33	33	40	52
-with prevailing process innovations	17	29	26	12
Share of new products in the last 1-2 years in the total output	6	9	17	19
% of firm considering that the change of output composition is an important element of adjustment	28	21	31	31

As in other countries, in Russia the large firms (state-owned in table 12.) are specialised in process innovation, but the small ones dominate in product innovations.

Inspire their financial weakness a number of small Russian firms operate in science-based sectors. Small firms are intermediate agents connecting scientific institutions with large firms and banks. Their employees are often engaged in both firms and scientific institutes. Scientific researchers frequently create small firms.

INDUSTRIAL POLICY

The firm reconstructing in Russia need important investments volume, objectives, and distributions among the industries must be determined adequately. The good planning of investments intends to strengthen the firms financing, and risky financing of new technology. The current difficulties of Russian reconstructing reach not only from the deficiency of industrial policy, but from the scarcity of credits to implement such policy.

There exist actually four capital markets: exchange transactions, money interbank market, market of government stocks, and shares' market. The specificity of these markets in Russia is reported in " Guide for investment " (1997). Investment and innovative activity of firms depend on their financial situations. Since 1992 firms face financial crisis. Financial crisis particularity consists in non-payment waves. These non-payments are not only some temporary intensification of debtedness, but also the dysfunction of debt economy in Russia. Klepatch and ali (1996) pick out some specificity of Russian debt economy:

1. In 1990 the circulating assets of enterprises were financed at 60 % by internal retention. In 1994-95 they were financed at the level of 70 % by short-term debt. Arrears to budget became an important source of financing of current and social spending, and investment of enterprises.
2. Mutual non-payments compose the deficit of firm's own assets and of bank credits. Credit is used for production, and for surviving of firms. It does not depend on capacities of borrowers or on capacities to refinance the credits against goods.
3. The share of money circulation continue to be very narrow in Russia, and to compensate for this barter is developing representing in middle of 1996 36 % of trade. The purchasers' non-payments are also the consequences of weak development of money.

Non-payment in Russian economy is in a sense a means of financing (element of enterprise passives); the means of payment, and it is a mechanism of balancing the accumulated disproportion, helping the surviving of firms and sectors. In 1996 the credit debtedness was present in 39 % of firms of non-ferrous metallurgy, in 67 % of electric-energy, against 26 % in average in industry. This situation indicates that financial crises concern also the sectors of energy and row materials, which were supposed to be the sectors-lenders for other industries. The federal investment programme intended to finance in 1996 411 industrial projects, but only 12 were performed, and 320 were engaged. In such financial situation the Russian banks are playing a little role in investment, although fifteen of biggest banks proposed to government to finance some projects of high technology like aerospace, petroleum equipment, nuclear energy.

The government introduces some mechanisms of the incentive of investment into new projects:

- by guaranteeing to investors the ownership rights in new firms;
- by creating public and mixed investment and security funds;
- by developing investment insurance.

The possibility of tax exemptions is actually implemented in many Russian regions (Arkina (1997)). In accordance with Russian law, the region authority may suggest tax reduction for the project, seeking to compensate political risk and unfavourable factors of environment. For example, in Novgorod region the exemption practice allowed to increase attractiveness of foreign capital. The region occupies the second position in Russia (after Moscow) according to the ratio foreign capital per capita. 160 firms with foreign capital participation were registered in 1996.

Foreign investors, using standard methods of evaluation, often underestimate the complexity of Russian specific risks. Simachev (1996), Novikova (1996) and Livchits (1997) stress that qualitative non-formalised risks prevail, caused by permanently changing institutional environment (as tax and custom systems), and by absence of time series for quantitative studies. The interests of large number of agents have to be integrated: firms, shareholders, local and federal governments. The firms are characterised by instability of laws, monopoly situation of many of them, by fragility of financial structure, and by criminal background.

VENTURE CAPITAL AND FOREING DIRECT INVESTMENT (FDI)

Portfolio investment and syndication of capital in Russia by Palms & Company, Investment Bankers, USA may give an idea of foreign venture capital preferences. The segment of *high technology* is presented there by Security Device manufacturing, Satellite Dish Manufacturer, Bar-code manufacturer, Manufacturer of Super High Frequency Dielectric, Material Processing by Concentrated Energy Beams.

In Russia, venture capital seems to find advantage in penetrating *import-export* activity: Saw-Mill, Diamond Mine, Automobile Imports, Fur Exports, Freight Forwarding, and Copper Export.

We observe that it invests in *new services*, sometimes at the frontier with high tech: International Currency Exchange, Pension Fund Investment Management, Health Care Premium Management, Protection and Filing of Intellectual Property Rights, Defence Industry Business club, Advertising & Public Relations Agency, Office Building, Wholesale Distribution, Importing, Trust Company Services, Commercial Bank, Newspaper, Internet System Operator (Satellite).

But also in *traditional industries*: Textile manufacturing, Fur Farms, Tire manufacturing, Mining Precious Metals, Log Home Manufacturing, Food processing, packaging and storage.

More generally FDI went to almost all sectors of Russian economy (Boussiguine (1997). But it is remarkably low (7 $ per head in 1995), representing 0.5 % of PNB and 3.8 % of investments. By contrast, the portfolio investments are large. The balance of payments certified that in 1996 the portfolio foreign investments were fore time more important then FDI.

Table 13. Foreign direct investment in Russia (millions $) 1994 1995

Sectors	1994	1995
Electric power	1075	1396
Trade and Business	584	1229
Finance and Insurance	426	838
Machine-building and metallurgy	391	615
Food industry	326	782
Construction	221	433
Woodworking and paper	203	427
Trade and alimentation	139	343
Chemical and petrochemical	102	287
Other sectors	783	1506
Total	4250	7854

Source: Goskomstat

Official statistics reports that the foreign direct capital favours Electric power industries, Trade and Business. The impact of foreign capital is usually considered in several areas, which are interrelated. One of the most frequently discussed is the transfer of new technologies. Some methods were proposed to capture the effect of new technology diffusion through FDI. For example, Tomaczewicz (1997) estimates the R&D embodied in FDI for Poland using the input-output models.

The import of high technology equipment in Russia in 1994 is 10.5 times larger than export. The majority of import came from European countries followed by industrialised Asian countries. The increase of exchanges with North America is especially remarkable.

Table 14. Import and export of high technology equipment in Russia (percentage distribution)

World regions	Import			Export		
	1989	1994	1994 (100 = 1989)	1989	1994	1994 (100 = 1989)
Europe	84.1	73.7	88	23.9	35.2	147
North America	2.9	9.7	335	0.7	6.5	989
Latin America	0.0	0.0	101	45.9	35.0	76
Muscleman world	0.6	0.1	15	6.7	4.1	61
Africa sub-Saharan	0.0	0.0	15	1.1	3.0	260
Industrialised Asia	9.3	12.8	138	0.3	2.2	750
Other countries of south-east Asia	3.0	3.6	120	21.2	13.7	65
Oceanic	0.1	0.1	168	0.3	0.4	120
Total world	100.0	100.0	100.0	100.0	100.0	100.0
Volume	10 273	11 328	110	3 325	1 071	32

(MECU)						

Sources: OST (1998)

Conclusion

The Russian Federation, which was created in 1992, recognises patents granted by the USSR. The development of a new IPR law contributed to channel potential private funding towards research activities. The experience of various European countries may be compared with current Russian practices. In this perspective, the following issues may be addressed: the legal framework for intellectual property resulting from the evolution of the soviet system and from the conflicts of interests in the new market situation; the management of patents developed by research centres and firms, and particularly the marketing of new technologies. Finally, patent pricing and its influence on the value of research contracts should also be studied, as they are at the core of negotiations.

The innovative activity is yet timid being constrained by budget restrictions and by high political and economic risks for investors.

Bibliography

Acs, Z. and Audretsh, D. (1990) *Innovation and Small Firms*, MIT Press, Cambridge.

Adam, M., Farber, A. (1994) *Le Financement de l'Innovation Technologique : Théorie Economique et Expérience Européenne*, Paris, PUF.

Arkina, S. (1997) *Stochastic Model for analysis of tax policy to stimulate the innovations in transitional economy*, Diploma of Moscow University (in Russian).

Audretsch, D., Vivarelli, M. (1994) "Small Firms and R&D Spillovers : evidence from Italy", *Revue d'économie industrielle*, n°67.

Aukutsionok, S., Kapekiushnikov, R. (1996) " Labour Hoarding in Russian Industry ", *The Russian Economic Barometer,* n°2.

Aukutsionok, S., Batyaeva, A. (1997) " Investments in Russian Industry ", *The Russian Economic Barometer*, n°4.

Boussyguine, V (1997) " The Foreign Direct Investments in Russia: problems and prospects "*EAEPE 1997 Conference, Athens 6-9 November*

Brousseau, E. and Foray, D. (1997) " Une introduction à l'analyse économique de la propriété intellectuelle ", W.P. *IMRI* n°3.

Cohen, W.M., Klepper, S. (1996) "A Reprise of Size and R&D", *The Economic J.*, 106, 925-951.

Cohen, W.M., Klepper, S. (1996) "Firm Size and the Nature of Innovation within Industries : the case of process and product R&D", *The Review of Economics and Statistics*, n°2.

Connolly, L. (1997) " Does External Funding of Academic Research Crowd out Institutional Support ? ", *Journal of Public Economics*, 64, 389-406.

Darby, M. and Zucker, L, (1996) " Star Scientists, Institutions, and the Entry of Japanese Biotechnology Enterprises ", *NBER* n°5795.

Dasgupta, P. and David, P. (1987) " Information Disclosure and the Economics of Science and Technology ", in *Arrow and the ascent of modern economic theory*, ed. G.R. Feiwel, N.Y.U. Press.

Duguet, E., Iung, N. (1996) " An econometric analysis of patent life at the firm level ", 54th International Conference AEA *Econometrics of Inovation, Patent*, Luxembourg 28-29 november.
Geroski, P., Van Reenen, J. and Walters, C. (1996) " Innovations, Patents and Cash Flow ", *CEPR* Discussion Paper n°1432.
Goel, R. (1996) "Uncertainty, Patent Length and Firm R&D", *Australian Economic Papers*, June 74-80.
Gokhberg, L. (1995) " Statistics of Science " : Transition to International Standards ", *Voprosy Statistiki*, n°3, 10-19 (in Russian)
Gokhberg, L. and Kuznetsova, I. (1996) " Innovation statistics : first results and next perspectives ", *Voprosy Statistiki*, n°3, 9-20 (in Russian)
Gort, M. and Klepper S. (1982) "Time Paths in the Diffusion of Product Innovations", *The Economic Journal*, 92, 630 - 653.
Guide pour l'Investissement en Fédération de Russie (1997) OECD.
Hall, B. (1990) "The Impact of Corporate Restructuring on Industrial Research and Development", *Brookings Papers of Economic Activity*, Microeconomics, 85-135.
Hall, B. (1992) "R &D Tax Policy during the Eighties : Success or Failure ?", *NBER* W.P. n°4240.
Hall, B. (1993) "Industrial Research during the 1980s : Did the Rate of Return Fall ?", *Brookings Papers of Economic Activity,* n°2, 289-343.
Hall, B., Jaffe, A. and Trajtenberg, M. (1998) " Market Value and Patent Citations : a First Look ", W.P. University Paris I, March.
Industrial Policy : Selecting a Path of Development for the Next two Years (1996) Expert Institute, Moscow
Klepatch, A. and ali (1996) *Analyse of financial situation and solvency of industrial enterprises*, Ministry of Economics, Moscow
Kurenkov, Y. (1997) " Investment priorities in Russian's economy ", *The Russian Economic Barometer*, n°4.

Livchits, V. " Estimating Industrial Innovations Efficiency in Transition Economy of Russia " *EAEPE 1997 Conference, Athens 6-9 November*
Matusiak, K. (1997) " Innovativeness of small and middle - sized Companies in Poland ", *EAEPE* Conference, Athens 6-9 November
Novikova, T. (1996) *Introduction to the analyses of investment projects*, Novosibirsk, RAN.
OECD (1998) *Science and Technology Main Indicators and Basic Statistics in the Russian Federation*, Paris
Park, W. (1997) " A Note on Innovation and Patent Protection : Intertemporal Imitation-Risk Smoothing ", *Economics Letters*, 54, 185-189.
Peaucelle I. (1995) "Firme ou artel? Vers un rapport salarial original en Russie", in *Théorie de la Régulation. L'Etat des Savoirs,* eds. Boyer R. and Saillard Y., Paris, La Découverte.
Rapport de l'observatoire des sciences et des techniques, Indicateurs 1998, Economica
Raut, L.K. (1995) "R&D Spillover and Productivity Growth : Evidence from Indian Private Firms", *J. of Development Economics*, vol. 48, 1-23.
Rizzoni, A. (1994) "Technology and Organisation in Small Firms : an interpretative framework", *Revue d'économie industrielle*, n°67.
Romary, J. and Kwon H. (1996) " The New Patent Regime of the Russian Federation ", presented at *NATO conference* in Moscow in September 1995.

Rosen, R. (1991) " Research and Development with Asymetric Firm Sizes ", *The RAND Journal of Economics*, n°3, 411 - 429.
Sapsai, B. (1998) "Issues of Intellectual Property", Predprinimatelstvo v Rossii, n°1 (in Russian)
Science and Technology Statistics in the Partners in Transition Countries and the Russian Federation (1996), OECD
Simachev, Y. (1996) " Specificities of evaluation of industrial projects in Russia ", *Predprinimatelstvo v Rossii*, n°4, 4-9 (in Russian).
Stephan, P. (1996) " The Economics of Science ", *Journal of Economic Literature*, 1199-1235.
Tomaszewicz L. "Domestic and foreign RTD embodiment in the industry : Polish case" *EAEPE 1997 Conference, Athens 6-9 November*
Waldman, M. (1996) "Planned Obsolescence and the R&D Decision", *The RAND Journal of Economics*, n°3, 583 -595.
Zucker, L., Darby, M. and Brewer, M. (1994.) " Intellectual Capital and the Birth of U.S. Biotechnology Enterprises ", *NBER* n°4653.